

Defining Natural Sciences

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As Lawrence Fraley describes in his “About Behaviorology” article (Fraley, 2000a [In this issue.—Ed.]), today one encounters behaviorology and other disciplines, such as psychology, dealing with topics that at first blush seem to be similar. This leads some to assume that these topics are treated in similar ways. But behaviorologists define the topics differently, and treat them in ways that are radically different from the treatments of other disciplines. The concern here is to differentiate behaviorology from other disciplines like psychology, and the definition of natural science is crucial to this distinction.

Among disciplines, one particular difference will be emphasized here, because it would seem to have more impact for society than any others (see Fraley & Ledoux, 2002). This difference, a difference critical to the definition of natural science, pertains to whether or not a discipline invokes non-natural events in its explanations.

How are natural sciences defined? Fundamentally, *natural sciences are defined as disciplines that deal only with natural events* (i.e., independent and dependent variables in nature) *using scientific methods*. These disciplines always exclude non-natural events from their considerations. Other definitions are extant. However, none of them—compared with this definition—so accurately reflects the observed line of fracture dividing natural science disciplines from other disciplines. Since so much confusion stems from the distinction between natural and social sciences, that distinction will receive the attention in this discussion.

One common misconception involves the use of scientific methods. Status as a natural or social science is not determined solely by a discipline’s use of scientific methods. All natural science and social science disciplines use scientific methods. However only some of these disciplines invoke the exclusion of non-natural events from their considerations; those that do so have historically (and contemporarily) earned the title “natural science.” Even “creation science” may make use of scientific methods, but it does so while making non-natural events—the will of a mystical, faith-based being whom creation scientists consider supreme—the centerpiece of its considerations; thus it is not, and cannot be, a natural science.

Historically, the natural sciences arose out of mystical origins. In western civilization the practice of early natural science involved studies undertaken mainly to unravel the mysteries of the creative powers of the investigators’

God. Those early investigators focused on various facets of “nature” and, in doing so, developed what came to be known as scientific methods. The phrase *natural science* initially referred to the various subject matters to which such attentions were being directed. Of particular significance here is that most of these subject matters were aspects of the extrinsic environment in which the social activity of humanity was conducted; they were not aspects of how that environment controlled behavioral reactions to it, a topic which inheres in the subject matter of behaviorology.

As the natural scientists continued to pursue their work, however, the phrase natural science came to connote their emerging philosophy of naturalism—the consideration, with scientific methods, of *only* natural events (i.e., only independent and dependent variables *in nature*). Thus the phrase natural science became divorced from the original body of subject matters upon which its early investigations were focused. It came to represent an integral philosophy, naturalism (see Fraley, 1999).

Today, the connotation of the phrase natural science transcends subject matter limitations; that phrase no longer implies *what* is studied. Any subject matter can be approached in different ways, including mystically or naturalistically. A subject matter may be approached in the way that *allows* non-natural events in its considerations, which would be a “non-naturalistic,” or mystical, approach. Or it may be approached in the way that *disallows* non-natural events in its consideration, which would be a “naturalistic” approach. In both cases *different* terms are used to name the resulting disciplines. But only those disciplines maintaining the naturalistic approach (and using scientific methods, though this need not always be mentioned) would be considered natural sciences. For example, the most common mystically based search for water is called dowsing while the naturalistically based search for water is called hydrology. The subject matters may appear similar yet, of the two, only hydrology is a natural science.

Adhering to a naturalistic perspective confers the status of a natural science on a discipline while adhering to a non-naturalistic perspective does not. The phrase natural science applies to any subject matter based on the philosophy of naturalism; it applies to any subject matter that studies only natural events (independent and dependent variables in nature) using scientific methods. Behaviorology, for example, is a strictly natural science because it applies scientific methods to study only the natural events of behavior and its independent variables.

Thus, status as a natural or social science is also not determined by the subject matter that is under investigation. One traditional notion is that “social science” refers to disciplines dealing with people issues. This is a serviceable definition that is not in conflict with the description of natural sciences as disciplines that exclude non-natural events. Accordingly, some disciplines may qualify un-

der both of these definitions. They might then be considered both a natural science and a social science. For example, the sub area of biology (an historically acknowledged natural science) called epidemiology deals extensively with people issues, and often is considered to be a social science; yet it never sacrifices its exclusion of non-natural events and so remains a natural science. Meanwhile, another sub area of biology, medicine, also deals extensively with people issues. Yet medicine is seldom considered to be a social science; while not nearly as exact as the biology and chemistry from which it comes, it does not maintain explanatory reliance on non-natural events and so is considered to be among the natural sciences.

Status as a natural or social science is also not determined by membership in any organizational or institutional arrangement of disciplines. One example is the differing arrangements of disciplines listed in college catalogs. These placements of disciplines typically reflect the common understanding of what makes a discipline a natural or a social science. Institutions differ in their views both on which disciplines have ended explanatory reliance on non-natural events (“the natural sciences” such as physics, epidemiology, geology, etc.), and on where to put disciplines that deal with people issues (“the social sciences” such as anthropology, epidemiology, sociology, etc.). Confusion occurs because some natural sciences are also social sciences, because they deal in people issues, and so could be listed with the social sciences as well. Behaviorology is an example. More confusion occurs because some social sciences are also natural sciences, because they maintain the exclusion of non-natural events while using scientific methods, and so could be listed with the natural sciences as well. (As an additional source of confusion, some disciplines receive the “social science” label mainly *because they allow* non-natural events in their considerations—with the questions of whether or not they deal with people issues, or use scientific methods, being secondary.)

All those considerations apply to the original concern of differentiating behaviorology and psychology. At the most fundamental level, behaviorology—as a discipline—disallows the inclusion of non-natural events in its considerations and, by that approach to its subject matter, joins the ranks of the natural sciences. However, *as a discipline*, psychology *allows* non-natural events in its considerations (although individual psychologists may refuse to do so). This approach to its subject matter constrains psychology to remain outside the ranks of the natural sciences. (On pages 128–129 of Fraley & Ledoux, 2002, Fraley discusses the improbability of psychology changing from this position. Also, see Fraley, 1992, 1998b.) So one basis for differentiating behaviorology and psychology is that they do not share a common approach to their subject matters, with only behaviorology qualifying as a natural science (see Fraley, 2000b).

In addition to the differences in *how* they approach the study of a subject matter, psychologists and behaviorologists do not define their subject matter in the same way, even though both engage in studies of behavior. So they can be differentiated on that basis as well. The subject matter of behaviorology, which it approaches naturalistically, is the functional relations between behavior and independent variables. The most helpful and productive of these variables are in the external environment and are subject to interventions that bring about beneficial behavior changes (with common yet sophisticated examples being the behavior-engineering skills used at home and in school; see Latham, 1994, 1998). However, the subject matter of psychology, which it approaches non-naturalistically, is the hypothesized relations between behavior and a range of variables, including the psyche, mind, self, and other non-natural, magical, mystical internal agents that are put forward as causes of behavior. But the causal status of those variables cannot adequately be assessed because they are non-natural and cannot be scientifically tested in spite of attempts to rely on scientific methods to do so. As a result, psychology cannot directly change these non-natural variables and must instead rely on intuitive approaches regarding what might be done with real variables to produce helpful behavior change (see the appendix on “Adventitious Control,” Ledoux, 2002a).

Calling behaviorology a natural science, however, causes discomfort for some people, because classifying behaviorology as a natural science is not in keeping with common though misplaced perceptions of what constitutes natural sciences (see Fraley, 2000c). The most common misperception, previously mentioned with respect to college catalogs, is that “natural science” is defined by traditional membership in a certain group of disciplines (the group comprised of physics, chemistry, etc.) when instead *the membership of a discipline in that group is itself defined by the excluding of non-natural events from the considerations of the discipline*. It is *that exclusion* that (a) defines a discipline as a natural science and so (b) automatically places it among the group of disciplines known as natural sciences. Any discipline that fails to exclude non-natural events from its considerations is not to be found in that group, while every discipline that relies exclusively on real variables is in that group, *regardless of how long ago or how recently that distinction was invoked*. (Of course, higher education administrators sometimes locate natural science disciplines in other administrative units for reasons that are little related to those disciplines’ membership in the natural science group. Such action, however, does not alter the validity of those disciplines’ membership in that group.)

More significantly, while every discipline that excludes non-natural events from its considerations, and uses scientific methods, is in the natural science group, not all

such disciplines became part of this group at the same time—and *that* is yet a further source of confusion. There was a time when no disciplines were natural sciences. Then, starting several hundred years ago, there was a period in which subgroups of members of several different disciplines did begin excluding non-natural events, at least from their inquiries if not from their motives. Eventually that path, for the groups that took it, converted their disciplines into natural sciences. And thus appeared (though the details are beyond the scope of this article) many of the usual natural sciences we know today (physics, chemistry, biology, geology, astronomy, etc.).

Quite some time has passed since a subgroup of a non-natural science discipline took the step of excluding non-natural events from its considerations. But this can still be done. From among the professionals in *any* discipline that maintains a *non*-naturalistic perspective, a subgroup can take that step and, in so doing, create a new natural science of its subject matter. In the twentieth century, a subgroup of the professionals operating within psychology took precisely that step (see Fraley & Ledoux, 2002, for the historical details). This subgroup followed the centuries-old lead of other natural sciences and excluded non-natural events from its considerations. By doing so, and thus creating a critical discontinuity between themselves and those remaining behind in the original non-naturalistic discipline, these professionals created a new natural science of their subject matter. This natural science came to be called behaviorology.

While those professionals initially called their natural science “behavior analysis,” a political rift arose among them that resulted in the organizing of those calling themselves behaviorologists (see Fraley & Ledoux, 2002). Today, while *behaviorology* is the *independently* organized natural science of behavior–environment functional relations, *behavior analysis* has become largely a political movement for natural scientists of behavior who are devoted to (a) developing new scholars and scientists (of naturalistic behavior–environment relations) through attempts to convert to naturalism the members of another discipline, psychology, that is committed to the non-naturalistic perspective, while (b) keeping the behavior analytic proponents in contact with the copious resources of those on whom they exert their conversion efforts. Within the behavior analysis movement, the relative strength of these two motives varies from person to person. However, the behaviorologists, in general, entertain neither of those motives, regarding the former as impractical and the latter as a stretch of ethics (see Fraley, 1998c and 1997, for elaboration).

Substantial progress in knowledge and applications attended the long ago creation of the traditional *natural* sciences. That same kind of progress has attended the more recent emergence of the natural science of behavior

now called behaviorology. This progress is reflected in the advances in principles and practices applied in many major areas of human concern. For some details on those advances and applications, see the bibliography in Ledoux, 2002b. Meanwhile, no one should be surprised that behaviorologists’ concern with scientifically solving *human* problems has led some people to wish to categorize it *both* as a natural science (using the definition of natural sciences as disciplines that exclude non-natural events) *and* as a social science (using the definition of social sciences as disciplines concerned with people issues).

Endnote: The author thanks Lawrence Fraley for providing helpful comments on an early draft of this material.✻

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