COMPORTAMENTO E A PELE

BEHAVIOR AND THE SKIN

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RESUMO

Skinner (1938) uma vez definiu comportamento como um certo subconjunto de atividades do organismo – aquelas que envolvem intercâmbio com o mundo exterior. Neste artigo reexamino e reformulo a definição de Skinner para tornar mais explícito o quadro conceitual subjacente. Esse quadro resulta ser parcialmente morfológico e apoiado em conceitos biológicos de organismo e adaptação. Proponho uma reformulação da definição de Skinner numa perspectiva semelhante e ressalto a importância da pele, não apenas na vida de um organismo, mas na definição de seu comportamento.

Palavras-chave: definição, comportamento, ambiente, organismo, fronteira.

ABSTRACT

Skinner (1938) once defined behavior as a proper subset of organismic activities—those that involve commerce with the outside world. Here I reexamine and reformulate Skinner's definition to make the underlying conceptual framework more explicit. This framework turns out to be partly morphological and to rely on biological concepts of organism and adaptation. I propose a reformulation of Skinner's definition along these lines, and I underscore the importance of the skin, not only in the life of an organism, but in the very definition of its behavior.

Keywords: definition, behavior, environment, organism, boundary.

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Behavior and the skin

The definition of behavior has been a controversial topic in behavioral and biological sciences, and little consensus seems to exist today (Levitis, Lidicker, & Freund, 2009). In behavior analysis, only a few definitions have been proposed, often with little justification or reflection on the rationale of the proposed definition. A significant exception to this trend is an early definition that Skinner proposed in *The Behavior of Organism* (1938). A property of Skinner's definition that sets it apart from more recent ones is that it is not all-inclusive with respect to organismic activities. Only the activities that in some sense "are having commerce with the outside world" (1938, p. 6) count as behavior on Skinner's definition.

I do four things in this paper. First, I reexamine Skinner's (1938) definition of behavior and I uncover the central idea behind it. This task is not as straightforward as it seems, because Skinner gave at least three different definitions in his book (see below). I assume that Skinner took his successive definition attempts to be be roughly equivalent, but such is not the case and the differences among them need to be discussed. Second, I analyze the conceptual framework that underlies Skinner's central definition. This requires sizable elaboration. A definition along the lines that Skinner took up is rooted in biology (not behavior analysis) and relies on the concept of a morphological boundary between organism and environment. Because both of these conceptual aspects have been criticized by behavior analysts, I rebut their criticisms and defend Skinner's biological and morphological orientation. Third, I sketch a reformulation of Skinner's definition to make the underlying conceptual framework more explicit. The result is not so much a full definition as a set of criteria to separate, among organismic activities, those that quality as behavior from those that do not. Finally, I comment briefly on the conceptual implications of the criteria I propose.

Defining behavior

The concept that is most basic to Skinner's work in *The Behavior of Organisms* (1938) is undoubtedly that of behavior. It is defined at the start of the book, before discussing the generic nature of stimulus and response, before distinguishing operant from respondent units, even before defining the concept of reflex. Here is the paragraph in which Skinner (1938) first defines behavior:

> It is necessary to begin with a definition. Behavior *is only part of the total activity of an organism* [emphasis mine], and some formal delimitation is called for. The field might be defined historically by appeal to an established interest. *As distinct from the other activities of the organism* [emphasis mine], the phenomena of behavior are held together by a common conspicuousness. Behavior is what an organism is *doing*—or more accurately what it is observed by another organism to be doing. But to say that a given sample of activity falls within the field of behavior simply because it normally comes under observation would misrepresent the significance of this property. It is more to the point to say that *behavior is that part of the functioning of an organism which is engaged in acting upon or having commerce with the outside world* [emphasis mine]. The peculiar properties which make behavior a unitary and unique subject matter follow from this definition. It is only because the receptors of other organisms are the most sensitive parts of the outside world that the appeal to an established interest in what an organism is doing is successful. (p. 6)

A shorter, separate paragraph, follows immediately:

> By behavior, then, I mean simply the movement of an organism or of its parts in a frame of reference provided by the organism itself or by various external objects or fields of force. It is convenient to speak of this as *the action of the organism upon the outside world* [emphasis mine], and it is often desirable to deal with an effect rather than with the movement itself, as in the case of the production of sounds. (p. 6)

We can distinguish basically four different definitions (or definition attempts) in these paragraphs: behavior as (a) "what an organism is *doing*"; (b) "what it is observed by another organism to be doing"; (c) the "part of the functioning of an organism which is engaged in acting upon or having commerce with the outside world"; and (d) "the movement of an organism or of its parts in a frame of reference provided by the organism itself or by various external objects or fields of force."

Let us first clear up (a). Any reference to an organism's "doings" in a definition of behavior, as in (a), should be rejected on the ground of obscurity. Some philosophers have taken the concept of "doing" to apply not only to purposive behavior but also to events such as slipping on the floor or falling down (e.g., Millikan, 1993). If this were the case, the concept of doing would be too broad to be useful in a definition of "behavior." But one might just as well take the concept of doing to be too narrow. If Arnold commits suicide by jumping over the cliff, his jumping is his own doing, but his falling to the ground is not something that he does; rather, it is something that happens to him. Similarly, if Betty reacted to bad news by sweating profusely, no one would take her sweating as a case of "doing" (except perhaps as a joke: "What is Betty doing?"—"Sweating profusely."). The concept of doing is so tightly linked with the notion of purposive behavior that one can hardly take the former as a non-circular definition of the latter. Taken as a definition of all behavior (purposive or not), the concept of doing fares even worse.

Skinner's second attempt at defining behavior, (b), adds an observational requirement to (a). To quality as behavior, an activity X must not only be what an organism is "doing," it must also be observed as such by another organism. Note that Skinner formulates (b) in terms of *actual*, not merely potential, observation. Taken literally, this requirement seems absurd, since it excludes from the domain of behavior numerous cases of animal and human actions that have never observed by anyone. In all likelihood, however, Skinner meant definition (b) to be formulated in terms of observability rather than actual observation. Reformulating (b) along these lines, an organism's doing X counts as behavior only if it *can* be observed by another organism; actual observation is not needed. And indeed, consistent with this interpretation, on the next line Skinner describes behavior as something that *normally* (but not necessarily) comes under observation.

Regardless of the distinction between observation and observability, characterization (b) is not central to Skinner's attempt at defining behavior. What is central to Skinner comes next, with characterization (c), a definition of behavior which appeal neither to an organism's "doings" nor to their observability. According to (c), behavior is "*that part of the functioning of an organism which is engaged in acting upon or having commerce with the outside world*" (Skinner, 1938, p. 6, italics mine). Two elements make me conclude that definition (c) is the central one for Skinner. First, he uses (c) to ground the appeal to observation in definition (b). According to Skinner, an event does not qualify as behavioral because it is observable or easily observable, as (b) seems to suggests. The relation actually is the other way round. As Skinner explains at the end of his first paragraph, an organism's behavior is easily observable *because* it is behavioral, that is, "engaged in acting upon or having commerce with the outside world". Second, Skinner emphasizes that "the peculiar properties which make behavior a unitary and unique subject matter" derive from (c). Of characterizations (a) to (d), (c) is the only one that Skinner mentions in this respect. Accordingly, I take (c) to be Skinner's (1938) basic definition of behavior, and it is the one I will defend.

Before defending and elaborating on (c), however, let me briefly comment on characterization (d), according to which behavior is bodily movement relative to the organism itself or an external frame of reference. This definition has been quoted to illustrate Skinner's lapses into "mechanistic," as opposed to "functional," thinking (Gifford & Hayes, 1999, p. 293). My own reason for criticizing (d) is that even though Skinner presents it a reformulation of (c), definitions (c) and (d) are actually non-equivalent. An electric eel's stunning its prey, for example, involves "commerce with the outside world" in the sense of (c) but no bodily movement in the sense of (d)– unless one takes "bodily movement" to include ionic currents inside the body, which I do not think is what Skinner (1938) had in mind. Here I will take (d) to be nothing more than an illustration of (c) in the case of the laboratory rats that Skinner used as subjects. The illustration is admittedly typical, but it is worth remembering that it does not encompass all forms of behavior in the sense of (c).

The behavior of organisms

According to (c), behavior involves an organism's functioning plus the additional condition of "having commerce with the outside world."

There is a good reason for mentioning the concept of organism in (c). All scientists study behavior in a broad sense, from the behavior of subatomic particles to the behavior of planetary systems. In spite of their profession's name, however, behavior analysts do not analyze any kind of behavior. They do not study the behavior of electrons or that of slabs of concrete, for example, but the behavior of *organisms*. In fact, behavior analysts study the behavior of organisms in a tiny sample of animal species, chosen in part on the basis of their possible relevance to human behavior. In Skinner's (1938) words:

> In the broadest sense a science of behavior should be concerned with all kinds of organisms, but it is reasonable to limit oneself, at least in the beginning, to a single representative example. Through a certain anthropocentricity of interests we are likely to choose an organism as similar to man as is consistent with experimental convenience and control. (p. 47)

Because the concept of organism is basically a biological concept, definition (c) appeals to another science in order to circumscribe the research domain of behavior analysis. The dependency of definition (c) on the concept of organism has been criticized by Roche and Barnes (1997). Many of these authors' criticisms are well taken but do not apply to definition (c), only to flawed extensions or misinterpretations of it. I agree, for example, that we should not attribute agency to the organism (Roche & Barnes, 1997, p. 602) and that behavior analysts should not confuse their subjects, which are organisms, with their subject matter, which is not an organism (p. 603). We can also agree on the importance of history and context in behavior analysis (pp. 606-609). None of this, however, shows that there is something wrong with appealing to the concept of organism in delimiting the research domain of behavior analysis.

Furthermore, Roche and Barnes' (1997) own alternative to the organism concept is ultimately unsatisfying. They suggest that the type of behavior of interest to behavior analysts can be distinguished from other types, not by the nature of the systems involved but by the principles or laws on which behavior analysts focus (p. 602, p. 604). On this conception, a rat's lever-pressing qualifies as "behavior" of the type of interest to behavior analysts, not because it involves a rat but because it adheres to principles of reinforcement (for example). The problem with this conception is that it inverts the relative positions of domain identification and theory formulation in behavior analysis. Domain identification came first. Skinner (1938) identified rat lever-pressing as behavior, and did so explicitly on the basis of definition (c), *before* formulating principles of reinforcement. Roche and Barnes' formulation also fails to explain why behavior analysts consider operant and respondent principles to apply to the same research domain (namely, "behavior") even when these principles are taken to be non-overlapping. The alternative is to recognize that different as they are, these principles are bound together in the same discipline because they apply to a single domain—the behavior of organisms—that was understood as such before taking any stance on the kind of laws that would apply to it.

Finally, invoking the concept of organism in the definition of behavior, as in (c), may be taken as a scientific strength of behavior analysis rather than a philosophical weakness. Any science is connected to other sciences—a "science" that is not so connected is probably not a science. Admittedly, "organism" is not a technical term in behavior analysis, and the term does not appear in the formulation of behavioral principles (Roche & Barnes, 1997). Rather, the concept of organism is part of the background connection between an antecedent science, biology, and the very definition of behavior. Once our definition of "behavior" is formulated, the concept of organism drops from behavioral principles without making the former less important at a foundational level.

Organism and environment

Definition (c) further involves the notion of an organism's "commerce with the outside world." Taken at face value, Skinner's wording implies a conception of the organism with an inside and an outside, as well as a boundary or interface between the two. This *morphological conception of the organism* has been the target of philosophical criticisms reviewed ten years ago by Palmer (2004). This author's main argument is that the distinction between organism and environment does not coincide with the skin or any other morphological boundary. Not only are the organism and its environment physically interpenetrated, they are also codependent in such a

way that they can only be defined as complementary poles in a single biological process (which Palmer terms, *bioprocess*). As a corollary of his insistence on a continuous bioprocess, Palmer champions the notion of an organism as an "ongoing organization rather than a skin-bound body" (p. 317).

The issues that Palmer (2004) discusses are profound. They are also complicated by the existence of different concepts of organism in biology (Pepper & Herron, 2008). On a conception of the organism defined merely in terms of genetic cooperation among parts (Queller & Strassmann, 2009), whether a biological entity qualifies as an organism is merely an issue of degree. Definitions of "organismality" in terms of genetic cooperation or coherence, however, neglect two fundamental features of the entities we commonly recognize as "organisms."

The first fundamental feature is spatial cohesiveness (Scheiner, 2010). The components of a typical organism do not float around but are maintained together by a membrane (in the case of unicellular organisms) or specialized mechanisms of cell adherence. Presumably, the presence of such mechanisms is not accidental but functional, in the sense of involving natural selection (Bonner, 1988). The second fundamental feature is the presence of a biological boundary between the inside of the organism and its outside (Wagner & Laubichler, 2000). The boundary counteracts or regulates causal influences from the outside—causal influences that would otherwise have deleterious effects on the inside of the organism. This protective function is carried out by the cell membrane (in the case of unicellular organisms) and by the integument (in the case of multicellular organisms). Examples of integument are animal skin, the epidermis of plants, and the exoskeleton of insects.

Because the boundary of the organism has protective functions, it is often described colloquially as a "barrier:"

> The integument must act as a protective barrier; it helps shield the individual's delicate, moist, internal tissues from a changing and often harsh environment that might otherwise infect the body with bacteria, freeze the body's fluids, evaporate the body's water, or mutate the body's genes (Brum, McKane, & Karp, 1994, p. 542).

Far from being impermeable, however, this "barrier" allows material exchanges between organism and environment. Many invertebrates, for example, respire through their integument; they would quickly die if this were not the case. Arguing that the boundary is arbitrary, or perhaps even nonexistent, on the ground that it can be crossed would be fallacious. Far from being arbitrary, as a mere geometrical boundary would be, a biological membrane or integument is both morphological *and* functional. That (some) organisms have a biological boundary is no accident but, presumably, the result of natural selection (Maynard Smith & Szathmáry, 1997).

Because biological boundaries are permeable, it is not surprising that some of the materials present on the outside of the organism eventually end up inside (Palmer, 2004, p. 325). Neither is it surprising to find non-organic components in the integument of an organism (Sumner, 1922, p. 232). All organisms have components (such as carbon atoms) that are not alive in Muller's (1966) sense of variation and multiplication with heredity. Actually, organisms are built of non-organic components. Finally, the organism, including its boundary, is in constant renewal. Within our skin, for example, cells constantly migrate toward the surface and die. The boundary can even change completely, as when insects molt; the dead boundary stops being part of the organism when it is no longer attached to it. Thus, to Palmer's (2004) view of the organism as an "ongoing organization *rather than* a skin-bound body" (p. 317, italics mine) we can substitute that of an organism as an ongoing organization *and* a skin-bound body. There is no incompatibility between these two aspects of the organism; on the contrary, the boundary of the organism exemplifies both morphology and function (Wagner & Laubichler, 2000).

A definition (almost)

Here, then, is a possible reformulation of Skinner's (1938) definition that explicitly links behavior and the skin. To quality as an organism's behavior, an occurrence must at the very least:

(1) involve an effect at the organism's boundary;

(2) this effect must be the result of the organism's internal activity;

(3) the type of causal relation from activity to effect must have a biological function;

(4) the effect at the boundary must be reversible.

The most obvious example of behavior according to these criteria is animal movement. Whether the whole animal moves or only a part of it, criteria (1) to (4) are fulfilled. The effect is a change in the shape of body surface (1), this change is the result of muscular activity (2), changes of body shape are a biological function of muscular activity (3), and the observed change is reversible (4). The *absence* of movement, however, as in standing still or freezing, also qualifies as behavior provided it fulfills (1-4).

Notice that in humans and other animals, "the gut and the internal genital organs like the uterus are topologically part of the body surface" (Wagner & Laubichler, 2000, p. 26) or what I have called the organism's boundary. Thus, any change that involves the gastrointestinal tract, for example, and fulfills criteria (1-4) qualifies as behavior—of a sort difficult to observe by others, admittedly, but behavior nevertheless. Breathing, eating, drinking, urinating, and defecating, are all activities that fill in or drain on bodily cavities (Lockard, 1964), and all qualify as behavior. Sweating also qualifies as behavior according to (1-4). In this case as well as Lockard's, the effect defined in (1) consists of the boundary's being crossed by bodily products. In the case of the electric eel stunning its prey, again an example of behavior according to (1-4), ionic currents inside the eel result in the boundary's being crossed by a net flow of charge. Color changes in animal skin and the emission of pheromones (Millikan, 1993) also count as behavior when fulfilling (1-4).

Let us now have a closer look at what criteria (1) to (4) exclude from the category of behavior. Criterion (2), inspired by Dretske (1988), excludes passive changes of body shape such as a student's having his hand guided by the teacher. Criterion (3), inspired by Millikan (1993), excludes neural changes unaccompanied by motor output. At first sight, it seems that such activities (hereafter, *silent* neural activities) would fail to count as behavior merely by virtue of having no effect at the organism's boundary. Even silent neural activities have physical effects at the organism's boundary, however—minute electromagnetic effects arising from action potentials inside the brain. These effects usually go unrecorded but are nevertheless real; and what prevents an organism's silent neural activity from counting as this organism's behavior is not (1) but (3). In the case of silent neural activities, the causal relation from internal activity to electromagnetic effects on the skin has no biological function. That is, the presence of this causal relation in the organism's ancestors never played any role in their reproductive success (Perlman, 2010). By contrast, in the case of the eel stunning its prey electrically, as well as in the case of neural activities that eventuate in muscular movements, the causal relation from internal activity to effects at the organism's boundary involves a history of natural selection, and qualifies as behavior according to (3).

As in Millikan (1993), criterion (3) appeals to biological function, and ultimately adaptation through natural selection (Rose & Lauder, 1996), in defining behavior. A first difference between Millikan's definition and mine is that (3) mentions effects at the organism's boundary instead of effects on the environment or on the relation between environment and organism (Millikan, 1993, p. 137). A second difference is that (3) appeals to the function of a *type* of causal relation between internal activities and effects at the organism's boundary, instead of a specific causal relation. A minor advantage of the present formulation is that it allows knee jerks, for example, to quality as behavior, whereas Millikan rejects them on the ground that they have no adaptive significance. Even though a knee jerk may be a spandrel (Gould & Lewontin, 1979), it still counts as behavior according to (3), however, because it involves a type of causal relation from neural activity to muscles to body shape that is globally adaptive.

Finally, criterion (4), which focuses on reversibility, excludes a variety of developmental changes from the category of behavior (cf. Levitis, Lidicker, & Freund, 2009, p. 108). If your hair grow, for example, no change in the amount or nature of the internal activity that made them grow will make them "ungrow" (although you may cut them with a pair of scissors). By contrast, hair raising in terrestrial mammals is reversible and qualifies as behavior along the lines of (1-4).

Now it should be admitted that in proposing (1-4) I have fallen short of giving a definition of behavior.

Instead of saying what behavior *is*, I have listed four criteria that any episode must fulfill, minimally, in order to qualify as behavior; and, following Kantor (1924/1985, p. 5), I could have imposed further restrictions to distinguish the kind of complex behavior of interest to psychologists from simpler kinds. In all cases, behavior will involve activity with effects at the organism's boundary. Why not go one step further and stipulate, along with Skinner (1938, p. 6), that behavior *consists* of activity with effects at the organism's boundary? Because behavior analysts typically deal with the environmental results of organic activity rather than the activity itself. Think of the most well-known laboratory examples of operant behavior: lever pressing in rats and key pecking in pigeons. A rat cannot press a lever, and a pigeon cannot peck a key, unless a lever and a key are actually present in the environment. Thus, lever pressing and key pecking do not consist of muscular activities in and by themselves, but of achievements that involve surrounding objects. In Guthrie's (1952, pp. 27-28) terms, lever pressing and key pecking are not movements but acts.

For Skinner (1938), dealing with behavior as an achievement instead of the organism' own activity may have been merely a matter of convenience ("it is often desirable to deal with an effect rather than with the movement itself", p. 6). The fact remains that theorizing behavior in terms of the underlying activity rather than its environmental effects would entail dramatic changes with respect to most scientific practices in behavior analysis. Furthermore, the organism's boundary being permeable, any internal activity with effects at the boundary will also have effects (however trivial) in the environment. Behavior being a prime example of continuous causal flow (or bioprocess in Palmer's 2004 sense), how deep inside the organism its behavior starts, and how far away in the environment the organism's behavior ends, are issues perhaps best left open.

Concluding comments

Regardless of the distinction between movements and acts, the four criteria I have proposed make for a possible reconstruction of Skinner's notion of "commerce with the outside world" (1938, p. 6). I believe the reconstruction to be both coherent and worthwhile, not only with respect to what it includes but also with respect to what it excludes. Consistent with our refusal to decide where behavior starts, neural activity that affects the organism's boundary and follows (1-4) qualifies as an early component of behavior. Neural activities without motor output, however, do not follow (1-4) and accordingly are not behavior, not even part of it.

Note well: I do not assume that all life forms that may count as organismic (slime molds, for example) must have a specialized boundary. Neither do I assume the impossibility of organisms (with their boundary) living inside another organism (with *its* boundary), as in symbiosis. Also, I realize that the concepts of boundary, inside, and outside are co-defining. I do insist, however, on the importance of an organism's having its own boundary in order to have its own behavior. If a colony of cells, for instance, has no boundary of its own, then its only boundary is the union of its cellular boundaries, and the behavior of the colony is nothing more than the union of the behavior of its cells. So a life form without its own boundary has no behavior other than the behavior of its parts. The skin is that important as a boundary, and even more than you think: *No skin, no behavior of the organism*.

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