Contextualistic Mechanism or Mechanistic Contextualism?: The Straw Machine As Tar Baby

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For a generation, we behaviorists have been chiding our cognitive friends that they seemed to be treating the organism as a white box in a black world. For many cognitive psychologists, at least historically, human behaviors emerge like wraiths out of a mysterious cauldron of processed images, thoughts, strategies, schemas, rules, and representations, all apparently disembodied from history and current contingencies. I am reminded of the linguist Julie Andressen's address (1991) at the convention of the Association for Behavior Analysis where she showed de Saussure's diagram of a floating head spouting words into a contextual void. Well, cognitive psychology has gradually discovered context as they have other things (like implicit learning and remembering) we behavior analysts have known about from the beginning. Within behaviorism, however, "context" is gradually taking on the character of the "Man Who Came to Dinner," that is, a once-welcomed guest is becoming, in my view, an overbearing nuisance. "Context" has evolved into "contextualism," a conceptual and presumably foundational framework—*eine Weltanschauung* for radical behaviorism. Contextualist behaviorism had been argued by Kantor in bygone days, and more recently, with accelerated vehemence, by Linda and

Steve Hayes, Hayne Reese, Ed Morris, and others.

Ed Morris has been a most scholarly, eloquent, and persuasive spokesman for the behaviorism-as-contextualism view, and this essay will be in response primarily, though not exclusively, to his presentations of that view. My sources include his article entitled "Contextualism: The World View of Behavior Analysis" (1988b) and two presentations, one at the 1988 American Psychological Association meeting in a symposium on Skinner's *The Behavior of Organisms* (1988a) and his presidential address (1991) at the meeting of the Association for Behavior Analysis. Those presentations are encompassed in a book chapter entitled "*The Behavior of Organisms: A Context Theory of Meaning*" (in press). His thesis includes at least the following points: (a) Radical behaviorism is fundamentally committed to a contextualist position; (b) Skinner began with this view, then subsequently either ignored or abandoned it; and (c) behavior analysis has, and indeed, must reassert this position conceptually and empirically in order to compete effectively in the tough market of psychological theory and practice.

In keeping with Morris's perspective, his work must be viewed in historical context. Foremost is the strong imprint of J. R. Kantor's "integrated field orientation" (see, e.g., Morris, 1984, 1988b), and Pepper's *World Hypotheses* (Hayes, Hayes, & Reese, 1988; Pepper, 1942). The Hayes et al. paper on Pepper's *World Hypotheses* deserves special attention. This very stimulating paper demonstrates, in spite of its thesis (and that of Pepper), that there is a kind of law of conservation of opinion: The more defensible one view is, the less defensible another view. Pepper's assertion is that one worldview is

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incommensurate with another, so that strengths in one do not imply weaknesses in another. Argument (and, I believe, reality) usually proceeds otherwise, however. The incommensurate position can be made defensible if the various world-views are adroitly *defined*. The issue arises, however, as to whether those definitions are merely *formal*—that is, usually highly simplified verbal abstractions constructed or derived from dictionaries and other sources—or *functional*—descriptive, for example, of the relevant behaviors of those in fields in which the terms in question have a relatively safe and comfortable home. Part of my thesis is that formal–functional distinctions are basic to arguments asserting that behaviorism is one thing or another. If, for example, it is asserted that behaviorism is not mechanistic, but something else, then how is “mechanism” to be defined (never mind the something else)? My approach is first to look at what the theories and practices of mechanism are and have been in those fields in which the term has persisted in one form or another (physics is a prime example, but there are many others). Second, I compare those activities with the interests, basic and applied, of those calling themselves behavior analysts. There are numerous dimensions of what constitutes a mechanistic approach. Space does not permit, however, anything like a full accounting of how all those dimensions might be reflected in modern behavior analysis. In this essay I want to focus on the issue of “contextualism” as a conceptual framework for behaviorism, set in contrast to “mechanism.”

As a starting point, consider Pepper’s “root metaphors” for “mechanism” and “contextualism.” Here, I rely on Hayes et al. (1988):

The root metaphor of mechanism is the machine. Any common-sense machine is composed of discrete parts related to other parts in some systematic way. Relations among the parts do not change the nature of the parts, however, because the parts exist independently of those relations. Further, in any common-sense machine, some sort of force or energy is exerted on or transmitted through the system to produce predictable outcomes. (p. 98)

As for contextualism,

The root metaphor of contextualism is the ongoing act in context. Another term might be the historical act, but not as a dead description of a thing done. It is doing as it is being done, as in hunting, shopping, or making love. (p. 100)

Having planted these roots, it might appear that very different kinds of flora would grow from them. I would like to argue, however, that distinctions between those flora are based upon a kind of category error. Thus to place mechanism and contextualism in contrast is to misunderstand the role of both in the language game of scientific inquiry. Behavioral contextualists have set up a straw machine that, under examination, turns out to be a conceptual tar baby to snare the unwary.

Problems arise immediately with the root metaphors as quoted. The parts of a machine are said to exist independently of the relations between them within the machine. Hayes et al. (1988) continue by examining the lever as “a simple example”: “The lever is composed of two discrete and independent parts—a lever and a fulcrum” (p. 98). (It is curious that the authors came to use the same word to describe both the machine and a part of the machine. To avoid some confusion, I will use the term “bar” instead of “lever” to describe the part.) So, then, a lever consists of a bar and a fulcrum. In what sense, however, can the bar and fulcrum be said to exist *independently* of their role in the machine? Certainly they are not independent as far as their function in a lever is concerned. “Fulcrum” has meaning only in the *context* of a lever. Moreover, there is no particular object to which the term “fulcrum” necessarily applies, independently of its role in a lever. Try going to a hardware store and asking for a “fulcrum”! The case of “bar” is different, but the conclusion is the same. We could point to a bar lying on a table, but that bar might be used for many purposes having nothing to do with levers (e.g., construction, a weapon, a weight, a prison door, etc.). Thus, to say that the bar can exist independently of its role in a lever is saying very little. This

is a kind of disembodied existence with “potential” purpose. Again, the meaning of “bar” depends on context. With respect to the machine as a whole, as Gregory (1981), in a very valuable discussion of machines and mechanisms, puts it:

A machine is generally conceived as a functional entity consisting of clearly defined parts, such that the internal functions can be understood from knowledge of the parts and how they interact. To understand its external functions—what it does—we must know about its “environment.” (p. 73)

And,

When we speak of the function of the entire organism, rather than its organs, or of an entire machine rather than its parts, then we have to see the organism or machine within a context within which it plays its part. (p. 83)

These points provide a link between function in a machine and function in an organism. The former has an ontological history established through contingencies related to human need and use, and perhaps a bit of adventitious control through evolutionary mechanisms. Both are the outcome of selective contingencies; for example, one could trace a selective shaping of design leading from the Wright brothers’ original Kitty Hawk plane to the space shuttle. Moreover, although the term “purpose” cannot reasonably be applied to the outcome of biological evolution as it might to a machine, there is no clear necessity to abandon a mechanistic perspective to embrace something called contextualism when the former already implies the latter.

The retreat from mechanism often hinges on the relations between part and whole in the machine, or the organism, or whatever. The trick, however, is to sail carefully between the Scylla of ghostly emergence and the Charybdis of simple reductionism. Emergence is often cited as a counter to simple-minded mechanism. The whole is somehow more than the sum of its parts. Contextualism embraces emergence. Context, improperly treated, can easily become an eerie aura surrounding a functional account, as well as an infinite well of explanatory appeal.

What is contributed beyond a *careful* specification of contingencies is not clear.

As for the whole being more than the sum of its parts, the immediate problem is that both “parts” and “sum” are undefined. How does one “sum up” the “parts” of a clock to yield a clock? To quote Gregory (1981) once more:

I think we can dispel Ghostly Emergence from machines . . . by saying that when parts are combined into more complicated . . . structures, these structures have different interfaces with each other and with their local environment, and so when combined they display different properties from the isolated parts, and from the parts combined in different ways. Thus, for example, two halves of a wheel separated are obviously functionally very different from the complete wheel, just because, and with no mystery, there is not a continuous rim for half-wheels, so they will not run on a surface. In other words, what emerges is given simply by the differences at interfaces, as the parts are added or removed. When the interfaces are different, the behaviour of the machine is correspondingly different. (And it does not matter what is inside the parts, for only the interfaces are significant.) (p. 87)

Naïve reductionism, wherein *all* phenomena at one level of analysis are fully accounted for by processes at a subadjacent level, and so forth, is not a view held by any modern perspective on mechanism, or, indeed, any scientific endeavor. The issues of reductionism, like those of mechanism, are very much more complex than are usually appreciated (see, e.g., Marr, 1990; Mercer, 1981; Nagel, 1979). To invoke, for example, as some contextualists have, Skinner’s (1938) treatment of the “conceptual nervous system” and his views on neurologizing as justifying an antimechanistic stance for radical behaviorism is to display a red herring that is, in fact, also a dead herring.

The root metaphor of contextualism as the “ongoing act in context” (Hayes et al., 1988) tells me little about what context means, intuitively or otherwise; indeed, there seems to be no metaphor there at all. Morris (in press), however, has provided a more useful focus:

the historical context . . . establishes what functional relationships *may* occur among stimuli and responses at present. . . . The current context, in turn, affects behavior in two ways: It influences

which of these relationships *can* and *will* occur. More specifically, the *form* of the current context (i.e., organismic and environmental structure) influences whether the historically-established relationships can physically occur (i.e., be enabled), while the *function* of the current context . . . influences whether the relationships will be instantiated. (emphasis in original)

"Current context," in the senses that Morris has given us, has always been an essential part of that most lofty representation of mechanism—classical mechanics—Newton's "system of the world." Newton's second law of motion, $F = m(dv/dt)$, is a differential equation that, suitably applied, can describe the motion of the moon, the fall of a sparrow, the bounce of a billiard ball, and the beat of a drum. By itself, however, the law is not only useless but meaningless. The law is comprised of three terms—force, mass, and acceleration—no one of which can be defined independently of the other two. Likewise, the elements comprising Skinner's three-term contingency cannot stand alone in a contextual vacuum. In both cases, the meaning of these relations is to be found in their *application*. But the commonalities do not end there. As a differential equation, Newton's second law cannot yield useful solutions without specification of initial, and, in many cases, boundary conditions. As an example, consider a vibrating drum membrane. This system may be described by a partial differential equation whose form per se can encompass an infinite number of systems and solutions. The equation takes on meaning by assignment of initial conditions, for example, the initial form of displacement and its location on the membrane, and by boundary conditions, such as the shape of the drum. Also to be included are properties of the drum membrane, for example, its "springiness." All these specifications dwindle to a precious few an infinity of possibilities. So it is that any use of Skinner's three-term contingency requires clear descriptions of the properties of and interrelations among responses, consequences, and prevailing stimuli. Otherwise, we are left chasing our conceptual tails.

Although initial and boundary conditions are not part of nature's laws, they

are obviously important variables to study because they define and set the limits under which a given law will apply. Thus, variables such as species, age, reinforcement history, deprivation, and so forth may modulate the results of applying a behavioral law, just as the material of which a drum membrane is made, its shape, the way it is clamped, and how it is struck will determine the pattern of vibrations produced. It is important to emphasize that initial and boundary conditions are *not* part of the laws to which they apply; rather they provide a *frame of reference* to assess those laws. They are the grounds upon which laws of nature are seen as figures. Perhaps this reflects Morris's assertion that context gives meaning to behavior. But it could just as well be said the other way around. Context, by itself, is as empty and meaningless as a frame without a picture.

There are, of course, significant subtleties here. One is the boundary between context and the laws describing the events under study. What, at first glance, seems to be part of the context may disappear when a more general law is derived. For example, Galileo's law of falling bodies does not take into account the effect of the medium through which a body is falling (e.g., air resistance). The law really applies only in a vacuum. Does adding a retarding medium such as the atmosphere change the context, or, in Morris's terms, meaning of the law? No. Both are expressible by Newton's second law of motion. How, then, do we take this new situation into account? It is dealt with by deriving a *new*, more general law with the vacuum as a limiting condition. A parameter of the general law is changed accordingly.

Perhaps one of the reasons that contextualism claims to be the proper "worldview" of behavioral analysis is that both behavioral laws and their relevant contexts are only vaguely discerned. Under these conditions, the boundaries between the two must be fuzzy indeed. But ever since Skinner (1938), we have at least the possibility of clarifying the boundaries by distinguishing between prevailing contingencies and what Skinner called

“third variables” (e.g., those characterizing motivational conditions). As mentioned previously, such variables set up or establish conditions within which functional relations may be assessed; in doing so, they constrain behavioral variability. We typically, however, isolate these conditions from contingency specifications, such as arrangements of multiple or concurrent sources of reinforcement for certain classes of emitted behaviors under certain schedules and stimulus conditions. Given all these initial and boundary conditions, doting on a vague entity like “current context” is a superfluous and unfocused affectation. Moreover, different fields of scientific endeavor focus on different classes of dependent, independent, and controlled variables—one investigator’s context is another’s career.

Returning to Morris’s dichotomy, what about “historical context”? As behavior analysts are quick to point out, “history,” or, if you like, “historical context” may carry a considerable explanatory burden in an interpretive account. Moreover, the role of history is commonly emphasized as differentiating contextualistic (and organismic) from mechanistic accounts. Newtonian classical mechanics possesses no arrow of time; Newton’s world run backwards would look the same as it does going forwards, a perfect temporal symmetry. The same may be said of the two great pillars of 20th century physics, relativity and quantum mechanics. However, physics has long dealt with systems in which there is a direction to time, from thermodynamics and fluid mechanics to modern nonlinear dynamical systems (see, e.g., Coveney & Highfield, 1990; Gardner, 1990; Gleick, 1987; Nicolis & Prigogine, 1989; Prigogine, 1980; Prigogine & Stengers, 1984; Ruelle, 1991). The issues raised by consideration of what might be called “neoclassical” mechanics deserve more space than is reasonable in a presentation of this sort, but suffice it to say, for example, that seemingly “simple” mechanical, electrical, and chemical systems are capable of considerable complexity—evolving over time in irreversible and unpredictable ways; the slightest

changes in initial conditions or other parameters result in totally different outcomes. Such systems may evolve in ways pictured only by actually letting them evolve; that is, the outcomes and all the intermediate states can be known only by seeing them happen, just as in biological evolution. (An expert on evolution, knowing all there was to know about the Jurassic period, could never predict that something we call a giraffe would appear in the Miocene.) Unlike the essentially stochastic mechanisms underlying biological evolution, however, so-called chaotic systems may display an astonishing underlying order expressible by properties of deterministic (i.e., non-stochastic) equations. The principal point here is that immense complexity may be encompassed within a mechanistic framework that is potentially capable of capturing even the deep mysteries of behavior dynamics (e.g., Hoyert, 1992; Marr, 1992; Palya, 1992).

In this context, I feel compelled to address, at least briefly, the argument that even physics itself is not mechanistic, and, in fact, has not been since the 19th century. Hence, if behavior analysts looked to physics as a model of what mechanism can achieve, then they should also look to what mechanism did not achieve. I have already mentioned temporal irreversibility—the arrow of time—or, as it has been elegantly expressed by Prigogine (1980), “from being to becoming.” Modern nonlinear dynamical systems theory—a mechanistic system—deals with phenomena exhibiting “becoming.” But perhaps the most often cited “nonmechanistic” aspect of physics is a “field.” The logic of contextualists and other field-theoretic psychologists seems to be this: Physics successfully invokes the field concept, and the field is nonmechanistic; we contextualists invoke an “integrated field perspective,” so we are not mechanists either. Furthermore, we gain scientific respectability by being (or perhaps I should say “becoming”) part of the retreat from mere mechanism. This identification with that most esteemed of sciences—physics—might be worthy if there were some clear correspondence between

the term "field" as it functions in physics and "field" as it appears in, say, contextualism. In physics, the concept of field helped deal with uncomfortable feelings about action-at-a-distance and, much more importantly, provided an account of properties of, for example, electromagnetic radiation. Since at least Maxwell's time, the term has been essentially a mathematical abstraction wherein each point in a space is assigned a magnitude and possibly a direction.

On the other hand, I will freely admit that as much as I have been exposed to the term "field" in psychology, and recently in contextualism, I have never understood it. I have calculated and measured electric and magnetic fields, but I haven't a clue about how to do either in the analysis of behavior, or what I would have if I did. Perhaps "field" is simply one of those kinds of metaphors we chide our cognitive psychology colleagues about. If it is, then it would be a wispy criterion indeed for claiming a nonmechanistic stance.

My inability to appreciate the value of the term in a behavioral context aside, "field" in physics (e.g., the electromagnetic field) possesses properties that can be described as "mechanical." That is, it has velocity, momentum, and energy. In fact, the notion of a field can virtually be dispensed with altogether and replaced by particle interaction, as it is in Feynman's (e.g., 1985) formulation of quantum electrodynamics. Thus, contextualists will have to choose another model for their fields. The one in physics is too mechanical. Perhaps they should look to agronomy.

The experimental analysis of prevailing stimulus contingencies, the influences of differential histories, and the modulating effects of what Skinner called "third variables" has and continues to be the major, indeed, the accelerating focus of interest in our science. There is nothing in modern behavior analysis to discourage such efforts. It should be emphasized, too, that, for the most part, the experimental analysis of behavior offers the most effective methods and principles for assessing those classes of variables and

more. As I have tried to emphasize, the overall approach has, and continues to fit into, an already established mechanistic framework with a long evolutionary history (Killeen, 1992; Marr, 1989, 1992). This framework has had from the beginning an inherent "contextualism." Not, to be sure, the vague contextualism of, for example, Kantor and his followers, but one based upon a careful experimental and analytic approach to behavioral phenomena to seek the original goals of a behavioristic formulation—prediction and control.

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