An Introduction to the Origins, Status, and Mission of Behaviorology: An Established Science with Developed Applications and a New Name

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Behaviorology? What's that? Where does it come from? How does it differ from other disciplines and fields that evince some interest in why people do what they do? How is it related to other disciplines and fields? How much is encompassed by behaviorology, such as its contributions? Why should anyone learn anything about behaviorology? Questions such as these typically arise when people first come across the term *behaviorology.* This paper presents some initial answers to these questions by surveying an analyzed history of the origins of the discipline of behaviorology and the behaviorology movement. The survey includes some corroborative evidence from the status of behaviorological science in China. (For elaboration of the points introduced in this paper, see Fraley & Ledoux, 1997, and Ledoux, 1997a, b, c.)

What is Behaviorology?

Put too simply, behaviorology is the science and technology of behavior relations. This may appear similar to the way some other disciplines define themselves. A more elaborate definition, an expansion of the definition written for the By–laws of TIBA, The International Behaviorology Association (an expansion undertaken when experience indicated some lingering confusion over the discipline's range and depth of coverage), should help discriminate between behaviorology and those other disciplines:

> Behaviorology, a comprehensive discipline with philosophical, experimental, analytical, and technological components, is the natural, life science, emphasizing the causal mechanism of selection, that discovers, interprets, and applies the simple and multiple variables that are in functional relations with the simple and complex, overt and covert behaviors of individual organisms (especially people) during their lifetime (and beyond, with respect to cultural practices), and that takes into ac-

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This paper was originally part of an invited address to faculty and graduate students of the School of Management, Xi'an Jiaotong University, Xi'an, Shaanxi, People's Republic of China, 20 March 1991, as well as to other Chinese audiences. It was prepared for those and other audiences, including students, who wanted a brief introduction to the concept of a discipline of behaviorology separate from psychology. As indicated by its title, it also serves as the introduction to a larger work (i.e., Fraley & Ledoux, 1997).

count socio–cultural and physical variables from the environment as well as variables from the biological history of the species.

Here is a simpler way to present that thorough definition:

The discipline of behaviorology,

- being a comprehensive discipline with philosophical, experimental, analytical, and technological components,
- is a natural, life science;
- emphasizes the causal mechanism of selection;
- discovers, interprets, and applies the simple and multiple variables that are in functional relations with the simple and complex, overt and covert behaviors of individual organisms (especially people) during their lifetime (and beyond, with respect to cultural practices); and
- takes into account socio–cultural and physical variables from the environment as well as variables from the biological history of the species.

Where Does Behaviorology Come From?

As a current *discipline*, behaviorology comes from the interaction of the previously developed behaviorological science and technology with the current behaviorology *movement*. The conditions under which the original behaviorological science and technology developed gave rise to the current behaviorology movement, and that movement has enabled recognition of the current disciplinary status of behaviorology.

Science and Technology Origins

The science, and the technology originally developed from the science, began about sixty years ago, early in the career of B.F. Skinner. Paradigmatically, Skinner never really was a psychologist in the sense of accepting the *transformation* paradigm of psychology. Sometime during his work in the 1930s, he began using the life–science *selection* paradigm, typical of the natural science of biology, in the task of developing a natural science of behavior, especially the behavior of people. Skinner was operating within a department of psychology, a social science, at Harvard University. However, he did much of his pre–graduation work under W.J. Crozier, the head of the physiology branch of Harvard's biology department (Skinner, 1979, p. 16). Crozier had been a student of the biologist Jacques Loeb, and both Crozier and Loeb had emphasized the causal mechanism of selection in their natural science work. Skinner, perhaps without initially realizing he was doing so, transferred the concept of selection from biology to behavior relations. He thereby brought a particular, natural science paradigm to bear on the questions of a scientific study of behavior.

With respect to behavior, selection refers to the lasting effects, on a person's or other organism's behavior, of the consequences of that kind of behavior. For example, a child who must ask loudly and repeatedly for a cookie (the response) before receiving one (the consequence) is a changed person. He or she is changed physically and thus behaviorologically by the occurrence of the consequence. The consequence alters the bodily structure in a manner that can be observed at the physiological level and at the behaviorological level. At the physiological level the alteration can be seen as nervous system changes the specifics of which physiologists are making better known. At the

behaviorological level it can be seen as a changed behavior repertoire in that, in the future, asking–for–cookie responses will be even louder and more persistent. These inseparable effects occur because receiving that past cookie selected for loud and persistent asking. Selection causes physical changes now that are seen as altered behavior later.

Behaviorologists address those altered behaviors by referring to the probability of behavior and changes in that probability occasioned through selection by consequences; consequences select behavior to occur more often or to occur less often. In selection causality on the behaviorological level, a response A is followed by (and usually has actually produced) a consequence B. The occurrence of B leads to responses of *class* A being more, or less, likely to occur again in the future. That is, in the selection causal mode, B *affects (class)* A. Selection is thus a type of causal mode different from the more familiar mechanical causal mode where A *leads to* B. In the mechanical mode, for example, too high a temperature in cooking (A) burns the food (B), or, in reflexes, an increase in light (a stimulus, A) elicits a decrease in pupil size (a response, B). With selection causality, at the level of the behavior of organisms during their lifetime, behavior is selected *by its consequences* to occur again or not; from this arises the more common term, *selection by consequences* (see Ledoux, 1997d, for more detailed terms).

The specifics of selection causality operate differently at other levels of life science (while the shared use of selection causality attests to the interrelationships of the disciplines at all levels of life science). On the biological level, selection causality affects species through natural selection. On the level of cultures, selection causality involves selection of cultural practices. (Among natural sciences, a mechanical causal mode is emphasized in physical sciences while the causal mode of selection is emphasized in life sciences.) Behavior is functionally related to many other variables as well, but the selection mechanism is usually a necessary component of those relations (e.g., stimulus control variables). The relationships found in nature between all these variables and behavior are described by, and often as a group referred to as, the natural laws, or nature's laws, of behavior.

In conjunction with the philosophy of science called radical behaviorism, decades of research by Skinner and those trained in this new approach followed Skinner's use of the paradigm of selection by consequences as the fundamental component of studying behavior. (See Ledoux, 1997a, for an introduction to some basic elements of radical behaviorist philosophy; the selection paradigm is not included as one of those elements even though, for behaviorologists, this philosophy and paradigm may have become inseparable.) The efforts of Skinner and those other researchers produced discoveries of the elementary natural laws involving the behavior of organisms. By the 1950s, those researchers were developing technologies to change accessible environmental variables and so produce behavior change. Further, they were applying these technologies to improve various aspects of the human condition. These applications help people to do more, act better, and behave more effectively in all facets of life, for example, in child care, health care, education, daily living, work, leisure, art, entertainment, academic pursuits, and even science itself.

Ever since those early discoveries and applications, new generations of researchers have continued to make further advances, discovering more complex principles and interactions and developing more complex technologies. The application of these technologies extends into ever wider areas, continually improving personal and cultural practices. The term *behavioral engineering* provides a general description of these appli-

cations for it suggests both the technical process of changing the relevant environmental variables and the resulting changes in behavior. (This name, behavioral engineering, supersedes an earlier name, behavior modification, partly because the older name is misleading. The older name implies that behaviorological practitioners directly manipulate behavior whereas they actually arrange—engineer—changes of the particular environmental variables related to the behavior of concern, with the result that the behavior changes.)

Movement Origins

The behaviorology movement encompasses the efforts of behaviorologists in developing professional organizations and academic homes to preserve and extend the behaviorology discipline and its contributions to humanity. This movement arose from the conditions under which the original behaviorological science and technology developed. Those conditions involved incommensurable differences between a discipline of behaviorology and the discipline of psychology, especially concerning their respective paradigms. Incommensurable differences are differences that are incompatible, and that cannot be compared like those between apples and ghosts.

Lett (1987) explains paradigmatic incommensurability as "the question of whether rival theories can be compared and evaluated according to a standard measure" (p. 35). Lett also points out that alternative paradigms need not be incommensurable:

> If two paradigms agree about the nature of the problem to be solved and about the appropriate means of solving that problem, they are commensurable. Furthermore, paradigmatic commensurability is a relative matter. Two paradigms may agree about the problems to be investigated but disagree as to the means of solution. Scientific evolution and "scientific creationism," for example, are both concerned with the origins of the human species, but the two paradigms have radically different epistemological principles. If one paradigm chooses to rely upon experience as its epistemological foundation, it can make no impact upon a paradigm that appeals ultimately to revelation. (pp. 35–36)

So, "if the participants in such a debate restrict themselves to the terms and assumptions of their own paradigm, they can have nothing to say to one another" (Lett, 1987, p. 36). They are incommensurable (see Ulman, 1992, for elaboration).

Behaviorological science had arisen and existed for some decades, mainly within the realm of psychology, before the accumulating effects of incommensurable differences required independence–oriented actions. During this time, behaviorological professionals had become accustomed to trying (and failing) to change psychology fully into a natural science of behavior. By the 1960s the differences between the two became more openly incommensurable. Events in later decades showed more and more why the earlier strategy of trying to remake psychology was inappropriate (see Fraley & Ledoux, 1997). But the momentum of decades of that strategy was hard to break. Behaviorological professionals found considering other strategies difficult. Some of them finally did so however, and thereby initiated the behaviorology movement.

Effects of incommensurability. By the 1970s, behaviorological professionals were experiencing the *effects* of the incommensurability of their science and psychology. (By this time they were called behavior analysts, the name still used by, among others, some professionals trying to engage in behaviorological science, with its selection paradigm and radical behaviorist philosophy of natural science, within the social science of psychology.) The effects of incommensurability are varied. Some concern the extent to

which behaviorology can make its contributions to the culture. Others concern employment opportunities and the control of disciplinary infrastructures. And still others exist also (Fraley & Ledoux, 1997).

One effect of incommensurability was that within psychology the science of behavior was increasingly underrepresented, underfunded, de–emphasized in most departments, and simply dropped in others. As a result, students were less and less able to receive training in the science of behavior. (Ledoux, 1997b, provides a description of some behaviorology curricula in higher education. The contents of these curricula reflect the depth and range of the behavior science training unavailable in psychology.) Students covered few courses related to the science of behavior in their degree programs because few were offered by psychology departments. More likely, the student's required exposure to the laws of behavior involved a single chapter, or part of a chapter, from the twenty or so included in standard introductory psychology textbooks. And those chapters not only typically misrepresented behavior science (e.g., the usual confusion between negative reinforcement and punishment) but also they were increasingly out–of–date; researchers were reporting advances in behaviorological work mostly in journals *outside* those of the usual psychology literature perused by textbook authors.

With so little exposure, substantial interest in the science developed in fewer students. Those who did become interested usually did so due to studying under a behaviorologically oriented faculty member. But the opportunities to do that were also decreasing. After reducing the number of behavior science courses, programs reduced the number of behavior science faculty. So even interested students could not easily be fully trained in the science of behavior and its applications; not enough courses or teachers were accessible. But these students still had to take plenty of courses covering unparsimonious, non–natural science in their programs. As a consequence these fewer, newer natural scientists of behavior were less trained in the available behaviorological science than they might have been (and perhaps less trained than the earlier generations of faculty and personnel whom they replaced). So they were likely to be less effective than they could have been as scientists, as teachers, and as behavioral engineers, and so were *their* students, and so on.

If those effects of incommensurability were the only ones, and no effective actions occurred to change that trend, the long term result could have been the practical disappearance of an effective and advancing scientific and systematic approach to people's behavior and how to change and improve it. Fortunately, positive effects of incommensurability were also detectable, along with appropriate and supportive actions to consolidate and further advance the science. For instance, personnel in various cultural agencies were increasingly looking specifically toward behaviorological science as the provider of effective behavioral engineering, relevant to their concerns. To mention but a few, these personnel included (a) educators looking beyond the typical resources of their field, (b) workers and managers in business and industry looking for ways to increase productivity and job satisfaction, etc., and (c) government units, especially at state level, responsible for services to citizens with disabilities. (For example, in the 1970s some California state officials wanted to spot whether or not applicants for certain jobs had specific training in behavior management. To make this easier to do, Joseph Morrow, a behaviorological scientist at California State University, Sacramento, arranged for students to receive a "Certificate in Behavior Modification"—using the

designation common at the time—if their studies included a particular pattern of courses that specifically expanded their skills in the area of behavioral engineering.)

Early independence actions then the behaviorology movement. From the 1960s through the 1980s, both positive and negative effects of incommensurability prodded some initial actions, early moves towards independence. Behavior analysts founded numerous behavioral journals and their own professional organizations. Most of these were separate from psychology's literature and organizations. None of them, however, openly espoused the disciplinary status implied by the incommensurable differences with psychology. Some behavior analysts and behaviorological professionals also founded academic programs (especially at the graduate training level). Many of these programs were also organizationally independent of psychology through their association with academic departments representing various applied behavioral *fields* which could be informed by various disciplines, including behaviorological science (e.g., special education). A few programs functioned with the status and structure of a separate *discipline* by forming a natural science training alternative in a distinct department separate from their respective university's psychology department. These departments, typically describing themselves with the term *behavior analysis* (the term *behaviorology* not yet being in use at their founding), did begin to reflect the independent disciplinary status implied by the incommensurable differences with psychology.

The effects and implications of incommensurability made the need for separation into independent disciplines increasingly clear. Some behaviorological professionals finally began to take the necessary actions. They contributed to the academic debates (which began in earnest in 1984) in the behavior–analytic literature about an appropriate name and directions for the comprehensive natural science discipline concerned with behavior relations. In 1987 they (a) formally recognized the separate and independent status of that discipline, (b) accepted *behaviorology* as the name denoting that discipline, and (c) founded the scientific organization now called The International Behaviorology Association. By the end of 1992, their organizational efforts were reflected in (a) a continuing series of annual conventions with, as a sample, the second in Mexico at the Los Horcones community in January 1990, and the fourth in New Orleans, USA in January 1992, (b) a newsletter, originally called the *TIBA Newsletter,* and now called *Selections,* in its fourth volume, (c) a carefully planned, comprehensively peer–reviewed disciplinary journal to appear in 1993, called *Behaviorology,* (d) a non–copyright–retaining journal, with short–process peer reviewing, in its third serial, called *Behaviorological Commentaries* (which was later to be renamed *The International Behaviorologist*) for articles that fall between the respective domains of the newsletter, *Selections,* and the journal, *Behaviorology,* and (e) the allocation of one–fourth of all dues explicitly for the support of behaviorological research.

How Does Behaviorology Differ From Other Disciplines and Fields?

The original question was longer: "How does behaviorology differ from other disciplines and fields that evince some interest in why people do what they do?" An initial response is that behaviorology is interested in more than this. It is also interested in *what can be done* about what people do. Encompassing this difference, and substanti-

ated by other differences (in philosophy of science, subject matter, methodology, etc.), is the fundamental and incommensurable difference in paradigms between behaviorology and these other disciplines and fields. So most of this answer focuses on the paradigm difference. (See Vargas, 1991, whose names for the paradigms are used here; also see Fraley & Ledoux, 1997, for additional details, including consideration of the other differences as well.)

Of Paradigms and Eclecticism

The two paradigms are the *selection* paradigm Skinner had adopted from biology and the *transformation* paradigm of psychology and some other disciplines. Psychological subscribers to the transformation paradigm are most interested in positing (with emphasis on a hypothetical–deductive model) the causes of behavior chiefly in the transformations that they believe occur inside the person. These are the transformations that external variables (inputs, to use current cognitive terminology) seem to undergo before becoming apparent as behavior (outputs) in a basically mechanical causal mode. Since this paradigm does not support much interest in the inputs or outputs for their own sake, the possibility of, and consequently concern for, effective control is diminished. In contrast, behaviorological subscribers to the selection paradigm are most interested in discovering (with emphasis on an inductive model) the causes of behavior chiefly in the genetically affected, potentially manipulable behavior–environment interactions, with selection by consequences as the fundamental causal mode. Since this paradigm explicitly supports interest both in behavior for its own sake and in the variables of which behavior is a function, the possibility of, and consequently concern for, effective control is enhanced.

Psychology's transformation paradigm has played a particular role regarding eclecticism. Psychologists have generally considered their discipline as an eclectic aggregate. Their eclecticism seemed originally pragmatic. It allowed them to search along multiple paths for an effective approach to the general question of "Why do people do what they do?" But could it allow them to find such an approach? They were convinced that multiple, eclectic paths constituted the best course for them to follow. However, their eclecticism had no built–in need for resolution. They could continue working under eclecticism indefinitely (and have been doing so). Eclecticism actually *does not require* either ultimately adopting, or even looking for, an effective approach. Indeed, the notion of an effective approach, as in a single, substantive, systematic, comprehensive approach, seems to be anti–eclectic by definition. In addition, as psychologists were to discover, they already *shared* a paradigm, the transformation paradigm, that allowed them their eclectic differences. So the availability of a more effective approach, especially one with a different and incommensurable paradigm, evoked little interest. Psychologists' paradigm and eclecticism remain thoroughly intertwined.

The fact that different schools and approaches divided psychology merely masked its otherwise characteristic transformational paradigmatic unity. Psychologists' stress on eclecticism focused on differences in emphases and particulars of the various schools and approaches. Consequently they have only gradually apprehended their common transformation paradigm. Outside psychology critics often complained about the apparent lack of a unifying paradigm in psychology, thereby casting doubts on the disciplinary status of that aggregate. The critics also seemed influenced by the differences in emphases in the various psychological approaches. So they too were distracted from ap-

prehending the basic paradigm. In defending against these criticisms, psychologists stressed their eclecticism since they had not yet clearly recognized their paradigmatic unity. They stressed it to the point that the previously pragmatic eclecticism became an inherent aspect of their self–description (as passed on by countless repetitions throughout a psychology student's training).

Conveniently, however, the transformation paradigm not only encompasses the similarities of psychologists' perspectives but also allows them their eclectic, even contradictory differences. Most psychologists, regardless of eclecticism or perspective, seem little interested in behavior or the variables of which it is a function. They are little interested in inputs (the variables) and outputs (the behavior). They try to relate these mainly for other reasons. They try to relate these as a social "science" adapting an older (and changing; see Chiesa, 1994) natural science *x leads to y* (or *x is followed by y*) type of mechanical causality. But psychologists cannot easily relate a given input to a given output as cause. So psychologists presume something must happen to the inputs before outputs occur. Somewhere and somehow the inputs must be changed, *transformed,* into outputs. Those changes, as they do not seem apparent elsewhere, must be happening inside the organism, possibly because of something the organism can be seen as doing. Psychologists try to relate the inputs and outputs to learn something about what they presume is behind them. Psychologists then undertake to tell the world, from their various perspectives, all the things they assume are happening inside the organism, perhaps because of the organism. In placing their interests inside the organism, they keep to their familiar mechanical causality. Now, however, this causality takes the form of *x leads to* o *leads to y.* Here, o (for organism) represents the various *transformations* different psychologists believe occur inside the organism as inputs are then said to *become* outputs. However, the transformation paradigm does not address the makeup of transformations; it addresses only their position between the inputs and outputs. Psychologists hypothesize, from various perspectives, numerous types of transformations and these can be contradictory and even mutually exclusive. The result is the interplay between the transformation paradigm and eclecticism. The paradigm supports transformations in general, whether agreeable or contradictory, while under eclecticism the latter are automatically tolerated.

Even though the many, specific psychological approaches differ among themselves, they all adhere to the transformation paradigm. Giving them a label like "school" does not change this characteristic. None of them adheres to the selection paradigm. At this level of analysis, only the science of behavior founded by Skinner adheres to that paradigm (but see Ulman, 1991, also). And the selection paradigm is as different from the transformation paradigm as evolution is from creationism.

The Skinnerian Alternative

Skinner was doing research in the 1930s using the selection paradigm; but he was operating *within a unit of organized psychology.* The location of this research may simply be a product of what evolutionary biologists call historical contingency (see Gould, 1989) since Skinner could, and under Crozier's influence almost did, pursue his work officially from within a unit of organized biology. Yet the venue of this research constitutes the beginning of an historical trunk, shared by both behaviorology and psychology. This trunk lasted only for about three decades and has since divided, forming two distinct branches, each with its own continuing disciplinary history.

The roots of this trunk are also as different as the two paradigms and disciplines that shared the trunk before diverging. The history of these roots traces back, in Western culture, to various early Greeks and their philosophies and approaches, and the ideologies of those and other times. As Lerner (1991) reports, the early Western versions of "The empirical and the deductive methods…both arose around 500 B.C. They emerged from a fierce social conflict to determine what sort of society would succeed Bronze Age civilization—a society of free labor or one of slave labor" (p. 62).

The characteristics of the selection paradigm and behaviorology have their Western roots in the preferences of the Ionian Greeks (e.g., Thales, circa 550 B.C.E., and Anaxagoras, circa 450 B.C.E.). With navigation and other needs prompting developments in science and technology, the Ionians preferred the empirical method, its associated philosophical approach known as materialism (which takes matter, nature, as primary, that is, reality exists whether or not people are around to think about it), and the inductive (observation– and measurement– and action–based) approach to knowing. These Ionian roots are found to be ascendant or prevalent in societies during periods of increasing social progress, for example, during the time of the Ionian trading cities when "new societies of traders, craftsmen, and freeholding peasants—the first limited attempts at democracies and republics" (Lerner, 1991, p. 63) were forming, as well as during the Renaissance and the nineteenth century (Lerner, 1991, p. 419) and to some extent the present (e.g., in Japan around the 1980s).

In contrast, the characteristics of the transformation paradigm and psychology have their Western roots in the preferences of the dualist Greeks (e.g., Plato, circa 350 B.C.E., and Aristotle, circa 325 B.C.E.). The dualist Greeks preferred the deductive method, its associated philosophical approach known as idealism (which takes ideas, thoughts, as primary, that is, reality does not exist apart from what people think exists), and the hypothetical–deductive (pure reason and little observation) approach to knowing. These dualist roots are found to be ascendant or prevalent in societies during periods of decreasing social progress, for example, during Greek slave–holding society, during the Western middle ages, and in many ways during much of the 1900s (e.g., see Carl Sagan's 1995 book, *The Demon–Haunted World: Science as a Candle in the Dark*).

Both these roots and their differences have some impact on most disciplines. The branching of the psychology–behaviorology shared historical trunk is not an isolated instance in academic history. It may be part of an ongoing scientific revolution. For example, in his 1991 book *The Big Bang Never Happened*, Eric Lerner argues that these roots and differences are the basis of the competition between big bang cosmology and plasma cosmology. He argues that big bang proponents continue in the Plato–Aristotle tradition, and that observational evidence seems to show their position to be less parsimonious than their competitor's position. Plasma proponents, he argues, continue in the Ionian tradition, and their position seems to be more consistent with observations. Some parallels with psychology and behaviorology, and their paradigm clash, are evident. Even so, whether or not a Big Bang happened is irrelevant to any clash between psychology and behaviorology, and in any case is still unresolved.

Sometimes in paradigm clashes, one position ultimately eclipses or subsumes the other, as when quantum mechanics superseded Newtonian mechanics in physics. The positions co–exist for a time as one develops and advances while the other declines. With other paradigm clashes, such as the one between behaviorology and psychology, the positions co–exist for a time, sharing their history. Then they branch off, going their separate disciplinary ways.

Figure 1 illustrates the shared history, its roots, and its later branching for behaviorology and psychology:

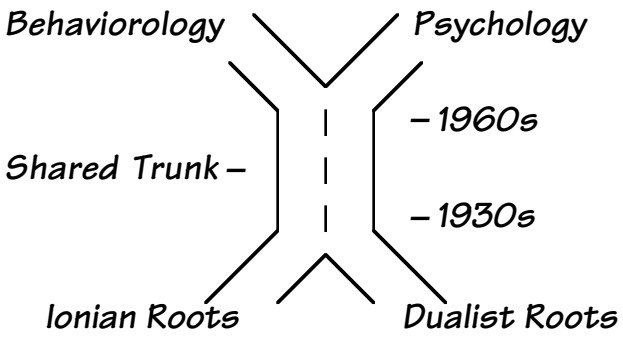

Figure 1. Branching disciplinary tree and philosophical roots.

Different kinds of reasons bring about those different paradigm–clash scenarios. Regarding behaviorology and psychology, how could the shared historical trunk come about? How was Skinner's beginning behaviorological science from within psychology possible, given the incommensurable differences between the paradigms?

Skinner's doing such work from within psychology was possible because the psychology of the time was much more sensitive to differences at the level of schools and approaches than to differences between paradigms. Various schools of thought were already contending within psychology. All these shared the transformation paradigm. But no school was able to demonstrate itself to be better than the other schools nor could they show that other schools were inadequate. So they all had to tolerate each other and co–exist, which they did under the rationale of eclecticism. When Skinner originated the operant approach, it also could not be shown to be inadequate and so it also was tolerated. The fact that the operant approach did not share the transformation paradigm with the psychological schools but was based in the selection paradigm did not originally occasion much comment.

By the 1960s, however, circumstances had changed. Those who continued to advance the science and technology Skinner had originated had come to be known first as operant behaviorists and then as behavior analysts or *radical behaviorists.* (The latter was more concise since usage of the other names had become blurred over time; now, *behaviorologists* is the best descriptor, at least for those who are part of the behaviorology movement.) By using the criterion of e*ffectiveness in action regarding subject matter,* radical behaviorists were demonstrating the value of their science. That same evidence was also showing the various psychological approaches to be less effective and unparsimonious. Yet parsimony receives scant attention in psychology, and *effective action regarding subject matter* was then—and still among psychological approaches today is—but a minor criterion for adopting explanations (see Fraley & Ledoux, 1997, Ch. 5). As a result, the stage was set for various substantial changes in the positions of both psychologists and radical behaviorists. The effects of incommensurable paradigms were

driving both the overt paradigmatic differentiation and the subsequent historical separation into officially independent disciplines.

The Reaction for a Non–Natural Science Tradition

Also during the 1960s, psychology was undergoing the "cognitive revolution" (or, depending on one's perspective, "cognitive counterrevolution"). One aspect of that development was psychologists' increased acceptance that they had little interest in behavior for its own sake or in demonstrations of effective control. So they could not convince themselves of much need to heed the concerns of radical behaviorists. But they were not unmoved by those concerns. They were paying more and more attention to the paradigmatic similarity among the various psychological approaches and less attention to their eclectic differences. They began to apprehend the role of their paradigm in emphasizing their similarities without threatening their differences. As a consequence they began to disassociate from any group that did not share their transformation paradigm. This especially meant disassociation with *radical* behaviorism since several other forms of behaviorism do operate under the transformation paradigm (including interbehaviorism, methodological behaviorism, paradigmatic behaviorism, and Watson's original behaviorism).

Radical behaviorists, after decades of a history shared with psychology, experienced the disassociation as the effects of the incommensurability of the respective paradigms. Before the cognitive movement, psychology had tolerated and benefited from radical behaviorism. However, since the cognitive movement began, psychologists have labeled and treated as dead any non–transformational positions regardless of the facts (see Wyatt, Hawkins, & Davis, 1986). Radical behaviorism was a common target of such unjustifiable slurs because its paradigm was fully incommensurable. Consequently the demonstrated quality and quantity of its research and applications were given less and less consideration. Accumulated scientific evidence for its more parsimonious and practical accounts of behavior no longer received the attention their effectiveness had earned. Instead, political and economic concerns prevailed, with programmatic emphases, funds, and other resources being more emphatically directed towards hypothetical cognitive transformations. The result of these developments was the objective, though not necessarily immediately recognized, differentiation of the transformation and selection paradigms. And this differentiation provided the foundation for the separation of the independent disciplines of psychology and behaviorology.

Also, psychology is not entirely consistent in these matters. It continues to claim *that behaviorism is dead.* However, this is only true within psychology and only in the sense that psychology all but ignores transformational behaviorisms while the work of radical behaviorists is no longer advancing in psychology (although this work does continue to advance in behaviorology and in the efforts of behaviorological scientists who remain employed in units of organized psychology). Yet psychology also claims *that behaviorism still is part of psychology.* This also is only partly true in that various transformational *behaviorisms* continue to exist within psychology. Also, the principles and practices of the first few decades of radical behaviorist research did occur mostly in units of organized psychology and so are a part of that historical time shared with psychology. Introductory psychology textbooks still faithfully report, usually as part of the chapter on learning, this outdated material, and little beyond it. While over thirty years out of date, that material is presented as though it were the latest material available,

which it generally is—*in psychology.* However, the years of advances since the paradigm differentiation of the 1960s are arguably not part of psychology and are rarely covered in those textbooks. (As an exception the text by Poling, Schlinger, Starin, and Blakely, 1990, is somewhat more up to date.) Again, the advances were generally reported in journals (beginning, for example, with the *Journal of the Experimental Analysis of Behavior*) that, being independent of psychology's principal disciplinary literature, are seldom perused by most psychology textbook authors. The benefits from those advances accrue mostly according to the extent to which one has acquired and maintains a verbal and skill repertoire in behaviorology or, at least, in behaviorological science.

The experience in China. The situation of behavior science in the People's Republic of China provides corroborative evidence for the separateness and independence of behaviorology and psychology. Chinese behavior science professionals in Xi'an, Shaanxi, provided commentary on the situation in China to the author while he was there, as part of a faculty exchange, teaching courses on Verbal Behavior, and Behaviorology and Education, during the 1990–1991 academic year.

The discussions uncovered several points of mutual interest. The Chinese use a word they translate as *psychology* to encompass the three sources they currently see for their discipline: traditional Chinese views on why people do what they do, the views adopted from the discipline in the Soviet Union (especially the work originating with Pavlov on reflex/emotional, that is, respondent, behavior), and Western perspectives. The Chinese have included three parts in the Western component of their discipline: psychoanalytic (i.e., Freud), cognitive/mentalistic (e.g., Maslow and Piaget), and behavioral (i.e., the science of behavior originated by Skinner).

The Chinese report a special preference for the Pavlovian and Skinnerian work based on the natural science approach and experimental methods these two share. In part, this preference for Pavlov and Skinner may be due to a particular aspect of Chinese history. The Chinese culture has been less burdened than Western culture has been by philosophically idealist dualism, a dualism that pervades Western culture. So Chinese culture has suffered less from the unscientific separation of phenomena into the different realms of mental and physical (soul/body, spiritual/material, mind/reality) that results from philosophical dualism. Western psychology traditionally prefers the non–physical aspect. (The Chinese language, while it has a rich variety of terms for most of the Western usages of the term *mind,* actually lacks a direct translation of mind as Western psychologists use that term—as a dualistic, uncaused metaphysical cause. Instead, for that usage, Chinese professionals generally use a word that, less appropriately, translates back into English better as "brain.")

However, in the 1950s, Chinese behavior science professionals lost contact with Western developments. They spent the decade of the 1980s trying to update, and thought the update complete. But they were disturbed by what they saw as very few advances in principles and practices, from those missing years, relevant to solving practical, behavior–related problems.

In beginning to look elsewhere for solutions, they are discovering that their update is not complete. It involved little beyond the traditional Western psychology sources (literature, texts, personnel) and these contain little of the substantial behaviorological–science advances from those years. The Chinese are discovering that they have overlooked virtually all the post–1950s advances in principles and practices in the science originally founded by B.F. Skinner. This occurred because at about the same time that

the Chinese lost contact, the greatest proportion of those advances began to be, and have since been, increasingly reported and supported *outside* psychology, greatly reducing access to them from within psychology. The Chinese are also considering the possible reasons for this situation, including the incommensurable paradigm differences indicating and validating separate disciplines. (See Ledoux, 1997c, for a more complete discussion of behaviorology in China.)

Transformations and eclecticism revisited. Are hypothesized, internal transformations a reasonable alternative to behavior–environment interactions? The variety of psychology's transformations may indeed be more initially captivating than the patient discovery and tested application of complex behavioral laws. Transformations seem smoothly consistent with the philosophically dualist cultural history that pervades the milieu of Western society. Are these a rationale for the many people attracted to psychological theorizing? This attraction occurs in spite of the much greater difficulty in later making use of theorized transformations to help solve society's various general and personal problems, compared to the more technological applications of behavioral laws to such concerns. Is this another example of being affected more by short–term variables (e.g., the fun of discussing competing transformational accounts) than by delayed variables (e.g., the later, improved effectiveness, in helping situations, after having studied behavior–environment interactions)?

In any case, some of these transformations are simply mentalistic inventions that violate a basic premise of the natural sciences, namely respect for the continuity of events in space and time that accumulates, link by related link, in a researchable natural history. Hence the scientific status of those transformations is questionable and unparsimonious. The transformation paradigm allows and invites such untestable, metaphysical inventions to enter the chain of space–time events, breaking and thereby disrespecting the continuity of those events. Such transformations, their related paradigm, and disciplines or parts of disciplines supporting that paradigm have thus removed themselves from consideration as part of any *natural science* discipline or field.

Many other transformations are not transformations at all but rather are the physiological bases of behavior, an appropriate subject matter for a natural science such as physiology. For example, neurons firing (in the central or peripheral nervous systems), in ways often but not necessarily connected to muscles contracting or glands secreting, etc., are physiological aspects of the same fact whose behaviorological aspects observers might witness as, say, salivating or the movements of a hand or of the vocal cords under particular conditions and with particular consequences.

Sometimes the physiological and behaviorological aspects cannot be separated, such as when the behavior is covert. Muscles or glands may not even be involved. For example, due to having learned to observe and verbally report the occurrence of private responses (Skinner, 1953, Ch. 17), people may observe and report themselves seeing something, regardless of whether the thing seen is present to be seen or not; yet all that the properly instrumented physiologist observes about this *seeing* is neurons firing at the back of the brain. These neurons firing (physiological level) and the behavior of seeing (behaviorological level) are inseparable aspects of the same fact, the same phenomenon. Neither overt nor covert behavior can occur without nervous system activity; but the nervous system activity aspect may sometimes occur only along with a covert behavior aspect. Exactly what is happening physiologically when behavior (overt or covert) occurs and when related variables occur (the particular conditions and par-

ticular consequences) are important questions to which the natural science discipline of *physiology* can provide answers.

Is psychology's crossover to physiology an appropriate one? Psychologists who take this route show some preference for natural science, physiology in this case. However, psychologists may be the only ones viewing the crossover as a reasonable disciplinary activity. For the crossover interrupts physiology's mission and further compromises the status of psychologists' own discipline by shifting their subject matter into areas legitimately claimed already by a different discipline. Psychologists may find academic turf battles with physiology far more common than with behaviorology.

As for eclecticism, observers can already note a decrease in its importance even in psychology. The shift in emphasis under the cognitive movement to stressing similarities (e.g., the transformation paradigm) seems to have prompted the decrease in eclecticism which is evident in the relative coverage of the psychological perspectives. Perusal of various psychology film series (e.g., the *Discovering Psychology* series) and any number of introductory psychology textbooks shows the cognitive perspective to be filling the stage. Next in coverage is information derived from another discipline, physiology. Other perspectives (e.g., psychoanalytic, humanistic, or gestalt) often receive little more than lip service. Unfortunately, this waning of eclecticism has not paralleled any commitment for changing toward an effective science concerned with why people do what they do and what can be done about it. (The Poling, *et al.,* 1990, text is one exception in that it provides some natural science standards with which to compare and evaluate the several alternative perspectives it includes at appropriate points.)

The Historical Division

Psychology's increasing stress on similarities like the transformation paradigm had contributed substantially to the differentiation of the established disciplinary paradigms. That *differentiation,* in the 1960s, objectively created two separate and independent disciplines out of the previous shared history. The historical trunk divided into separate branches. These disciplines differ not only in paradigms but also, in associated ways, in subject matters, philosophies, methodologies, etc. Not until the 1980s, though, did the resulting changes in contingencies (the effects of incommensurability) begin affecting people enough for them to emit behavior consistent with the fact of different disciplines. Not until the 1980s did they begin to name and reorganize behaviorology.

How is Behaviorology Related to Other Disciplines and Fields?

The distinction between *social science* and *natural science* is relevant because the interest behaviorologists have in people is taken by some professionals as placing behaviorology in the social science arena. However, social sciences not only derive from an interest in people (an interest shared by many natural sciences), but from another commonly acknowledged characteristic as well; social scientists easily reach contradictory conclusions after following the same scientific procedures. This is partly because social scientists allow metaphysical events to enter their explanatory accounts. In contrast, natural scientists more easily reach consistent conclusions after following the same scientific procedures. This is partly because natural scientists disallow the inclusion of

metaphysical events in their explanatory accounts, for such events are untestable. Natural sciences respect the continuity of events in space and time that accumulate in a researchable natural history. These are defining characteristics of natural science which behaviorology shares. [A later, more refined view has natural science opposing mysticism instead of opposing social science. See the *Afterword* for details and references.]

Among the natural sciences, behaviorology is one of the foundation life sciences (along with biology) rather than one of the foundation physical sciences (such as physics or chemistry). Figure 2 illustrates behaviorology's position along a life science continuum (see Fraley & Ledoux, 1997, about the term *culturology*).

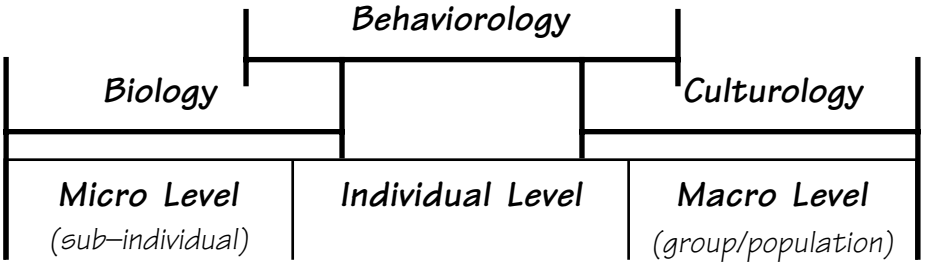

Figure 2. Disciplinary coverage for the three main levels of analysis in the life sciences.

(The study of ecosystems, species evolution, and the behavior of animals in groups by some animal biologists implies that a disciplinary overlap also exists between biology and culturology. So Figure 2 might be redrawn as a triangle with extended sides that cross each other. Each side would represent one of these domains and its associated discipline. The areas where the lines cross would then represent the overlap in the interests of the intersecting disciplines.)

As a basic science, behaviorology provides the foundations that inform the considerations and technologies of various applied behavioral fields (e.g., organizational behavior management) as they seek to fulfill their respective cultural missions (a *field* is where one applies a foundation science *discipline*). Such fields range from advertising to zoology, with many currently in a scientific limbo without an appropriate basic science informing their efforts. Fraley (1987), in a paper addressing the cultural mission of behaviorology, stresses the role of behaviorology as the appropriate science to inform these areas (also see Fraley & Ledoux, 1997).

How Much is Encompassed by Behaviorology, Such as its Contributions?

Plenty, but thorough coverage goes beyond the bounds of this paper. The point of this paper was to introduce an analyzed history of the emergence of the discipline of behaviorology through the behaviorology movement. In the process the status and mis-

sion of behaviorology were introduced as well. One must still address the basic and advanced natural laws involving behavior as discovered by behaviorological scientists as well as behaviorology's philosophy of science, interpretations, and analyses, plus its technologies and applications. All of these constitute parts of behaviorology's past, current, and potential cultural contributions.

For instance, here are some basic components of the radical behaviorist philosophy of science; these components have value beyond the boundaries of behaviorology itself, and some have been mentioned already: (a) Radical behaviorists respect behavior as a *natural* phenomenon as part of respecting the continuity of events in space and time which accumulates as a natural history. (b) Radical behaviorists emphasize experimental control over dependent variables and the application of that control in culturally beneficial ways. (c) Radical behaviorists recognize private events, such as thinking or emotions, as covert behaviors involved in the same lawful relationships that involve overt behavior. (d) Radical behaviorists acknowledge that scientists are also behaving organisms whose behavior, scientific or not, is affected by the same variables that affect other behavior, and that those variables include scientists' philosophy of science. (See Ledoux, 1997a, for some elaboration; see Chiesa, 1994, for extensive discussion.)

The laws involving behavior essentially reflect the functional relations between behavior and the variables inherent in an organism's (a) species history, (b) personal history, (c) current situation and, for people, (d) cultural setting. These contain the variables a behaviorologist addresses when trying to analyze, understand, predict, control, and interpret the behavior of organisms. A peek at some of the advances in researching and applying these laws (advances arising since the paradigm differentiation in the 1960s) would involve describing numerous topics: (a) the distinction between event–shaped and verbally–mediated behavior (Vargas, 1988), (b) the analysis of verbal behavior (Skinner, 1957), (c) the recombination of repertoires (Epstein, 1981), (d) establishing operations (Michael, 1982), (e) multi–term (n–term) contingencies (Sidman, 1986a, 1986b), (f) the function–altering effects of contingency–specifying stimuli (Schlinger & Blakely, 1987), (g) stimulus equivalence relations (Sidman, 1994; Stromer, 1991), (h) the general level of reinforcement (Cautela, 1994), and (i) behavioral engineering and cultural design (Skinner, 1971; Ulman, 1991; West & Hamerlynck, 1992). These topics highlight some of the state–of–the–art aspects, in the 1990s, of the scientific comprehension and handling of complex human behavioral relations.

Other cultural contributions involve continuously developing and extensively tested behavioral engineering technologies applicable to all facets of life, with particular value in resolving both personal and cultural concerns. These range from preventative measures in child–rearing practices, to making education effective (e.g., Johnson & Layng, 1992) including the critique of developmentalism, to enhancing business, industrial, and organizational management, to the design and redesign of cultures and cultural practices including those related to rescuing the planetary environment and so helping restore the mutually beneficial balance between the Earth and its inhabitants (see Gore, 1993; also see the bibliography at the end of Ledoux, 1997e, for references to other examples, as well as to works covering more of the depth and range of the behaviorology discipline and its cultural utility). Either a general–behaviorology textbook (e.g., Fraley, 1996) or issues of the *Journal of Applied Behavior Analysis* can provide a starting point for reviewing the research on many of these applications.

Why Should Anyone Learn Anything About Behaviorology?

The laws of behavior (that is, the relations described by those laws) do not always produce benefits; at least as often as not, they may produce problems. For instance, many families fall victim to the accidental, unplanned conditioning of various undesired behaviors. Without contact with behaviorological science, parents may never realize that yelling at or even spanking a child may actually strengthen the behavior they are trying to weaken, especially if that is the only or main kind of attention the child receives. Parents may never realize that the general rule to provide appropriate kinds of attention more when children are behaving in the ways parents desire (i.e., to "catch your children being good") is both more effective than just ignoring them, and more effective than just catching and punishing them when they are bad. "Catching them being good" is more effective in increasing desired behavior and thereby reducing the occasions for undesired behavior. (See Christophersen, 1988, for details on this and other behaviorologically based, prevention oriented child–rearing practices.)

As that example shows, the accidental or unplanned operation of behavioral laws having undesirable effects on behavior becomes a tyrant affecting people's lives. Until after behaviorological research began in the 1930s, few could do much to stop that tyranny for those laws were little understood. Today, through behaviorology, people can increasingly replace that tyranny by designing and redesigning the world in which they live. They can take the responsibility to use the ongoing discoveries about those laws to improve the human condition (and even to evaluate scientifically what words like "improve" mean; see Krapfl & Vargas, 1977; Vargas, 1975, 1982). These actions are possible because one of the behaviors generated and maintained by the operation of these laws is the behavior of people in general taking control of themselves, and the environmental variables that affect them, in informed ways (which also enables them to countercontrol for potential misuses of this science). The greatest initial significance of behaviorology may not be in the management of day–to–day individual affairs nor, perhaps, even in providing solutions to large social problems (e.g., the crisis in American education). Instead the greatest significance may be in providing some critically needed tools to help understand and deal with the world–wide environmental and outer space concerns and crises facing the generations of today and tomorrow.

The basic reason to study behaviorology, then, is to reduce the risks and derive more than the minimal, automatic benefits from the way nature's laws govern behavior. Studying behaviorology expands your repertoire of behavior with respect to those laws and their applications. The more extensive your training in behaviorology is, the greater can be your effectiveness, your success, with its applications to human concerns.

How much behaviorological knowledge and skills is right for you? Everyone should be as familiar with the basics of behaviorology as they are with the basics of biology and physics and other standard natural sciences covered through primary and secondary education. Beyond the basics, "How much is right?" depends on the complexity of the applications appropriate to your areas of concern. The more complex the applications are in a particular area, the greater is the amount of behaviorology study needed if you are to be effective in that area. For instance, look at some of the areas involving chil-

dren, for these are typical of the complexity levels of most areas of human concern. While a lack of study leaves anyone's potential for success to accident or chance, parents can, by design, attain a quite reasonable level of informed effectiveness in child–rearing practices with only a basic amount of behaviorology study (the equivalent of one or two courses in behaviorology; see Ledoux, 1997b). Educators, on the other hand, find that teaching effectively requires substantially more study. And working with autistic children requires even more. In each of the two latter cases, the complexity of both the applications and the relevant controlling variables increases (while gaining access to those variables is often more difficult as well). Such circumstances demand a more professional level of training (starting with a Bachelor's degree in behaviorology) if practitioners are to be as effective as possible in areas such as these.

A Matter of Epistemology Also

The "Why study behaviorology?" question need not be answered only with respect to complexity and effectiveness. Consider also this answer: "We should study behaviorology because we are affected by nature's laws anyway; perhaps the more we know concerning these laws, the better off we will be." But what does "know" mean? Let us take a little trek into a scientific *epistemology* (the question of what *knowing* is) to help understand this answer better, including how it relates to the complexity and effectiveness answer.

Nature's laws, the laws of the universe, affect us at different *levels of knowledge*. They affect us (a) whether we like it this way or not, (b) whether we have used those laws or not, (c) whether we "know *about*" those laws or not (as in "can use the laws effectively," that is, whether our use–skills have come effectively under the control of those laws or not), and (d) whether we "know" those laws or not (as in "can state and use them," that is, whether our talk, or better, our talk and our use–skills, have both come effectively and explicitly under the control of *statements* of the relationships inherent in those laws or not). In these levels, *knowledge* refers to the range and depth of our behavior repertoires. To illustrate these levels of knowledge (repertoire), consider an example from the teaching profession.

Persons untrained in chemistry but trained in English literature (and even trained in teaching literature as well) would be quite out of place conducting a chemistry class. They do not know the names or properties of the chemicals under discussion in that class (i.e., their behavior repertoire does not include responses appropriate to the pertinent variables, such as the discriminative stimuli and consequences, present in that situation). Yet if they mix some of the chemicals before them, they will produce the same chemical reactions that their trained chemistry colleagues would have produced had those colleagues mixed those same chemicals. The laws of chemistry are in force whether they like it or not, *and* whether they use them (by mixing some of the chemicals before them) or not.

What about the trained chemistry colleagues? Are they trained only in chemistry or are they also trained in teaching, and does that make any difference, especially to teaching? After accumulating, usually over years, certain kinds of experiences (which typically occur by accident or chance), the chemistry teachers who are trained only in chemistry come to *know about* teaching. At least, you would say they do so to the extent that they come to be effective in teaching, that is, in expanding the chemistry–related repertoires of their students. Their teaching–related use–skills have come effectively under the control of the laws involved in successful teaching. Yet even after

decades of teaching, they are unlikely to be able to describe, in terms of nature's complex laws relating to the expansion of repertoires (i.e., the scientific foundations of teaching and learning), the reasons for their effectiveness. They cannot tell another *chemistry–trained* person how to *teach* chemistry effectively. (They can, of course, make up theories about their successes; but that is a different matter entirely, and something to be avoided if teaching in general is to become effective.) While they can effectively teach chemistry, and can model doing so, they cannot effectively *teach* teaching, even of chemistry. They do not *know* teaching as they know chemistry.

Effectively expanding the repertoires of students through knowing teaching (an instructional design repertoire), and effectively handling chemicals (a subject–matter repertoire), are very different behavior repertoires. The latter is informed by chemistry while the former is informed by behaviorology. If the would–be teachers of chemistry or any subject matter want to become effective teachers, want to know teaching, want a comprehensive repertoire of teaching skills, and want it by design in a shorter time rather than by chance over a longer time, then they must study the discipline that informs teaching. To the extent that they learn both to teach a particular subject matter (i.e., to expand their students' repertoires in that subject matter) and to accurately and scientifically explain what it is that they are doing which results in that expansion of repertoires, to that extent you would say not only that they *know* their subject matter but also that they *know* teaching as well. Their talk and use–skills have both come effectively and explicitly under the control of *statements* of the relationships described by the laws of behavior relevant to teaching. (You might even say they *know* teaching even if only their *talk* has clearly come under that control.) And teaching is but one example of the many human endeavors where levels of knowledge/repertoire relate to effectiveness.

Vargas and Fraley (1976; also see Vargas, 1996) discuss some benefits of separating these two major repertoires in education, the repertoires of subject–matter expertise and instructional design expertise. These repertoires might be too complex to expect most individuals to expend the effort to master both thoroughly. However, two experts, each with mastery of one of these repertoires, can combine their efforts and thereby achieve greater overall educational effectiveness. Indeed, one design expert can combine efforts with a dozen or more content experts to achieve such improvements. The subject–matter experts can concentrate on the subject–matter content of the courses or programs of study while the instructional design expert concentrates on the instructional arrangements to teach those contents with scientifically sound methods.

The point Vargas and Fraley make is significant because the usual emphasis on subject–matter expertise generally leads to ignoring the complementary need for instructional design expertise. People presume, incorrectly, that someone who is a subject–matter expert automatically has a thorough enough repertoire appropriate for *teaching* that subject. Yet usually the teaching repertoire is minimal. That is especially common in post–secondary education. However, as our example with teaching chemistry showed, *early* and long–sustained effectiveness requires training in both expert repertoires. Vargas and Fraley refocus attention on the need for employing a scientifically based instructional design repertoire if educational effectiveness is to improve. The question is, will effectiveness arise by chance in the slow, lucky accumulation of the necessary experiences, or will it accrue by design through training and practice, especially in the so–far neglected arena of instructional design? Vargas and Vargas (1992) extend the discussion to current instructional materials and programming.

Our trek into epistemology helps put into perspective the differences between *just being affected* by nature's laws (whether we like them or not, *or* use them or not), *knowing about* them, and *knowing* them, as these relate to increasing complexity requiring more comprehensive study for effectiveness. This applies especially to behaviorology, as the science of behavior relations, since so many areas of interest involve human behavior. The more extensive your training in behaviorology, the more effective you can be in dealing with behavior in the contexts of concern to you. (For reasons of this sort, TIBA included among its purposes support for a basic "behavior literacy" graduation requirement of appropriate content and depth at all levels of education; at the college level, that would likely involve a couple of courses. See Fraley & Ledoux, 1997, and Ledoux, 1997b; also see the Addendum to the appendices in Ledoux, 1997e/2002.)

A Matter of Hygiene Also

Yet another answer to the "Why study behaviorology?" question is available. With so many human problems (and potential threats to survival itself), the importance of learning and applying behaviorology today is akin to the importance of learning and applying the then new discoveries of biological science about 150 years ago. The discovery of the relation between micro–organisms and disease formed the basis, in the first half of the 1800s, of today's standards for biological hygiene. (Biological hygiene is that vital ounce–of–prevention whose success, in reducing the frequency of disease, we take for granted today, so many years after the discovery of the relevant scientific facts.)

Learning and applying behaviorology could be called a matter of *behavioral hygiene,* the next step, especially in problem prevention, after having successfully developed and adopted biological hygiene. We would not consider risking hepatitis by eating without first cleaning our hands after using the toilet. Why should we then continue to risk, for example, low success rates (relative to potential) in education when we can, *if appropriately trained,* bring about consistently demonstrated high success rates in both deportment/emotional and academic/intellectual areas? (See Johnson & Layng, 1992; Latham, 1997; Skinner, 1968; and West & Hamerlynck, 1992.) Why should we take those risks when we can, instead, clean up our *actions* by applying some behavioral hygiene? How many years will pass before we achieve *today's* potential successes and take behavioral hygiene for granted? The sooner we become more informed by this science, throughout society, the less time it will take.

Let us take the responsibility to learn and apply behaviorology's discoveries about the laws of behavior at least for the sake of behavioral hygiene. Let us do so to improve the human condition, to take control of our interactions with our environments, and to master control of ourselves.

Endnotes

From the original address prepared for Chinese and other audiences, this paper was revised for publication (1992) in *Behaviorological Commentaries, Serial No. 3*, pp. 11–31. Subsequently, it was the first—and principal—part of a presentation at the second Behavior Analysis Around the World Conference, held in 1992 at Keio University in Tokyo, Japan (the other part of that presentation coming from Ledoux, 1997c). Before receiving further minor revisions for inclusion in *Origins and Components of Behaviorology*

(Ledoux, 1997e) it received minor revisions for inclusion in the 1992 edition of this book of readings. In any case this paper presents only a starting point for further, more in–depth examinations of behaviorology to be found in other behaviorological–science resources (such as Fraley & Ledoux, 1997).

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