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Skinner and a Solution to the Problem of Inner Events

Nathan Stemmer
Bar-Ilan University

Skinner's treatment of inner states has been criticized not only by cognitivists but also by people who are close to behaviorist views. In particular, critics have argued that because of the limited conceptual resources of his scientific framework, Skinner cannot account for "mental" phenomena such as the qualitative character of feelings, conscious contents, or states of awareness. The present paper claims that these criticisms are mistaken. By paying careful attention to Skinner's strict physicalist position and by employing a consistent physicalist terminology, it can be shown that Skinner is able to account for the phenomena in question.

Key words: inner events, covert behavior, Skinner, radical behaviorism, physicalism, cognitivism

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Skinner's treatment of inner events has been criticized not only by cognitivists but also by people who are close to radical behaviorist views (e.g., Killeen, 1984; Natsoulas, 1983). For example, Natsoulas (1983) argues that because of the limited conceptual resources of his scientific framework, Skinner cannot account for "mental" phenomena such as the qualitative character of feelings, conscious contents, or states of awareness. In this paper, I claim that these criticisms are mistaken. By paying careful attention to Skinner's physicalist position and by employing a consistent physicalist terminology, it can be shown that Skinner is able to account for such phenomena.

Some of the expressions used by Skinner, such as *pain, sensation,* or *thought,* may have dualist connotations. However, in view of Skinner's strict physicalist position, as expressed, for example, by his statements "My toothache is as physical as my typewriter" (1945, p. 294) and "No special kind of mind stuff is assumed" (1974, p. 220), I give these expressions a physicalist interpretation.

Physicalism is primarily based on the view that "modern science has attempted to put forth an ordered and integrated conception of nature" (Skinner, 1953, p. 258), and that a "unified account of nature" has no place for phenomenal entities, for mental stuff. Different characterizations of physicalism have been given (e.g., Carnap, 1934, 1936, 1937, 1963; Feigl, 1963; Neurath, 1931/1973, 1931/1983a, 1931/1983b; see also Moore, 1985). The characterization most congenial to Skinner's position is Carnap's (1936) view that all scientifically significant statements are reducible to statements of physics. (See, e.g., Skinner's statements that "an operant is defined by an effect which may be specified in physical terms" [1953, p. 65], and "an experimental analysis of behavior describes stimuli in the language of physics" [1969, pp. 78–79].)

Physicalist conclusions also hold for inner events; they are physical events having normal physicochemical properties. In Skinner's terms, "Private and public events have the same kind of physical dimensions" (1969, p. 228). To be sure, we are often unable to specify the physicochemical dimensions of inner events. But this frequently occurs in science. We attribute the solubility in alcohol of some newly discovered product to the physical microstructure of both alcohol and the product, even though we may presently be unable to give the physicochemical dimensions of the structures that are responsible for the solubility.

THE PHYSICALIST FRAMEWORK

Skinner speaks of different kinds of inner events (or states, stimuli, conditions, etc.). For example, he mentions inner states of affairs that control the response

The author wishes to acknowledge the constructive comments of the reviewers and the editor on earlier versions of this paper. Address for correspondence: Nathan Stemmer, Department of Philosophy, Bar-Ilan University, Ramat-Gan, Israel.

My tooth aches (1957, p. 130), private stimulations that evoke *I am hungry* (1957, p. 135), private stimuli generated by a sharp blow or cut (1974, p. 23), private stimuli that come to control the response *That hurts* (1974, p. 24), or small-scale behavior that corresponds to thinking (1974, pp. 27, 103). These events are physical, more specifically, physiological, because they "are enclosed within the skin" (Skinner, 1957, p. 130). However, Skinner does not distinguish between the events on the basis of their physicochemical properties—which even professional physiologists are usually unable to specify—but on the basis of external evidence; in particular, the environmental events that precede or generate the inner events and the behavioral responses that follow or are evoked by the events. This evidence suggests that the inner physiological events are different.

Because neither psychologists nor physiologists can state the physicochemical dimensions of the inner events, the events can play no direct role in prediction and control. (I will ignore the few cases for which the physical dimensions of the inner events are known.) For example, we cannot base on inner events our prediction that this child will now say *That hurts* (or that the probability of this response has increased), because we don't know whether the physical properties of the inner events that are now occurring within the child are of the type that determine this response.

What is the function of the inner events in a physicalist framework? Skinner suggests that it is explanatory. By assuming the existence of the events, we become able to give plausible explanations to certain phenomena; the assumption allows us to overcome "embarrassing gaps in our account" (Skinner, 1957, p. 434). We explain why receiving a sharp blow increases the frequency of responses such as *That hurts,* by assuming that the blow generates inner events that evoke the responses.

But important precautions must be taken when inner events are used for explanatory purposes. Because their physicochemical nature is presently unknown, the role of the events in influencing behavior should be supported by *independent* evidence. Otherwise, our explanation would be circular; we would be assuming the efficacy of events that "could only be inferred from the behavior which was said to result from them. Such inferences . . . could not justifiably be used to explain the very behavior upon which they were based" (Skinner, 1953, p. 28).

Do we have independent evidence of the behavioral efficacy of the inner events? The answer is affirmative. Because the events are supposed to be normal physiological events, their behavioral role is confirmed by (a) general evidence such as the behavioral effects of brain damage or the activation of different cortical areas following certain tasks (e.g., Petersen, Fox, Snyder, & Raichle, 1990) and (b) specific evidence such as the precise physicochemical data about the neural effects of exposure to certain behavior-modifying contingencies (see, e.g., the studies on cellular correlates of learning in Byrne, 1987; Dudai, 1989; Hawkins & Kandel, 1984; Kandel, 1979).

However, various assumptions must be made in order to give explanatory power to inner physiological events. I will now examine these assumptions.

Indirect Individuation

Consider the events that evoke the responses *My tooth aches* and *I am hungry,* respectively. Although Skinner does not explicitly say so, he probably assumes them to be different. Only this assumption would explain the difference in the verbal responses. The assumption would receive additional support if, for example, we learned that the first speaker has an abscessed tooth and the second has been deprived of food for a long time.

In what sense are the inner events supposed to be different? The above-mentioned general and specific evidence suggests that the difference is physicochemical. However, because we are unable to express the difference in physicochemical terms, I will generally assume a functional difference only—that is, a

difference that is supposed to reflect only differences in the external events that precede or generate the inner events and differences in subsequent behavior or other observable effects.

What about similarities between inner events? Suppose that within a period of five minutes the first person utters twice *My tooth aches,* whereas the second person says once *I am hungry.* The evidence already mentioned suggests that there is more physical similarity between the inner events that evoke the first person's responses than between them and the events that evoke the response of the second. But again I will only assume different degrees of functional similarities.

Assumptions of differences and similarities are necessary for giving explanatory power to inner events. In order to account for the person's response *My tooth aches,* we must assume that the inner event that occasions the response is (a) different from events that occasion responses such as *I am hungry* or *I was on the point of going home* and (b) similar to inner events generated by a bad tooth.

Assumptions of differences and similarities between inner events will be called *individuating* assumptions; they allow us to give an *indirect individuation* to inner events. The individuation is indirect because it is based on external evidence rather than on the physicochemical properties of the events.

Because the differences and similarities on which indirect individuations are based are functional, the individuations determine *functional* types of inner events. Therefore, the specific properties shared by the elements of a type do not have to be physical. They can be functional properties, that is, properties derived from the functional differences and similarities. (It follows that indirect individuations do not imply so-called type-identities. For a detailed discussion of this issue, see Hocutt, 1985.)

A further assumption must be made. If an organism is exposed to appropriate contingencies, then the inner events can come to control (or evoke or occasion) certain responses; they can become discriminative stimuli for different types of behavior. Although this assumption is generally included in physicalist frameworks, it is convenient to mention it explicitly.

The physicalist framework adopted here agrees with Skinner's views. As mentioned above, Skinner often uses other terminology, but this is mainly a semantic issue. (We will have the opportunity to discuss some of the terminological differences below.) In the following, when speaking of a Skinnerian or radical behaviorist framework, the intention will be to this physicalist system. Note that the framework is nonreductionist, because the assumption of inner events is not supposed to have predictive effects. Predictions can be made only on the basis of functional relations between external factors. The framework is also environment oriented, because the inner events are individuated on the basis of external evidence. So-called incomplete accounts are therefore avoided.

Hypothetical Features

We can now clarify an important difference between radical behaviorists and (materialist) monist cognitivists. Both agree, or at least should agree, that we cannot directly observe the inner events that follow external events or precede instances of behavior. In particular, we cannot describe them in physiological terms. Still, both often attribute certain features to the inner events. Now, radical behaviorists attribute to them only features that are based on the above assumptions: differences and similarities with other inner events and controlling potential. Cognitivists attribute to them in addition *hypothetical* features, features that are not directly derived from observational data but are suggested by other considerations, such as conclusions from computer science. Cognitivists think that this approach may increase the explanatory power of their theories. Moreover, if the attributions are correct or close to correct, they might eventually increase the predictive (and controlling) power of the theories. This would vindicate the attributions.

Radical behaviorists think that postulating hypothetical features of inner physiological events should be discouraged. The practice induces scientists to neglect factors that are clearly relevant to an organism's behavior, namely, the environmental factors that are lawfully related to instances of behavior.

Our analysis suggests that despite what radical behaviorists and monist cognitivists may think, the difference between their positions is not a difference in subject matter or in the goals of their science. The difference is methodological. Both strive for theories that have strong explanatory and predictive power, but they have different views about the best method for achieving this. (For a detailed, and somewhat different, analysis of the relation between radical behaviorists and monist cognitivists, see Schnaitter, 1986, 1987.)

Skinner is presumably against accepting hypothetical assumptions about inner events. Nevertheless, he sometimes attributes to the events features that have a somewhat hypothetical character, especially to the events he refers to with the term *covert behavior.* These inner events, in addition to having normal physicochemical properties, are often also supposed to be analogous to certain overt responses: small-scale versions of overt behavior. However, various reasons speak against such analogy assumptions. First, which is the analogy? Consider a girl who, upon receiving a blow on her finger, starts crying, touches her finger, and says *That hurts* (cf. Skinner, 1974, p. 23). Is the inner event generated by the blow analogous to the crying, to the touching of the finger, or to the verbal response? It is not clear what answer can be given. Second, there seems to be no physiological evidence that allows us to distinguish between the physicochemical elements of the inner events that have behavioral features (e.g., that correspond to the three occurrences of the letter *t* in *That hurts*) and those that have nonbehavioral features (e.g., changes in levels of adrenalin). Third, and this is probably the most important reason, there is no need at all for accepting analogy assumptions. Treating the inner events as normal physiological events that can contribute to discriminative control over different types of behavior is sufficient for explaining the relevant phenomena.

Actually, Skinner himself is aware of the problems faced by analogy assumptions. For example, in *Verbal Behavior* (Skinner, 1957), he discusses various cases that show that there are "difficulties in assuming that covert behavior is always executed by the muscular apparatus responsible for the overt forms" (p. 435). I will therefore exclude analogy assumptions from our physicalist framework, and I believe that this agrees with the spirit of Skinner's physicalist approach.

I stated above that scientists should admit that the inner events of organisms are not directly observable. It seems, however, that the implications of this admission have sometimes been overlooked. Consider Killeen's suggestion that we should engage in an intense "study of the relation between inner and outer causes" (1984, p. 32). Clearly, in order to be of any scientific value, such study would have to examine the relation between particular inner events or particular types of inner events and outer events. But because we cannot directly observe an organism's inner events, we cannot directly observe the physiological properties of an inner event *a* that is related to an outer event *b,* or of the inner events of Type A that are related to outer events of Type B.

We could first derive individuating properties of the inner events by relying on the external factors that generate the events, and then study the relation between these properties and ensuing behavior. But if this approach is adopted, then we are not really studying the relation between *inner* and outer events. We are actually studying the lawful relations between environmental factors (including observable physiological factors) and instances of behavior, because the individuating properties are derived from the external factors.

We might adopt the hypothetical approach. We could study the relations between hypothetical properties of an inner

event *a* (or of Type A) and behavioral effects of *a* (or of Type A events). If the nonobservable inner event *a* (or the Type A events) indeed have these hypothetical properties, and if the properties indeed correspond to physicochemical or functional properties of the inner events, such study may even be fruitful. In particular, it may increase the predictive power of the framework. It should be clear, however, that a nontrivial study of the relations between inner and outer events requires such hypothetical assumptions. As said earlier, radical behaviorists believe that as long as we have not exhaustively examined the functional relations between environmental factors and instances of behavior, such hypothetical studies should be avoided.[1]

Monist cognitivists thus think that attributing hypothetical features to physiological events increases the explanatory and predictive power of their theories. Two versions of this view can be distinguished: methodological and substantive. According to the former, we do not yet know which additional data will be explained and predicted by cognitivist but not by radical behaviorist theories. We have to wait for more evidence, and the claim is therefore basically a claim regarding the best methodology. I will not examine this position, because it does not imply the present (alleged) inadequacy of Skinner's framework.

According to the substantive version, evidence already exists that cannot be accounted for by radical behaviorist theories because of their limited conceptual resources. This claim has been raised not only by cognitivists (e.g., Chomsky, 1959, 1975, 1986; Fodor, 1983, 1987) but also by people who are close to behaviorist views. I will now turn to this claim.

"MENTAL" ENTITIES

Feelings and Sensations

Suppose we observe that a 1-year-old boy receives a cut on his arm and then starts crying. Such an event is typically conceived by cognitivists as showing that the child has a feeling (or sensation) of pain, and that this feeling is similar to the feelings of other people who undergo similar experiences. The similarity is supposed to be very strong if, for example, the other feelings occur in the same child a couple of minutes later, weaker if they occur in other children or other people in similar circumstances, still weaker if they are caused by a different harmful event such as an abscessed tooth or by a beneficial event such as eating an apple, and so forth. On the basis of these similarities, cognitivists can arrive at relatively successful predictions about the behavior of people who are supposed to have the feelings. For example, they may predict that if other children have a similar feeling of pain, they will probably cry, provided the similarity is sufficiently strong.

Let me now describe the event in a neutral manner by using terminology and assumptions that are acceptable to both monist cognitivists and radical behaviorists. The child underwent an experience that is often biologically harmful, and he reacted in a way that is frequently observed when harmful events occur to children. On the basis of these and other relevant data, including biological conclusions, we infer that the cut has inner effects—it generates private stimuli (Skinner, 1974, p. 23)—and the child's

[1] There is almost no doubt that the neural systems of organisms have design features (e.g., Dennett, 1983; Schnaitter, 1986). But most cognitive hypotheses about these designs are based on input–output data. Because these data are compatible with many different designs, they do not significantly constrain the hypotheses (Schnaitter, 1986). Indeed, cognitivists have proposed highly different theoretical designs, all of them consistent with the evidence. (A typical example are the different types of language-acquisition devices that Chomsky has been attributing to humans, e.g., 1957, 1965, 1982.) It is therefore unlikely that theories that are based on such design hypotheses will have more predictive power than theories based on functional relations between environmental factors and forms of behavior. (A more promising approach might be the bottom-to-top hypotheses that are based on physiological data, such as data on cellular correlates of learning or cortical mapping, and that are low on speculative extensions. At this stage, however, it is not clear whether theories based on such hypotheses will have more predictive power than theories based on functional relations between environment and behavior.)

crying is a behavioral consequence of the inner effects. This neutral account agrees with physicalist constraints. We can therefore identify the account with a radical behaviorist account.

Is this physicalist framework sufficiently powerful to account for the relevant phenomena? We saw earlier that by assuming similarities between feelings, cognitivists can often arrive at reliable predictions. Now, cognitivists admit that they have no direct access to the feelings of the child or other people. They must therefore base their similarity assumptions on indirect evidence; in particular, on the observable causes of the assumed feelings and their observable effects (e.g., the cut and the child's crying). In addition, they will use other knowledge, such as that other harmful events are frequently followed by moaning or crying in children, or that giving analgesics diminishes the strength or frequency of the crying or of other behavior that is often evoked by harmful events.

The evidence on which the cognitivist assumptions of similarity are based is external. Consequently, the evidence can immediately be used by radical behaviorists to formulate analogous assumptions about similarities (physical or functional) between the inner events that are generated by episodes such as cutting an arm (Quine, 1985). On the basis of these similarities, radical behaviorists can then explain and predict all the phenomena accounted for by cognitivists. It follows that a physicalist framework does possess the conceptual resources for dealing with the phenomena.

However, Killeen thinks that because of their emphasis on inner events, cognitivist treatments of feelings are still better than radical behaviorist ones. Skinner (1974) had stated:

> It has been objected that we must stop somewhere in following a causal chain into the past and we may as well stop at a psychic level . . . [but] the point at which effective action can be taken . . . is not to be found in the psyche. (p. 210)

Killeen (1984) objects:

> Experimental analysis of one of the links in a causal chain should not necessarily be faulted because it does not include the previous ones. . . . We might infer from a person's pale face, hand over stomach, and low moan that he is in pain. We do not attempt to move his hand, nor silence the moans, nor rouge the face: The inference of an internal state of distress is more likely to be useful to him. Nor do we yet need to infer that it was something he ate, or that it was the flu that is going around, or that he was punched. Such determinations will certainly help, but we can take immediate and effective action based on our inference alone. Are we more likely to be helpful if we know that he ate strange food, but deny that he is in distress? (pp. 27–28)

The example is supposed to justify cognitivist views. It suggests that in order to help the person, we need not investigate the external events that cause the inner state; concentrating on the inner state itself is sufficient. But Killeen is ignoring crucial observations of *prior* external events. We infer that the person is in a state of distress—that is, a state that is similar (physically or functionally) to other states caused by harmful events—because previous observations, including reading relevant literature, have told us that factors such as pale face, hand over stomach, and low moan are symptoms of inner states that accompany or follow harmful events. That is to say, if these three elements occur together, then, in the absence of evidence to the contrary, it is likely that the person is in such a state. (Perhaps fewer symptoms are sufficient for this conclusion.) Moreover, previous observations (including reading relevant literature) have given us information about different devices that may reduce the strength of the symptoms or even eliminate them completely (e.g., surgical intervention if the inner state is caused by an inflamed appendix). It is only because of these previous observations of external regularities that assumptions about inner events can help us to arrive at reliable predictions regarding the effects of medication, changing the food, surgical intervention, and so forth.

Moreover, once the role of prior observations of external regularities is acknowledged, we realize that the predictions actually derive from the prior observations and present data, and not from assumptions of inner events. Killeen concluded from his example that the inference of an internal state of distress

is more likely to be useful to the person than knowing that he ate strange food. But the example shows only that relying on present data—the symptoms—may sometimes be more helpful than inquiring about past events. More exactly, if we have previously observed functional relations between different types of external factors (including symptomatic and behavioral factors), we can arrive at reliable predictions even if some of the external factors are not presently observable. Consequently, our capacity to arrive at reliable predictions on the basis of inner events—that is, on the basis of symptomatic data—does not vindicate cognitivist views. The capacity derives from observations of external data.

I mentioned above that inner events can play no direct role in prediction. Killeen's example points to an indirect predictive function they may have. Instead of basing a prediction on external data, we first infer from the data an inner state *s*, and we then base the prediction on this state. This procedure is harmless as long as the features we attribute to *s* are the individuating features derived from the data and not hypothetical features.

The Labeling of Inner Events

It is convenient to have verbal expressions that express the similarity between inner states or events. In many cases, this can be achieved by adopting natural language expressions that are modified to eliminate dualist connotations; in particular, adding the expression (*physiological*) *state* or *event* to the expressions will often accomplish this goal. Thus we can say that the effect of the boy's cut is a *physiological pain* state, that is, a state that is similar (functionally and perhaps also physically) to the inner states of other children that are caused by harmful events and that often evoke crying, moaning, or responses such as *That hurts.* If we want to use a stronger similarity relation for indirectly individuating this state, we can add, for example, that the pain state is caused by a cut in an arm or that it causes crying; that is, the state is similar to the states that have the additional features. Dualist implications are avoided, because the inner states are explicitly assumed to be physiological.

Qualitative Phenomena

Feelings and sensations are said to have a qualitative character; according to Natsoulas (1983), Skinner cannot account for this character because the conceptual resources of his framework are too limited. Qualitative phenomena are supposed to have behavioral effects. For example, "how something tastes to us may be reason for us to add more salt, to express our appreciation to the cook, or to spit it out" (Natsoulas, 1983, p. 6). But these effects are immediately accounted for by a physicalist framework. Ingesting food generates inner physiological events, and the nature of these events is strongly determined by the nature of the food; more exactly, among the external data we use for individuating the inner events, differences between foods have a prominent place. These inner events then occasion specific overt responses. Consequently, on the basis of external evidence, we can explain and predict all the effects mentioned by Natsoulas. (For the predictions, the inner events are unnecessary.) It follows that a radical behaviorist framework does not lack the conceptual resources for dealing with qualitative phenomena.

Why does Natsoulas (1983) think that Skinner cannot account for qualitative phenomena? It seems to derive from a position that still has dualist elements. Consider Natsoulas's justification of the existence of qualitative phenomena. He does not base their existence on normal empirical evidence such as adding more salt or thanking the cook, or on descriptions of such observable events. Rather, he appeals to verbal responses that are supposed to report certain intuitions: "most of us will swear to . . . [the] qualitative differences among the many tastes" (1983, p. 23). This justification, which reminds us of typical Cartesian arguments, suggests that for Natsoulas qualitative phenomena are not normal physical phenomena, phenomena whose existence is confirmed by normal empirical evidence, but some other type of phe-

nomena, perhaps spiritual (nonmaterial) ones. (I intentionally avoid the word *mental* because of its highly misleading ambiguity: For some people it refers to material entities, whereas for others it refers to nonmaterial ones.)

Clearly, as long as no normal scientific evidence is given that supports the existence of special types of phenomena, no insufficiency of radical behaviorist frameworks follows. The fact that verbally proficient people swear to the existence of certain entities proves nothing. People swear (or have sworn) to the existence of sunsets, phlogiston, epicycles, or Jupiter's thunderbolt. Of course, we must explain *why* people swear to the existence of the entities. But there is no reason why radical behaviorist frameworks should not be able to account for the production of such verbal responses. (See the analysis below of verbal reports of inner events.)

Thoughts, Beliefs, and Knowledge

Suppose that cognitivists, on the basis of certain evidence, infer that a 1-year-old boy has the thought *This apple is sour.* This hypothesis allows them to explain and predict several behavioral phenomena, for example, the child's refusal to eat a similar apple. Cognitivists admit they have no direct access to the thought. The thought is indirectly individuated on the basis of external evidence. Consequently, the cognitivist explanations and predictions actually derive from this evidence.

In our physicalist framework, we can immediately use the evidence to infer that the child is in a particular inner state (or that certain physicochemical processes are going on inside the child) and that this state is similar (functionally or physically) to the states that may occur in other children or other people or even in nonhuman beings, when similar evidence is available. With the help of such inferences, we can then account for the same phenomena as cognitivists can.

We notice that the physicalist account does not treat thoughts as autonomous entities. There are only indirectly individuated inner states (or events), and we may describe them as thought states. These states have normal, though presently unknown, physicochemical properties.

Similar conclusions hold for epistemic phenomena. Instead of assuming on the basis of observational evidence that a boy knows or believes something (e.g., he believes *This apple is sour*), we assume that a physiological event is occurring within the boy, and we individuate this event with the help of the same evidence. (For a more detailed analysis of epistemic phenomena, see Stemmer, 1989.)

Schnaitter (1987) suggests that in certain cases "a behavioral interpretation of private events no longer guides effective behavior and becomes ritualistic. That is when it is probably better for behaviorists to call a thought a thought, not a covert response, and let it go at that" (p. 10). Our conclusions suggest that whatever the case, there is no reason for adopting this mentalist (perhaps even dualist) terminology that admits autonomous thoughts. There is always a physicalist alternative: to attribute the relevant overt responses to the evocative power of inner physiological events, inner thought events.

What about Skinner? He frequently speaks of pains, feelings, or thoughts. Does he treat them as some kind of autonomous entities? The answer is negative. He does mention them, but he actually deals with the relevant phenomena in practically the same way as has been done here. The difference is therefore merely semantic; the entities are physical, just as typewriters are. Nevertheless, Skinner's terminology may produce misunderstanding. By using nouns for such "entities" as pains, hunger pangs, or feelings, Skinner may be interpreted as giving the entities an autonomous, perhaps even a nonmaterial, status. It is therefore preferable to avoid this terminology completely, and speak instead of inner physiological events explicitly: physical events that are enclosed within the skin.

Awareness and Conscious Content

Natsoulas claims that "Skinner has not got the problem of conscious content

right" (1983, p. 19; see also Killeen, 1984, p. 31). We will see that this claim is mistaken. A radical behaviorist framework can account for the phenomena that are often described with the terms *conscious content* or *awareness.* (I will frequently use the term *awareness* for both phenomena.)

Suppose that on the basis of certain external and behavioral data, cognitivists assume that a child is aware of the presence of an apple. We can then assume that the child is in a physiological awareness state, and we individuate this state by using exactly the same data. Finer distinctions can be made in the same way. For example, Natsoulas (1978) distinguishes between perceptual awareness (e.g., having a thought) and direct awareness (e.g., being aware of having a thought). If there is observable evidence that allows Natsoulas to distinguish between the two types of awareness, then we can use the same evidence for giving an indirect individuation to a parallel distinction between inner states. On the basis of these individuations, a radical behaviorist framework can then account for the awareness phenomena that are covered by cognitivists.

Apparently, Natsoulas believes that Skinner has not got the problem right because he has not realized the radicalness of Skinner's approach. Natsoulas attributes to Skinner the view that "we are aware of a stimulus *by virtue of* the production of operant behavior that is a response to that stimulus" (1983, p. 20, my italics). But this formulation is incorrect. It supposes that there are two phenomena: (a) being aware of a stimulus and (b) responding to a stimulus, and (a) is caused by (b). According to Skinner's physicalist approach, there is only one phenomenon, namely a response (possibly internal) to a stimulus. This single physical phenomenon can be described (in English) not only by the expression *to respond to a stimulus* but also by expressions such as *to be aware of a stimulus* or *to be conscious of a stimulus.*

Skinner makes an additional linguistic observation. He suggests that many, perhaps even most, speakers of English restrict the term *awareness* to those cases in which the response to the stimulus includes a verbal response (e.g., 1945, p. 277; 1969, p. 268; 1974, p. 220). Whether this is indeed a fact of English is of course irrelevant to our topic, because the distinction between verbal and nonverbal responses to a stimulus does not have to match exactly natural-language uses of the word *awareness.* Some people may use the word in such a way that animals, including perhaps paramecia, can be aware of being in pain, whereas according to other people, not even young children can be aware of their pain states. (Natsoulas seems to use the word in the second way, because he states that "a young child has visual perceptions before he develops the ability to be aware that he is having them," 1978, p. 146.) But divergence between scientific and natural language is a normal fact of science. It is therefore not important whether the distinctions made by radical behaviorism between different phenomena match exactly the distinctions that are expressed in natural language (or subdistinctions as those discussed in Natsoulas, 1978). What is important is that our physicalist theory can account for the available evidence and make predictions that are at least as successful as those of cognitivists.

VERBAL DATA AND INTROSPECTIONS

There is thus no place in our physicalist framework for autonomous entities such as pains, sensations, or thoughts. But what about our descriptions of such entities, our reports of their occurrence? Doesn't this verbal practice prove their existence and consequently the insufficiency of Skinnerian frameworks? In order to reply to this argument, it will be necessary to examine some aspects of verbal learning. (For simplicity, I will deal mainly with the learning of a listener.)

Suppose that 18-month-old Mary has never seen a dog nor heard the word *dog.* She now sees a dog for the first time while her parents say *Look, a dog.* According to Skinner (1957), the exposure to this pairing contingency—the presence of a dog paired with an utterance of the word

dog—may enable Mary to learn the relatively correct meaning of *dog* (see, e.g., the learning of *Open Sesame* and *Jones-plug* on pp. 359–360). More exactly, exposure to the contingency or to various contingencies of this type changes Mary in a particular way (Skinner, 1974, p. 215). Because of this change, further sights of the same or similar dogs now evoke her response *dog*. (I am assuming that Mary has already undergone the "long process of verbal conditioning" [Skinner, 1957, p. 360] that enables a listener of a word *w* to also become a speaker of *w*.)

From a physiological point of view, Mary's response *dog* is evoked by the inner event generated by the sight of a dog. Nevertheless, we can usually ignore this event, because we have here a clearly defined environmental factor that controls the response: dogs or sights of dogs. Hence, there is normally no need to refer to the inner effects of seeing a dog.

Suppose now that Mary, who has never heard the word *pain*, has an inflamed appendix. Her parents are unaware of this, but Mary's behavior suggests that she is in a pain state. The parents respond verbally to this situation, and in their utterances the word *pain* frequently occurs; that is, utterances of the word *pain* are paired with the inner state corresponding to appendicitis. These pairing contingencies may enable the girl to learn the relatively correct meaning of the word. For example, further pain states—inner states that are similar to states typically caused by harmful factors—may now evoke the response *pain*.

According to our physicalist framework, Mary has learned to use correctly the word *pain* because the exposure to the pairing contingencies has changed her in such a way that similar pain states now evoke responses of *pain*. Here, we can no longer ignore the inner state *s* that evokes the response, at least not in the case of an undiagnosed appendicitis, because neither we nor the parents can observe an environmental controlling factor.

The example shows that there is no need to introduce a nonmaterial pain entity to account for Mary's verbal behavior. The inner state that evokes Mary's response *pain* is a normal physiological state. To be sure, children may say *I have a pain* rather than *I am in a pain state*. But this is merely a consequence of the fact that the parents normally use the former rather than the latter locution. It does not prove the existence of nonmaterial entities.

Many scientists claim that when people utter *pain* (or, say, *I am in pain*), they *report, describe,* or *refer to* an inner event. Methodological considerations suggest that this terminology should be avoided. First, the expressions have not been well defined. Second, the normal connotations of the expressions suggest that there is *something* that is being reported or described, and then the question arises of what is this something and how can people make contact with it. Instead of this terminology, we should use the physicalist language that has been used here. Mary's response *pain* is a normal response evoked by an inner state *s* that is similar to other inner states. To be sure, we may use the response for acquiring information about Mary's bodily condition (cf., Skinner, 1953, p. 282). By assuming that the pairing contingencies have indeed established the correct controlling properties, Mary's response informs us that the inner state that evokes the response is probably similar to other inner states generated by harmful events. But with respect to Mary, the response *pain* is a normal response that is evoked by a number of physical factors, in particular, by the combined effect of the bodily changes introduced by the pairing contingencies and the inner state generated by an event that is often harmful.

Skinner, too, frequently speaks of verbal responses that report, describe, or refer to inner events. But because he explicitly rejects dualist assumptions, his talk can, and I think should, be replaced by the physicalist terminology presented here.[2]

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[2] The following passage from Malcolm (1984) shows how, by assuming that utterances *report* inner events, one can "prove" that sensations are part of the data of psychology:

What holds for the single word *pain* also holds for compound responses such as *I am hungry* or *My tooth aches.* They, too, are evoked by inner physiological events, and these events are generated by external and internal factors, including the organic changes caused by exposure to verbal contingencies. (For the learning of compound expressions, see, e.g., Stemmer, 1987, 1990.)

Certain compound responses, such as *I am thinking of my doggy, I swear this is bitter,* or *I am aware of having a toothache,* have often invited dualist conclusions. The responses are supposed to report or describe nonmaterial results of introspections: their conscious contents. According to our physicalist framework, however, the responses do not report or describe anything. Rather, they are evoked by normal physiological events just as the response *pain.* Certain factors give origin to a physiological introspection event, and this event then evokes a particular verbal response (if the person has previously been exposed to appropriate verbal contingencies). Hence, the response does not *describe* the event that takes place in the person; it is merely a behavioral effect of inner and outer factors. It can, however, serve as a symptom and therefore give us information about the factors. For example, the response *I am aware of having a toothache* suggests that if the speaker has correctly learned the relevant words, the response is evoked by an inner event generated, among others, by a bad tooth and *awareness* factors—that is, factors that are functionally related to verbal behavior containing variants of the expression *to be aware of.*

I concluded above that, contrary to Natsoulas's assertion, Skinner can account for the phenomenon of awareness and conscious content. The present conclusion shows that this also holds for those instances for which our evidence consists of so-called verbal reports of introspections. Skinner (1978) states that:

> no one doubts that behavior involves internal processes; the question is how well they can be known through introspection. . . . We do not, through introspection, observe the physiological processes through which behavior is shaped and maintained by contingencies of reinforcement. (p. 111)

Our conclusions enable us to give more precision to this statement. Not only is behavior shaped and maintained by physiological events, but introspection itself is such an event.

The treatment of introspections as physiological events applies to analogous phenomena. Thus, events such as observing, intuiting, reasoning, inferring, or deducing are normal inner events (or processes) that are generated by environmental factors. Consequently, we can explain relevant overt responses by assuming the evocative power of the inner physiological events, whereas our predictions of the responses are based only on external data.

We saw above that there is no need to admit nonmaterial entities in order to account for verbal responses such as *pain.* The responses are evoked by inner physiological states. This shows that there is nothing cognitivist about these words. Therefore, when calling the state generated by a harmful event a *pain* state, we are not borrowing from cognitivists. We are merely asserting that the inner state is probably similar to the states that evoke the response *pain* in normal speakers of English.

Private Speech

It is important to realize that "reports" of so-called private speech have the same status as the response *pain.* Suppose a student has been asked to solve a mathematical problem; after a while, she says *I just said to myself fifteen minus seven is eight.* We can then assume that the verbal response is evoked by an inner

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A human subject of a psychological experiment will *say* various things: e.g., "The light seems brighter now," "I am beginning to feel slightly faint," etc. These utterances are reports, not of the subject's behaviour, but of his sensations. So the subject's *sensations,* not just his verbal behaviour, become part of the data of the experiment. (p. 41)

The fallacy of this conclusion becomes apparent once we realize that the utterances do not report. They are verbal responses evoked by certain inner events.

event *e* generated by external and internal factors, that *e* has (presently unknown) physiological properties, and that *e* is similar to other inner events that are generated by similar factors and followed by similar responses.

Should we attribute further features to *e*? In particular, should we say that *e* has also behavioral, speech-like, features? Our previous conclusion about analogy assumptions suggests that unless we have direct physiological data (e.g., data about specific muscular activity), no such attributions should be made. In the absence of physiological data, attributing to the physiological event *e* a physical feature that corresponds to, say, the letter *n* in *minus* is unwarranted.

This analysis suggests that referring to inner events with expressions such as covert, inner, or private *verbal behavior* or *speech* should be avoided. The expressions imply that we possess more physiological knowledge than we actually do.[3]

PHYSIOLOGICAL VERSUS BEHAVIORAL TERMINOLOGY

Whenever necessary, our physicalist framework speaks of inner events that follow, accompany, or precede external (including behavioral) events, and it does not hesitate to treat them as physiological. The events are individuated on the basis of external evidence. Incomplete analyses are therefore avoided.

This approach enables the framework to give a consistent account of many behavioral phenomena, including the phenomena that allegedly are beyond the conceptual capacity of behaviorism. The framework uses a parsimonious terminology; it only speaks of (a) external events or stimuli, (b) (indirectly individuated) inner physiological events generated by the external events, and (c) overt behavior evoked by the inner events. The terminology lacks dualist connotations, and the existence of the entities that are assumed by the terminology is acknowledged by both cognitivists and radical behaviorists.

Radical behaviorists prefer to treat the inner events as behavioral rather than physiological; that is, they adopt the semantic convention of calling the events *behavioral.* The reason is pedagogical. They think that calling them *physiological* may lead to incomplete analyses, to pseudophysiologizing. However, if we strictly adhere to the method of indirect individuation of inner events by external evidence, this danger is avoided. On the other hand, using the word *behavioral* does not inoculate us against incomplete analyses. For example, Hayes and Brownstein (1986, pp. 187–189) discuss various cases in which the use of the expression *behavioral* for referring to inner entities may not prevent incomplete accounts. Moreover, whereas some inner events perhaps have the physical dimensions of overt behavior, others clearly do not (see, e.g., the results of the abovementioned experiments on cellular correlates of learning). Further, radical behaviorists admit that even those inner events that have behavioral dimensions are physiological events; the dimensions are physicochemical ones. Therefore, calling the inner events *physiological* rather than *behavioral* gives our framework a greater degree of generality. It enables the framework to consider not only inner events that have behavioral dimensions but also those that do not. Notice also that even if the inner events are called *behavioral,* their individuation will still be indirect, because we are unable to specify the physical dimensions of the inner events, irrespective of whether they are called *behavioral* or *physiological.*

[3] The analysis of the processes by which verbal behavior is learned throws light on many other inner processes as well. For example, by considering that the learning of words such as *dog* establishes the control of external factors over verbal behavior and the learning of relational words such as *x holds y* and *x who y* determines structured verbal behavior (Stemmer, 1987, 1990), one can give a radical behaviorist account of the so-called semantic integration of memory (e.g., Bransford & Franks, 1971). The first learning process accounts for the semantic character of "memory" and the second for its organizational character. But I will not engage in such analyses in the present paper. (Stemmer, 1987, 1990, also suggests that Chomsky's, 1959, criticisms of radical behaviorist theories of verbal behavior are invalid.)

Radical behaviorists have had little success in convincing the psychological community of the correctness of their position. One of the reasons for their lack of success is the practice of calling inner physiological events *behavioral* (or *small-scale behavioral*). Whatever the pedagogical advantage of adopting this terminology, it is largely offset by its artificiality. It is likely that the use of the present physicalist terminology, together with the method of indirect individuation on the basis of external evidence, may be more acceptable to psychologists, while still avoiding the danger of incomplete analyses.

CONCLUSIONS

A strict physicalist framework that individuates inner physiological events on the basis of external evidence can account for the "mental" phenomena that are presently accounted for by cognitivist theories. The framework has no dualist implications, and the method of indirect individuation prevents incomplete analyses. Autonomous "mental" entities such as feelings, pains, beliefs, or thoughts are not admitted. However, the corresponding words may be used for individuating inner physiological events. This step has no cognitivist implications. There has been absolutely no need to use the word *mental,* except for instances in which it appears within quotation marks. This fact, together with the misleading ambiguity of the term, strongly suggests that we avoid the word completely.

REFERENCES

Bransford, J. D., & Franks, J. J. (1971). The abstraction of linguistic ideas. *Cognitive Psychology, 2,* 331–350.

Byrne, J. H. (1987). Cellular analysis of associative learning. *Physiological Reviews, 67,* 329–439.

Carnap, R. (1934). *The unity of science.* London: Kegan Paul.

Carnap, R. (1936). Testability and meaning I. *Philosophy of Science, 3,* 419–471.

Carnap, R. (1937). Testability and meaning II. *Philosophy of Science, 4,* 1–40.

Carnap, R. (1963). Herbert Feigl on physicalism. In P. A. Schilpp (Ed.), *The philosophy of Rudolph Carnap* (pp. 882–886). La Salle, IL: Open Court.

Chomsky, N. (1957). *Syntactic structures.* The Hague: Mouton.

Chomsky, N. (1959). Review of Skinner's *Verbal Behavior. Language, 35,* 26–58.

Chomsky, N. (1965). *Aspects of the theory of syntax.* Cambridge, MA: MIT Press.

Chomsky, N. (1975). *Reflections on language.* New York: Pantheon Books.

Chomsky, N. (1982). *Some concepts and consequences of the theory of government and binding.* Cambridge, MA: MIT Press.

Chomsky, N. (1986). *Knowledge of language: Its nature, origins and use.* New York: Praeger.

Dennett, D. C. (1983). Intentional systems in cognitive ethology: The "Panglossian paradigm" defended. *The Behavioral and Brain Sciences, 6,* 343–390.

Dudai, Y. (1989). *Neurobiology of memory.* Oxford: Oxford University Press.

Feigl, H. (1963). Physicalism, unity of science, and the foundations of psychology. In P. A. Schilpp (Ed.), *The philosophy of Rudolph Carnap* (pp. 227–267). La Salle, IL: Open Court.

Fodor, J. A. (1983). *The modularity of mind.* Cambridge, MA: MIT Press.

Fodor, J. A. (1987). *Psychosemantics: The problem of meaning in the philosophy of mind.* Cambridge, MA: MIT Press.

Hawkins, R. D., & Kandel, E. R. (1984). Is there a cell-biological alphabet for simple forms of learning? *Psychological Review, 91,* 375–391.

Hayes, S. C., & Brownstein, A. J. (1986). Mentalism, behavior–behavior relations, and a behavior-analytic view of the purposes of science. *The Behavior Analyst, 9,* 175–190.

Hocutt, M. (1985). Spartans, strawmen, and symptoms. *Behaviorism, 13,* 87–97.

Kandel, E. R. (1979). *Behavioral biology of aplysia.* San Francisco: Freeman.

Killeen, P. R. (1984). Emergent behaviorism. *Behaviorism, 12,* 25–39.

Malcolm, N. (1984). Consciousness and causality. In D. M. Armstrong & N. Malcolm (Eds.), *Consciousness and causality: A debate on the nature of mind* (pp. 3–101). Oxford: Blackwell.

Moore, J. (1985). Some historical and conceptual relations among logical positivism, operationism, and behaviorism. *The Behavior Analyst, 8,* 53–63.

Natsoulas, T. (1978). Toward a model of consciousness in the light of B. F. Skinner's contribution. *Behaviorism, 6,* 139–175.

Natsoulas, T. (1983). Perhaps the most difficult problem faced by behaviorism. *Behaviorism, 11,* 1–26.

Neurath, O. (1931/1973). Empirical sociology. In M. Neurath & R. S. Cohen (Eds.), *Empiricism and sociology* (pp. 319–421). Dordrecht: Reidel.

Neurath, O. (1931/1983a). Physicalism. In R. S. Cohen & M. Neurath (Eds.), *Otto Neurath: Philosophical papers 1913–1946* (pp. 52–57). Dordrecht: Reidel.

Neurath, O. (1931/1983b). Sociology in the framework of physicalism. In R. S. Cohen & M. Neurath (Eds.), *Otto Neurath: Philosophical papers 1913–1946* (pp. 58–90). Dordrecht: Reidel.

Petersen, S. E., Fox, P. T., Snyder, E. S., & Raichle, M. E. (1990). Activation of extrastriate and

frontal cortical areas by visual words and word-like stimuli. *Science, 249,* 1041–1044.

Quine, W. V. (1985). States of mind. *Journal of Philosophy, 83,* 5–8.

Schnaitter, R. (1986). A coordination of differences: Behaviorism, mentalism, and the foundation of psychology. In T. J. Knapp & L. C. Robertson (Eds.), *Approaches to cognition: Contrasts and controversies* (pp. 291–315). Hillsdale, NJ: Lawrence Erlbaum.

Schnaitter, R. (1987). Behaviorism is not cognitive and cognitivism is not behavioral. *Behaviorism, 15,* 1–11.

Skinner, B. F. (1945). The operational analysis of psychological terms. *Psychological Review, 52,* 270–277.

Skinner, B. F. (1953). *Science and human behavior.* New York: Macmillan.

Skinner, B. F. (1957). *Verbal behavior.* New York: Appleton-Century-Crofts.

Skinner, B. F. (1969). *Contingencies of reinforcement: A theoretical analysis.* New York: Appleton-Century-Crofts.

Skinner, B. F. (1974). *About behaviorism.* New York: Knopf.

Skinner, B. F. (1978). *Reflections on behaviorism and society.* Englewood Cliffs, NJ: Prentice-Hall.

Stemmer, N. (1987). The learning of syntax: An empiricist approach. *First Language, 7,* 97–120.

Stemmer, N. (1989). Physicalism and the argument from knowledge. *Australasian Journal of Philosophy, 67,* 84–92.

Stemmer, N. (1990). Skinner's *Verbal Behavior,* Chomsky's review, and mentalism. *Journal of the Experimental Analysis of Behavior, 54,* 307–319.