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A Step Towards Ending the Isolation of Behavior Analysis: A Common Language with Evolutionary Science

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In spite of repeated efforts to explain itself to a wider audience, behavior analysis remains a largely misunderstood and isolated discipline. In this article we argue that this situation is in part due to the terms we use in our technical discussions. In particular, *reinforcement* and *punishment*, with their vernacular associations of reward and retribution, are a source of much misunderstanding. Although contemporary thinking within behavior analysis holds that reinforcement and punishment are Darwinian processes whereby behavioral variants are selected and deselected by their consequences, the continued use of the terms *reinforcement* and *punishment* to account for behavioral evolution obscures this fact. To clarify and simplify matters, we propose replacing the terms *reinforcement* and *punishment* with *selection* and *deselection*, respectively. These changes would provide a terminological meeting point with other selectionist sciences, thereby increasing the likelihood that behavior analysis will contribute to Darwinian science.

Key words: behavior analysis, reinforcement, punishment, selection, deselection, evolution

Although science itself remains an illusive and poorly understood process (see Skinner, 1956), it is uniformly accepted that progress is impossible without a clear and precise set of terms. In line with this, behavior analysis has worked hard to develop and maintain an unequivocal terminology, the benefits of which are more than evident in the burgeoning pages of our journals and books. But the advances that have accrued from the integrity of our terms have come at a price—isolation. It is indeed a bitter irony that one of our greatest strengths—the clarity and coherence of our terms—has led to an uncomfortable separation from other disciplines with whom we have much in common.

When George Bernard Shaw quipped that "England and America are two nations separated by the same language," he wittily drew attention to a familiar feature of language—that the same word can have different meanings in different contexts. Unfortunately, Shaw's aphorism can be equally well applied to the current predicament of behavior analysis, for it too is separated from other disciplines by a common language. Even our most basic term, *behavior,* is the source of considerable confusion. To those who are unfamiliar with behavior analysis, *behavior* is usually taken to refer solely to skeletal movements, thereby making it irrelevant to so-called cognitive phenomena, such as thinking and remembering. We should not be too surprised by this error because long before people have any contact with behavior analysis, they have extensive histories of understanding the word *behavior* in this way. To bridge the divide, behavior analysts have devoted significant amounts of time and effort to clarifying terms and their epistemological foundations in the hope of developing closer ties with other researchers (e.g., Czubaroff, 1993; O'Donohue, Callaghan, & Ruckstuhl, 1998; Skinner, 1974; Slocum & Butterfield, 1994). This has not yet happened, and behav-

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ior analysis continues to face an uphill struggle to influence those outside our community.

However, debates about the relative merits of behavior-analytic theory and terms notwithstanding, there is perhaps a greater hazard arising from our isolation. "The danger is not of being wrong, but of becoming irrelevant" (Baum, 1995, p. 2). Baum predicts that eventually evolutionary biologists will expand their field into the realm of operant behavior, and when this happens, behavior analysis may become an "historical footnote, a short-lived movement within psychology just before the Darwinian revolution took over" (p. 1). This process has already begun. Writers of such distinction as Richard Dawkins and Steven Pinker are discussing human behavior in general Darwinian terms without reference to the work of behavior analysts. To ensure that our work can contribute to future developments, Baum recommended that we begin to build links with other evolutionary disciplines by emphasizing our shared Darwinian foundation. But here again our language hampers this process. Within evolutionary biology, for example, the word *reinforcement* is used to describe a model of genetic speciation (e.g., Servedio & Kirkpatrick, 1997), which clearly has nothing in common with its behavior-analytic definition. If we are going to engage in a constructive dialogue with other evolutionary disciplines, we will need to start by talking the same language.

This paper will outline one way by which behavior analysis might begin to communicate more effectively with other Darwinian sciences. Our proposal is as simple as it is radical: Change the words we use for our technical terms. In particular, we propose replacing the words *reinforcement* and *punishment* with *selection* and *deselection,* respectively. It is true that these terms have served us well, and many will be skeptical that any changes are necessary. We are not, however, suggesting a change to our functional concepts, but merely to the words we use as their labels. Indeed, as *reinforcement* and *punishment* both describe the selective effect of the environment upon behavior, our proposed changes are really nothing more than terminological simplifications that have the added benefit of moving us closer to other Darwinian disciplines.

A DISTINCT DIALECT

Behavior analysts have long recognized that our terminology is a source of tension with, and separation from, other nonbehavioral researchers. Hineline (1980) suggested that the language of behavior analysis is best seen as a "distinct dialect of English" that "originates partly in the precise definition and precise use of certain terms" (p. 68). The distinctness of the language of behavior analysis stems from differentiating observations into functional rather than structural units (see Catania, 1973). By defining our terms functionally, we have parted company with everyday discourse and the other major schools of psychology, which continue to employ predominantly structural nomenclatures. Structural and functional analyses dissect the world along different lines; consequently, it is not difficult to see why the continued use of everyday words in our technical discussions has inevitably led to misunderstanding. Right from the outset, Skinner was aware of this problem, and throughout his career he warned against using vernacular language in technical accounts. In his first major work, *The Behavior of Organisms* (1938), he asserted,

> The vernacular is clumsy and obese; its terms overlap each other, draw unnecessary or unreal distinctions, and are far from being the most convenient in dealing with the data. They have the disadvantage of being historical products, introduced because of everyday convenience rather than that special kind of convenience characteristic of a simple scientific system. (p. 7)

Rather than trying to add new meanings to already-existing words, Skinner did not hesitate to invent new words (such as *operant, mand,* and *intraver-*

bal) which, being new, could not be confused with anything else. In light of Skinner's readiness to construct new terms to describe functional relationships, it is somewhat surprising that he continued to use words like *reinforcement* and *punishment* in his emerging science. Within behavior analysis today, *reinforcement* and *punishment* are recognized to be precise, technical terms, but to other disciplines their meanings continue to be infused with everyday associations that bear little or no relation to their functional definitions. These differences lead to misconceptions about behavior analysis that we believe contribute to our isolation.

REINFORCEMENT AND PUNISHMENT

Schoenfeld (1995) noted that initially "Skinner declared that terms like 'reward' and 'punishment' could not be of good standing in behavior theory because of their mentalistic connotations, and he offered 'reinforcement' as their replacement. It was, in his view, a *technical* word" (p. 174). Skinner used reinforcement to imply "strengthening," in the sense that behavior was strengthened when its probability of emission was increased. As the experimental analysis of behavior progressed, he reintroduced the word *punishment* as a technical term to describe the opposite effect to reinforcement and implying the "weakening" of behavior (i.e., reduction of future probability).

Although *reinforcement* has been a relatively uncontroversial, though poorly understood, term, *punishment* has been much more troublesome. Mulick (1990) detailed how much of the resistance and suspicion surrounding the word *punishment* stems from its ideological meaning in mainstream society rather than from its functional definition. In everyday life, punishment is associated with retribution, pain, and cruelty, but as Mulick clarifies below, these relations have no place in a functional analysis:

> When behavioral psychologists needed to talk about behavior showing an orderly decrease in probability when followed by stimuli with certain properties and when they needed to talk about behavior showing an orderly increase in probability when pre-existing stimuli were stopped or lessened in some of their properties, they needed convenient names for the relations. *Punishment* was chosen for the former (perhaps unfortunately and not because of the order perceived by society), but because the process looked like *one* of the effects commonly attached to the term in everyday usage. The other relation received a name that recalled a very similar increase in response probability (i.e., *positive reinforcement*), but with the sign reversed to suggest stimulus offset: *negative reinforcement.* (p. 145)

The vast majority of early behavior-analytic research took place in laboratories with nonhuman animals, and in this context the word *punishment* was not controversial. A problem arose, however, when the term began to be used in human clinical settings. The everyday meaning of punishment is simply out of step with the ethos of therapeutic intervention, and for many the phrase *therapeutic punishment* is simply an oxymoron. The abusive history of institutional care provision for vulnerable groups is an important backdrop against which this debate has taken place. As Iwata (1988) points out, "it should come as no surprise, . . . that parents and advocates literally cringe when they hear the words 'punishment,' 'aversive,' and so on, in reference to treatment for their children and clients" (p. 150). To the lay population, punishment and therapy are opposites, and as such, it is nonsense to suggest that the former can act as the latter. Indeed, as practicing clinical psychologists, we have found it impossible to use the word *punishment* with those professionals who are unfamiliar with its technical meaning without generating awkward misunderstandings.

Behavior analysts have long been aware of the problems that dog the technical use of the word *punishment* and have offered several alternatives.

Harzem and Miles (1978), for example, proposed the term *dysinforcement* to be used in place of punishment. An obvious advantage of this term is that it has an inverse symmetry with the word that describes the opposite effect, reinforcement. Also, being an invented term, dysinforcement has no previous associations to prejudice people when they first come into contact with our science. For some reason, however, dysinforcement has never found popularity. This may be because the word *reinforcement* itself is problematic. The notion of strengthening implied by this term does not accurately reflect the effect a consequence can have on a behavior. When we say a behavior has been reinforced, we do not mean that it has been strengthened, we mean that its future probability of emission has increased. Although it could be argued that this is all that is meant by strengthening, this misses the point. The issue is not about the coherence of our definitions but rather the precision of their metaphorical basis and the confusion that stems from their vernacular associations. The fact is that to those who are unfamiliar with behavior analysis, terms like *reinforcement* or *punishment* will not initially imply an increase in future probability.

Another alternative has been to use *acceleration* and *deceleration* in place of reinforcement and punishment. (This terminology was attributed to O. Lindsley by Patterson & Cobb, 1973.) Although these terms accurately describe changes in the gradients of graphed data, the root metaphor of acceleration (i.e., increasing and decreasing speed) in relation to behavior is again misleading. That is, a lay understanding will not immediately equate acceleration or deceleration with an increase in behavioral probability. This is perhaps why these terms have not become more popular, although deceleration (and its derivatives) has found favor in clinical behavior analysis, where for the reasons outlined above the word *punishment* is unacceptable.

The question under discussion is not the definitional coherence of our terms; it is about their metaphorical accuracy, their everyday associations, and their compatibility with evolutionary theory. The conclusion we have come to is that it is less confusing and more in keeping with the Darwinian nature of the processes under description to say that a behavior is selected (or deselected) by the consequence that follows. Certainly *selection* and *deselection* also have lay associations (i.e., free or conscious choice) that are not in keeping with a functional definition, but we think that they are nonetheless more neutral than *reinforcement* and *punishment,* and they have the added advantage of forging a direct terminological link with Darwinian theory. Further, although *reinforcement* and *punishment* describe opposite effects, this fact is not obvious from the words alone, whereas *selection* and *deselection* have a natural symmetry that, consistent with their functional definitions, implies effects in opposite directions.

To be fair, when Skinner (1938) originally coined the terms *reinforcement* and *punishment* to describe increasing and decreasing rates of behavioral responding, he did not appreciate that they represented selective processes. Only later did he begin to understand the environment's selective effect on human behavior, but by then he had already settled upon his terminology. As he himself noted, "I had done research on the selection of behavior by consequences for many years before the similarity to natural selection suggested itself" (Skinner, 1981, p. 503). His first reference to the parallel between behavioral evolution via the process of reinforcement and biological evolution via natural selection came in *Science and Human Behavior* (1953); thereafter, the evolutionary basis of operant behavior became more prominent in his writings (e.g., Skinner, 1972, 1981, 1984).

THE SELECTIVE ACTION OF THE ENVIRONMENT

Today, the selective action of the environment on an organism's behavioral

repertoire is a central theme of behavior-analytic thinking, and parallels with biological evolution have been discussed at length (e.g., Alessi, 1992; Baum, 1995; Glenn & Field, 1994; Palmer & Donahoe, 1992). It is now recognized that like phylogeny, ontogeny (i.e., behavioral evolution) is also underpinned by Darwinian natural selection, although the time scale of these two processes is different: Biological evolution occurs across generations, but behavioral evolution takes place within an organism's lifetime. Adaptation to the environment within an organism's lifetime (typically called *learning*) offers a great survival advantage over biological evolution alone, and it is easy to see why such an ability was selected for during phylogeny. As Skinner (1989) wrote,

> Natural selection prepares an organism only for a future that resembles the selecting past. That is a serious limitation, and to some extent it was corrected by the evolution of a process through which a different kind of consequence could select additional behavior during the lifetime of the individual. (pp. 114–115)

Another important difference between phylogenetic and ontogenetic evolution is the unit that is selected. In phylogeny, it is individual *organisms* (i.e., bundles of genes) that are selected, which leads to the propagation of particular genetic variants in the next generation. During ontogeny, it is individual *behaviors* that are selected, which leads to the increased probability of future emission. In evolutionary terms, both genetic and behavioral variations are selected according to the differential effect they have on an individual's survival and adaptation. We call organisms with common evolutionary histories *species* and behaviors with common historical contingencies *operants* (cf. Glenn, Ellis, & Greenspoon, 1992). But whereas species are populations of individual organisms extended through space, operants are populations of individual behaviors extended through time. We could say, therefore, that the unit of selection in phylogeny is the organism, and the unit of selection in ontogeny is behavior. Actually, there remains considerable debate about the exact focus of biological selection. Some hold that biological selection operates on the individual organism (i.e., phenotype), and others hold that it operates on the individual gene (i.e., genotype; see Dawkins, 1976, for a fuller discussion of this topic). According to the pragmatic philosophical position (to which radical behaviorism adheres; see Leigland, 1999), however, units are ultimately defined by the goals of the analysis being undertaken. Pragmatism holds that there are no absolute units in science, only more and less effective ways of talking about and dealing with the world; hence, it should come as no surprise that different research programs identify different units. This means that in some situations it may be more useful to talk of individual organisms as the unit of selection, whereas in others it may be better to talk about gene selection. A parallel and often-debated question in psychology is whether the basic unit of selection is behavior or its neurological correlate. Edelman (1992), for example, has argued that it is our neurology, not our behavior, that is selected. Just as the same genes can exist in different organisms, so the same neurological pathways can be activated during different behaviors; by analogy, therefore, we can think of neurological pathways as psychological genotypes and individual behaviors as psychological phenotypes. Which of these is the most appropriate unit to understand ontogenetic evolution, however, will depend on the particular goals of the analysis. The research program originally set out by Skinner (1938) and broadly pursued by behavior analysts ever since is that understanding behavior in its own right should be the aim of our science.

SELECTION AND DESELECTION

It is our belief that the Darwinian credentials of behavior analysis are be-

ing partly obscured by the words *reinforcement* and *punishment,* which, as pointed out above, do not directly imply a selective process and, in the case of the latter, has a contradictory meaning in therapeutic contexts. A solution that would clarify matters and bring us closer to other evolutionary disciplines would be to draw attention to the selective nature of the reinforcement process. After all, reinforcement refers to the process of behavioral selection; hence, to say that "a behavior is reinforced" is equivalent to saying that "a behavior is selected." Instead of saying behavior is reinforced by its consequences, by which we mean that it is selected, we could simply say that behavior is selected by its consequences. It is our sense that there is no conceptual loss as a result of this change. Indeed quite the opposite would occur, because the selective effect of the environment is more directly specified. Try it and see. Pick up any relevant text and read "select," "selector," and "selection" in the place of "reinforce," "reinforcer," and "reinforcement," respectively. Consider the following definition of reinforcement taken from Catania (1992): "When a rat's lever-presses produce food pellets and lever pressing increases, we may say that the pellets are reinforcers and the lever-presses are reinforced with pellets" (p. 72). Inserting *selectors* in the place of *reinforcers* gives the following: "When a rat's lever-presses produce food pellets and lever pressing increases, we may say that the pellets are selectors and the lever-presses are selected with pellets."

Although within behavior analysis *reinforcement* has a clear functional meaning, to those unfamiliar with our science it is often confused with the concept of *reward.* As Schoenfeld (1995) points out, "reinforcement has been used in connection with alleged 'responses' like 'writing a novel,' or 'getting married,' where it can only mean 'encouragement' or 'reward' in their plain senses" (p. 174). Although by our technical definition it is behavior, not people, that is reinforced, the everyday association between reinforcement and reward means that the two are often used interchangeably. Here *select* might offer an advantage over *reinforce* by shifting attention from the person–environment relation to the behavior–environment relation. That is, because *select* is not analogous to the notion of a reward, people may be less likely to say that "John was selected by an event," than they are to say that "John was reinforced by an event."

As a synonym of reward, reinforcement is also problematic in that it can imply that particular types of stimuli will a priori act as reinforcers. Society arranges particular events (e.g., prizes or money) to act as generalized reinforcers (selectors) and has termed these events *rewards.* Underpinned as they are by a structuralist view of the world, many in the lay community and other professional groups tend to assume that the qualities of a stimulus are determined solely by its physical structure. The natural conclusion, therefore, is that some stimuli will always act as rewards or reinforcers and that others will always act as punishers. However, this is not consistent with research findings that have shown that the effect a stimulus has on an organism is also governed by the contingency in which it is presented (see Herrnstein, 1970). The context-dependent basis of a reinforcer stands in opposition to the everyday, structuralist meaning associated with the word *reward*; hence, it is likely to cause misunderstandings. Here *select* (and its derivatives) may again be preferential to *reinforce,* because it is not directly associated with *reward,* or by extension to those stimuli that are thought to be *rewarding.* Although substituting *select* for *reinforce* will not remove structuralist preconceptions about the functions of different stimuli at a single stroke, it should at least reduce the common erroneous belief that reinforcers are akin to rewards.

Just as we have replaced *reinforce-*

ment with *selection,* so we can likewise replace the terms *punish, punisher,* and *punishment* with *deselect, deselector,* and *deselection,* respectively. Again this change is nothing more than a clarification of our terms, because punishment merely refers to the process of behavioral deselection. To use another of Catania's (1992) definitions, "if a rat's lever-presses produce electric shock, the lever-press is said to be punished and the shock a punisher, because this operation reduces lever-pressing" (p. 91). Replacing *punish* with *deselect* reads, "if a rat's lever-presses produce electric shock, the lever-press is said to be deselected and the shock a deselector, because this operation reduces lever-pressing." Apart from providing a welcome simplification, a more pressing reason for making this change is that it allows us to discard the problematic term *punishment.* The benefits of this change would be most keenly felt in clinical environments, in which (as discussed above) the notion of therapy is for many people inconsistent with the everyday meaning of *punishment.* Instead of having to whisper our way around *punishment,* we can talk of "deselecting behaviors from a repertoire." Certainly deselection interventions will employ aversive contingencies, but it is less likely that the therapeutic aims of these procedures will be confused if they are not described by the word *punishment.*

Finally, the adjectives *positive* and *negative* can continue to be used with *selection* and *deselection* just as they are with *reinforcement* and *punishment* (i.e., to denote the presence or introduction and absence or removal of contingent events). For example, we can say that work is positively selected by money and wearing a coat in the winter is negatively selected by the avoidance of cold. In relation to deselection, we can say a child's talking in class can be positively deselected by teacher criticism and negatively deselected by reducing the chance of doing well in exams. Although phrases such as *positive* and *negative deselection* are on first usage a bit of a mouthful, as a set of terms they are surely no more cumbersome than their predecessors. Whether we should continue to use *positive* and *negative* is another question. Michael (1975) has argued that these terms often confuse students who tend to conclude that "if reward is positive reinforcement, isn't it reasonable that punishment should be negative reinforcement?" (p. 33). This is an easy mistake to make, and Skinner himself has admitted to making it in his early work (Skinner, 1989, p. 126). In an effort to clarify matters, Michael recommended that we drop *positive* and *negative* from our terminology and instead refer solely to reinforcement and punishment to describe increases and decreases in the probability of behavior. Our own experience of teaching the principles of behavior analysis (and indeed learning them ourselves) supports Michael's arguments, but as yet there has been no satisfactory alternative way to talk about the presence or introduction and absence or removal of stimuli. That said, we could just say that selectors and deselectors are either presented, removed, or absent and thereby do away with the muddles that surround use of *positive* and *negative.*

SUMMARY

Baum (1995) has warned that "Behavior analysis risks intellectual isolation unless it integrates its explanations with evolutionary theory" (p. 1). Isolation is undesirable and unnecessary, because both genetic and behavioral evolution are underpinned by the same process—the selective action of the environment. Baum surmises that if behavior analysis does not build links with other evolutionary disciplines, it will not be in a position to contribute to the oncoming Darwinian era and will ultimately be superseded by others. In the last 60 years or so, behavior analysis has built up an impressive database and robust theoretical framework, and if nothing else it would be

a waste of precious resources and time for the human species to ignore this work and "reinvent the wheel."

It is our contention that the divide between behavior analysis and other evolutionary disciplines is in part being maintained by our terminology. From the outset, behavior analysis recognized the importance of developing and maintaining clear, precise terms. However, although behavior-analytic terms have a high level of internal coherence, terms like *reinforcement* and *punishment,* due to their vernacular associations, remain points of departure from other disciplines. Accordingly, the lack of a common language with other evolutionary sciences is likely to play a significant role in our present isolation. To emphasize our common ground and to increase the constructive dialogue between behavior analysis and other researchers, we propose replacing *reinforcement* and *punishment* with *selection* and *deselection,* respectively. Making this change will not involve any conceptual redefinitons, because reinforcement and punishment are already recognized to be selective processes. Rather, it is a simplification of our terminology that has the added benefit of emphasizing the place of behavior analysis within the Darwinian paradigm.

No doubt some will question whether these changes are necessary or desirable, but the fact is that in spite of no small effort to explain ourselves, other disciplines with whom we have much in common continue to misunderstand us. There is no good reason to assume that this situation will change if only we continue to pursue our current strategy of explaining the definitions of our terms. Quite the contrary; it seems likely that to go on as before will only maintain our isolation. Surely the best tactic to employ when someone does not understand *what* one is saying is to change *how* one is saying it. Simply repeating oneself with more frequency or volume will have little effect. After all, when one has dug into a hole, it makes sense to stop digging and try something else.

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