

Selection by Consequences: One Unifying Principle for a Transdisciplinary Science of Prevention

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The principle of selection by consequences is critical to the analysis of a broad range of phenomena in the biological and behavioral sciences from the evolution of species to the selection of cultural practices. This paper reviews the role of that principle in diverse areas of the biobehavioral sciences and discusses how it can provide one dimension along which the diverse disciplines relevant to the prevention of problems of human behavior can be integrated. Such integration should improve the ability of prevention science to reduce the incidence and prevalence of human behavior problems.

KEY WORDS: consequences; parenting interventions; prevention science; reinforcement; selection.

Kellam (in press) noted that prevention science is characterized by diverse theoretical and methodological paradigms with origins in diverse disciplines. He argues that many of the features of paradigms developed to work with one problem may have value when applied to a different prevention problem. For example, design and analytic techniques have been borrowed from one area of substantive research and applied to another, as have general orientations such as life course development and community epidemiology (Kellam *et al.*, 1999). Research on preventing the development of antisocial behavior has been strengthened by the integration of epidemiological and developmental perspectives (e.g., Kellam *et al.*, 1994). There also have been several efforts to identify cross-cutting theoretical principles for prevention science (Albrecht, 1994; Flay & Petraitis, 1994; Messner *et al.*, 1989). Such efforts could facilitate the integration of diverse disciplines into a more unified and effective science of prevention.

In this paper, it is argued that the principle of selection by consequences has broad applicability and can be a useful basis for integrating diverse disciplines and diverse substantive areas of concern in prevention science. At its most basic level, the principle might be stated: The organization of living systems is shaped

and maintained by the consequences of that organization at any given time. The principle provides a good account of the evolution of species, the shaping and maintenance of behavior, and the evolution of cultural practices. In this paper, I will describe the scope of the principle in analysis of the behavior of individuals and the actions of groups and organizations and will discuss ways in which the recognition of the scope of the principle could contribute to progress on some important current problems in prevention science.

THE SELECTION OF BEHAVIOR BY CONSEQUENCES

Although others, such as Thorndike (1932), contributed to the recognition that behavior was affected by consequences, Skinner (1938, 1953, 1972) trenchantly demonstrated the broad generality of the principle. His empirical work on the effects of reinforcement prompted numerous other behavioral scientists to explore the effects of reinforcing and other consequent events on behavior (Kazdin, 1978).

The fundamental principle of reinforcement is that certain events that follow a behavior increase the likelihood that the behavior will occur on subsequent, similar occasions. A consequent event is considered a reinforcer if it has this effect. Such consequent events can involve the presentation or occurrence of a

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stimulus, in which case they are labeled “positive reinforcers” or they can involve the removal or cessation of a stimulus, in which case they are labeled “negative reinforcers.” Reinforcers may be effective because of their direct contribution to the biological functioning of the organism—for example, they provide needed food, remove painful stimulation, or provide sexual gratification. These stimuli have been labeled *primary reinforcers*. Or they may be *secondary* or *conditioned* reinforcers that reliably precede primary reinforcers. The distinction is only approximate, since many events such as touch and attention from other organisms may be reinforcing both because of inherited tendencies to find them reinforcing and because of the conditioned relationships of these events to more biologically required consequences. In verbally able humans, many events are reinforcing because they participate in relational frames that relate the event to other events that are already reinforcing (Hayes & Hayes, 1992). For example, telling children of 5 that they can get ice cream if they earn five plastic tokens will establish the tokens as reinforcers.

The diversity of human behaviors that are affected by consequent events is immense, as are the consequent events that have been shown to be effective. Table 1 presents examples of the types of human behavior that are affected by reinforcement. Behaviors range from those of infants through those of the elderly. They involve most aspects of verbal behavior and quite diverse nonverbal behaviors including physiological functioning, aggressive and nonaggressive social behavior, and most of the types of behavior that we wish young people to develop. Reinforcement affects drug-taking behaviors and behaviors involved in resisting drug use.

Reinforcement for correspondence between verbal descriptions of behavior and actual behavior increases the accuracy of these reports. This appears to be a vital function for the social control of behavior, because, to the extent that accurate reports of behavior are maintained, it is possible to reinforce unobserved behavior by reinforcing reports of it (Israel, 1978). Social influence is also facilitated by human rule following. Our tendency to follow rules and expectations is affected by reinforcement; when rule following is reinforced, rule following is increased or maintained (Hayes, 1989).

Early in the discussion of reinforcement effects on humans, it was suggested that reinforcement could not account for creative behavior. However, it has been shown that key aspects of creativity, such as

emitting new forms or patterns of behavior can be reinforced.

Two Roles of Aversive Events in the Selection of Behavior

Behavior is also affected by aversive consequences. When a stimulus is made contingent on a behavior and the probability of that behavior subsequently decreases, the stimulus is said to be an aversive event and the arrangement is said to involve punishment (Hineline, 1984). Thus, the frequency of behavior is decreased by certain consequent events. A second arrangement—which is often confused with punishment—is negative reinforcement. As noted above, in negative reinforcement a behavior becomes more likely because it removes a stimulus. Here too the stimulus is said to be aversive. Both of these arrangements have been extensively studied in both humans (e.g., Patterson, 1982) and animals (e.g., Hineline, 1976) and there is little doubt that they play an important role in the selection of behavior.

There is a problem with the term “punishment,” however. Its colloquial meaning takes in many practices that do not meet the technical definition of punishment. For example, lengthy incarceration, the beating of children, lengthy grounding for misbehaving teenagers, and criticism and ridicule are often called punishment, but whether they suppress behavior is doubtful. For example, lengthy imprisonment of adolescents actually contributes to increases in criminal behavior (Laub & Sampson, 1995; Sampson & Laub, 1997).

Empirically validated parenting interventions are designed to influence parents to abandon harsh practices such as hitting, frequent criticism, and lengthy groundings. They help parents establish effective, nonharsh consequences for their children’s behavior such as time-out and the brief removal of privileges (Taylor & Biglan, 1998). Indeed, the work of investigators at the Oregon Social Learning Center on the role of aversive events in the development of antisocial behavior shows that many of the so-called punishing behaviors that parents engage in actually contribute to the shaping of children’s aversive behavior through negative reinforcement (Capaldi & Clark, 1998; Patterson, 1982; Patterson *et al.*, 1992). Children learn to whine, scream, or refuse to obey, because it prompts parents to cease their requests, commands, criticism, and yelling. Thus, although it is true that consequent negative events can

Table 1. Some Behaviors That Are Affected by Reinforcement

Type of behavior	Citation
Infant behaviors	
Gazing	Blass & Camp, 2001
Vocalizing	Weisberg, 1972
Imitative behavior	Peterson, 1968
Self care	
Toilet training	Matson & Ollendick, 1977
Tooth brushing	Horner & Keilitz, 1975
Dressing	Hall <i>et al.</i> , 1972
Verbal behavior	
Verbal imitation	Brigham & Sherman, 1968
Generative use of verbs	Schumaker & Sherman, 1970
Syntax	Garcia <i>et al.</i> , 1973
Use of adjectives	Martin, 1975
Correspondence between verbal and nonverbal behavior	Israel, 1978; Rogers-Warren & Baer, 1976
Aggressive and self-injurious behavior	Day <i>et al.</i> , 1994; Patterson <i>et al.</i> , 1992; Thompson <i>et al.</i> , 1998; Thompson & Iwata, 2001
Behavior in school	
Attending to school work	O'Leary <i>et al.</i> , 1969; Walker & Buckley, 1968
Study behavior in elementary school	Hall <i>et al.</i> , 1968
Cooperative play behavior	Hart <i>et al.</i> , 1968
Social interaction	Strain & Timm, 1974
Students reinforcing other students	Greenwood <i>et al.</i> , 1974
Students prompting adults to reinforce the students' meritorious behavior	Stokes <i>et al.</i> , 1978
Academic behavior	
Reading sight-words	Lahey & Drabman, 1974
Spelling accuracy	Ollendick <i>et al.</i> , 1980
Performance on standardized tests	Ayllon & Kelly, 1972
Behavior in work settings	
Work performance	Kortick & O'Brien, 1996
Safety behaviors and job performance	Austin <i>et al.</i> , 1996
Safety behaviors	Sulzer-Azaroff <i>et al.</i> , 1990
Drug use and related behavior	
Abstinence from cigarettes or reduction in smoking	Roll <i>et al.</i> , 1996; Stitzer & Bigelow, 1984; Stitzer <i>et al.</i> , 1986
Nonuse of benzodiazepine	Stitzer <i>et al.</i> , 1982
Cocaine and marijuana use	Budney <i>et al.</i> , 1991
Not selling tobacco to young people	Biglan <i>et al.</i> , 1995
Environmental conservation	
Recycling behavior	Witmer & Geller, 1976
Litter depositing in trash receptacles	Kohlenberg & Phillips, 1973
Bus ridership and reduced energy use	Tuso & Geller, 1976
Noise level in a dormitory	Meyers <i>et al.</i> , 1976
Behavior of the elderly	
Wandering-DRO reduced it	Heard & Watson, 1999
Senior citizen participation in meal program	Bunck & Iwata, 1978
Miscellaneous	
Creative responding	Glover & Gary, 1976; Henson, 1975
Reporting of info about available jobs as an aid to job finding	Jones & Azrin, 1973
Intrinsic motivation	McGinnis <i>et al.</i> , 1999
Food preferences	Kern & Marder, 1996
Recruitment of members to organizations	Herndon & Mikulas, 1996

make behavior less likely, it is misleading and perhaps dangerous to use the technically defined term "punishment," because it connotes many problematic practices.

Nonetheless, the measured use of aversive consequent events has an important role in efforts to reduce the incidence or prevalence of problem behavior. However, in discussing such arrangements, we

must keep before us that our problem is seldom to induce society to make greater use of contingent negative events to suppress behavior. Rather it is to bring about the appropriate use of mild and effective consequences and to increase the use of positively reinforcing consequences to support the development of desired behavior.

The Matching Law

The role of selection of behavior by consequences is parsimoniously summarized by the Matching Law which states that the frequency of a behavior or time allocated to engaging in the behavior is a function of the rate of reinforcement for that behavior relative to the rate of reinforcement for alternative possible behaviors (Herrnstein, 1970). McDowell (1988) reviewed evidence for the matching law. In a wide variety of laboratory and applied studies, it was shown that where two behaviors are concurrently possible, the relative rate of the behaviors is a precise function of the relative rate of reinforcement for the behaviors. The effect also holds when one compares the relative *time* spent on two behaviors. Moreover, if one is interested in a single behavior, one can predict the rate or time allocated to the behavior from the ratio of the reinforcement for the behavior of interest to the total amount of reinforcement for all other behaviors. McDowell (1988) did a meta-analysis of matching law studies. The matching law has been shown to hold in experiments with pigeons, rats, crows, cows, squirrel monkeys, and humans (McDowell, 1989). The modal percent of variance in behavior accounted for in these studies was 90%.

The matching law has also been shown to work where negative reinforcement is involved (Snyder & Patterson, 1995). Thus, behavior rate or time allocation can be accounted for by the relative rate with which a behavior escapes or avoids aversive stimuli.

The matching law accounts for individual differences in behavior as well as individual variability in behavior. For example, Snyder and Patterson (1995) directly observed 1 hr of mother-son interactions of 10 aggressive and 10 nonaggressive boys on each of 10 consecutive days. They calculated the relative rate of negative reinforcement for aggressive versus nonaggressive behavior. For example, for the boy they assessed the extent to which boys' aggressive behavior terminated the mothers' aversive behavior versus the extent to which the boys' nonaggressive behavior terminated the mothers' aversive behav-

ior. They found that 64% of the variance in boys' directly observed aggressive behavior during the last five observations could be accounted for by the relative rate of mothers' negative reinforcement for aggressive versus nonaggressive behavior in the prior five observations and the rate of mothers' aversive behavior in those first 5 days. Similarly, about 49% of the variance in mothers' aggressive behavior in the last five observations was accounted for by the relative rate of boys' negative reinforcement of aggressive versus nonaggressive behavior and the boys' rate of aversive behavior in those first 5 days.

It has long been understood that, if we are interested in increasing the rate of a behavior, we can increase reinforcement for that behavior. However, the matching law shows that one can also affect a behavior of interest by decreasing the reinforcement for other behaviors, decreasing the aversive consequences for the behavior we want to increase, or increasing the aversive consequences for alternative behaviors. Thus, the matching law provides a generalization about the effects of consequences on behavior that is exceedingly broad. As we will see below, it has important implications for how we can prevent diverse problematic behaviors.

The Diminished Role of Selectionist Accounts

Skinner's stark advocacy of the principle of reinforcement (Skinner, 1969) prompted considerable reaction (e.g., Bandura, 1974; Chomsky, 1971). To many, it appeared to leave no room for humans to make decisions or to shape their destiny. Indeed it was labeled a "wholly robotic view" (Bandura, 1978) that was "associated with odious imagery. . ." (Bandura, 1974).

The view that behavior is shaped by its consequences does not preclude conscious decision-making processes such as the enumeration of alternative courses of action or acts of self-control such as the eating of an apple rather than a cream pie. A thoroughgoing account of behavior in terms of the contingencies of reinforcement does assert, however, that such processes are, themselves, shaped by their consequences. If a child has learned to forgo the immediate pleasure of watching a TV show for the arduous task of completing homework, it is presumably thanks to a history of consequences in which that choice had more positive and fewer negative consequences than has skipping homework.

Nor does a selectionist account undermine traditional protections of the rights and liberties of the

individual. Many critics of Skinner's writings believed that accepting the principle of selection by consequences entailed the acceptance of a world in which individuals had no control over their own destinies (cf. Chomsky, 1971). However, a scientific account of the influence of consequences on behavior does not require that we abrogate the many traditional cultural practices that prevent people from being coerced (Biglan, 1993).

Indeed, an analysis of the influences of consequent events reveals ways in which individuals are exploited that traditional accounts had ignored (Biglan, 1995). Traditional analyses concentrated on coercive influences on behavior and fought to limit these influences. That was unquestionably an important contribution to society. However, by ignoring the influence of positive consequences on behavior, these accounts have been less useful in identifying the many ways in which people are exploited through manipulation of positive reinforcers (Biglan, 1995). Gambling and the use of tobacco, alcohol, and other drugs are some obvious examples.

Nonetheless, reactions to Skinner's writing (e.g., Bandura, 1974, 1978) placed contingency accounts of behavior in a bad light for many scientists. In the field of behavior therapy, theoretical work began to emphasize the role of cognitions in behavior and to place less emphasis on the role of consequent events. To put the matter, itself, in reinforcement terms, it became clear that theoretical analyses of the role of consequent events were unlikely to achieve recognition from other scientists. As a result, many investigators shifted from theoretical positions emphasizing the effects of consequences on behavior to cognitive theoretical accounts (cf. Conditte & Lichtenstein, 1981; Lichtenstein, 1971).

One reaction to experiments showing reinforcement effects on human behavior was to argue that reinforcers may affect behavior in contrived laboratory situations, but that does not mean that reinforcement plays a role in everyday life. However, studies involving direct observation of social interactions have shown numerous ways in which behavior is shaped and maintained by the responses of others (e.g., Biglan *et al.*, 1988; McDowell, 1982; Patterson, 1982). Moreover, critics of the theory that behavior is maintained by its consequences often failed to see ways in which quite subtle events, such as another's smile or frown, can function as consequences through their pairing with other more fundamental or substantial consequences.

The Role of Language

The appeal of cognitive theories of behavior was not without foundation, however. Selectionist accounts did not provide an effective account of the role of thoughts and feelings in human behavior. Nor was there a good account of how verbal behavior came to be reinforcing. For example, a teacher's statement such as "You got an A" might be shown to be a reinforcer, but how did it come to be reinforcing? Further, because so much human behavior involves language, it seemed that reinforcement was relevant only to a small slice of the nonverbal behavior of humans (e.g., Bandura, 1974).

Recent work on relational framing (Hayes *et al.*, 2001; Hayes & Hayes, 1989) suggests that reinforcement processes are fundamental to language processes. More importantly, the approach provides an empirically supported theoretical account of how verbal processes are involved in the development of reinforcing and aversive properties of both language and other events for humans. According to relational frame theory, human beings develop a very general response class of relating words and nonverbal stimuli in a bidirectional fashion. Children are exposed to literally thousands of occasions in which they are reinforced for relating a word to another stimulus or the stimulus to the word. In the context in which a child can say "ball" in the presence of a ball, they can also look at the ball when someone else says, "Ball." Bidirectional responding is reinforced and the word "ball" and the ball itself become equivalent in certain contexts. As a function of reinforcement for such bidirectional responding, humans develop a general tendency to relate words to nonverbal stimuli, the appropriate nonverbal stimuli to words, and words to other words. This bidirectional "training" results in "frames of coordination." Such frames have two properties important for understanding the way that language functions in human behavior. *Transitivity* among the stimuli in a frame of coordination means that if the spoken word "ball" and a ball are equivalent and the letters b-a-l-l and the spoken word "ball" are equivalent, then b-a-l-l and a ball are equivalent. *Transfer of function* means that the function taken on by any given stimulus is taken on by stimuli in the frame of coordination of that stimulus. If a child has phobic reactions toward dogs, then learning that there is a dog behind the gate will establish the gate as a phobic stimulus to some extent.

Space does not permit a review of the growing body of evidence supporting this account or a description of other types of relational frames that have been identified (see Hayes *et al.*, 2001). Nor is there space to describe the extensive research on clinical treatment in keeping with this work (Hayes *et al.*, 1999). However, the approach suggests that reinforcement processes are fundamental to the development of complex language processes and that the reinforcing or aversive functions of a stimulus—for verbally able humans—are a function of its participation in relational frames. Thus, a cigarette becomes something highly valued by an adolescent because it seems to be equivalent to maturity, independence, popularity, etc.

THE SCOPE OF SELECTION BY CONSEQUENCES IN PREVENTION SCIENCES

Although insufficient attention has been paid to the development of selectionist theoretical principles, they have been used extensively in practice. The role of selection by consequences can be seen in diverse preventive interventions. Consider first, parenting skills training programs. A core feature of these interventions involves teaching parents to increase the use of praise and rewards in order to support the development of children's appropriate social behavior (e.g., Taylor & Biglan, 1998). At the same time, parents are instructed in how to provide effective negative consequences such as time-out and privilege removal for unwanted child behavior. These features of the interventions are based on direct observation evidence indicating that parents of children who engage in aggressive behavior receive inadequate levels of positive reinforcement for appropriate behavior. Additionally, they have their coercive behavior negatively reinforced by its effect in getting other family members to cease aversive behaviors such as criticizing or making demands on the child (Patterson *et al.*, 1992; Snyder & Patterson, 1987)

Components of parenting programs that increase parents' positive interactions with their children also involve reinforcement. For example, parenting programs that teach parents to play with their young children (e.g., Webster-Stratton, 1984) reduce aversive parental command-giving and increase parents' positive attention to the child's positive behavior. Parenting programs for parents of older children also emphasize parents' monitoring their children. Increased monitoring is designed to help parents detect youthful activities that might put the child at risk for problem

behaviors, such as spending time in unsupervised settings. Thus, monitoring makes it possible for parents to consequte both undesirable behavior and desired behavior. In sum, the most parsimonious account of the effects of parenting interventions can be described in terms of the matching law: They increase positive reinforcement for desired behavior and aversive consequences for undesirable behavior, while reducing negative reinforcement of the child's or adolescent's coercive behavior.

Social skills interventions for children with conduct problems have been shown to be of some value in reducing aggressive social behavior, though their effects appear to be more limited than those of parenting skills interventions (Taylor *et al.*, 1999). The use of reinforcement procedures in some of these interventions is quite clear. For example, the Contingencies for Learning Academic and Social Skills (CLASS) program (Hops & Walker, 1988) provides intermittent reinforcement for on-task and appropriate social behavior in classroom and playground situations for brief periods each day and gradually increases the length of these periods until the entire day is covered. Other social skills programs place greater emphasis on modeling and role-playing appropriate social behavior and on changing decision making and attributions that appear to prompt aggressive social response (e.g., Kazdin, 1978). These interventions might seem to be inconsistent with a selectionist account. However, evidence indicates that new cognitive or social behaviors will not be maintained unless they achieve reinforcement in the child's social interactions (e.g., Kazdin, 1978). Peers and adults achieve such reinforcement when modeled social and cognitive behaviors prompt effective social behavior that is reinforced. It is not surprising, therefore, that the social skills interventions that have produced the strongest and most long-lasting outcomes are those that program reinforcement for the targeted social skills in natural social settings (Taylor *et al.*, 1999).

The role of consequent events in maintaining appropriate behavior in classroom settings is also well established (Madsen *et al.*, 1968). Programs like the Good Behavior Game (Barrish *et al.*, 1969) set up rich schedules of positive reinforcement for appropriate social behavior and mild, though consistent, negative consequences for inappropriate social behavior. Dolan *et al.* (1993) found that this program significantly reduced children's aggressive social behavior in first grade classrooms. Effects on behavior were still detectable in middle school (Kellam & Anthony, 1998). Additionally, reinforcement is operative even

when formal programs of rewarding desired behavior are not implemented. A sizeable literature documents that a teacher's attention functions as a powerful reinforcer that can shape desirable or undesirable behavior, depending on what is attended to (Walker *et al.*, 1995). There are also studies showing that much of children's uncooperative behavior in classroom settings is reinforced by enabling them to escape from learning tasks at which they are unable to succeed (Munk & Repp, 1994). Thus, instructional procedures that provide for high rates of success ensure a high rate of positive reinforcement for on-task behavior and make task-escape aversive behavior less necessary. In essence, effective behavior management in classrooms involves making sure that desired social and academic behavior is richly reinforced and that problematic behavior is not reinforced by teacher or student attention or by escape from too difficult academic tasks.

School-based tobacco, alcohol, and drug abuse prevention programs have been shown to have a significant benefit, though the size of their effects is limited (Rooney & Murray, 1996; Tobler & Stratton, 1997). Tobler *et al.* (2000) found that the most effective school-based prevention programs were ones that involved interactions between teachers and students, and among students. Although components analyses of these programs have not been done, the programs having a preventive effect include one or more of the following: (a) information about the social and media influences to use tobacco, alcohol, and other drugs; (b) decision making about drug use; (c) modeling and role-play of skills for resisting social influences to use substances; (d) feedback about the actual (and lower) proportion of young people who use substances; and (e) peer-led small group activities (Tobler & Stratton, 1997). Each of these components affects the consequence for youth substance use or the behaviors that lead to use. Information about the influence of media is designed to undermine depictions of substance use that make it seem reinforcing. Decision making about substance use leads young people to publicly stated resolutions that they will not use drugs, which may make it more aversive to subsequently do so. Modeling and role-playing provide reinforced practice of behavior that may help to resist peer influences. Feedback about how few actually use drugs may make it less reinforcing for youth to use, because it suggests that peer approval is less likely to result from use. Peer-led group processes presumably mobilize peer reinforcement for antidrug talk, attitudes, and behavior. However, these programs do not provide

any direct reinforcement for nonuse of substances or even for practice of skills for dealing with peer influences. Given the weakness of the effects of these programs, one might ask whether they would be more effective if they made better use of the principles of selection by consequences to mobilize reinforcers for nonproblematic behavior and curtail reinforcement for substance-using behaviors.

The role of consequences also can be seen in preventive interventions that focus on population level variables. For example, studies of alcohol-involved problems have shown that increased enforcement of drinking and driving laws can reduce drunk driving. In efforts to reduce illegal sales of tobacco to young people, it has also been shown that a program or reinforcement for clerks not selling tobacco to young people can significantly reduce the prevalence of outlets willing to sell (Biglan *et al.*, 1995; Henderson *et al.*, 1995).

The preceding merely presents a brief overview of the role of selection by consequences in a range of empirically supported preventive interventions. Systematic review of other such interventions would identify numerous ways in which they change the contingencies for behavior. Such a review should also identify ways in which these interventions could be strengthened by altering the consequences for desired and undesirable behavior.

In general, interventions that reduce the likelihood of problem behavior do so by some combination of (a) increasing the reinforcing consequences for behavior that is incompatible with the problem to be prevented, (b) decreasing aversive consequences for incompatible behavior, (c) increasing aversive consequences for behavior to be prevented, or (d) decreasing positive consequences for behavior to be prevented. Such generalization may seem to gloss over myriad details of preventive intervention that involve changing people's attitudes and cognitions, teaching them specific skills, and so on. However, the ultimate success of these activities depends on the attitude, cognition, or skill being maintained and the selection-by-consequence principle implies that it will be maintained only if it contributes to achieving some net improvement in consequences.

The Notion That Reinforcement Undermines Intrinsic Motivation

The widespread adoption of reinforcing practices has been impeded by the idea that the use of explicit

rewards for behavior could undermine what has been called intrinsic motivation. For example, Lepper *et al.* (1973) asserted that a child who was rewarded for academic work would be less motivated in the absence of rewards than the child had been before their use. However, a meta-analysis of studies examining this issue has not supported the notion. Cameron and Pierce (1994) found 96 experimental studies that compared rewarded subjects to nonrewarded on four measures of intrinsic motivation. They did not find that reward undermined intrinsic motivation. Praise clearly increased it.

Two things might be noted about this controversy. First, the very distinction between intrinsic and extrinsic motivation is inconsistent with a thoroughgoing analysis of behavior in context. From a contextualist viewpoint behavior is always a function of the environment (Biglan & Hayes, 1996). Thus, behavior that might have been labeled “intrinsically motivated” is, itself, assumed to be a function of ongoing consequences and the contextualist is prompted to search for those consequent events.

Second, the use of tangible rewards may be essential to motivating a person to engage in behavior that initially may not be sufficiently skilled or fluent to achieve the more “natural” reinforcements of success or social approval. One might think of such rewards as a prosthetic device for building behavior that will be maintained by these more common reinforcers.

Economic Analyses and Selection by Consequences

The fundamental model of economics states that people will choose the goods or activities that maximize their utility (Friedman & Friedman, 1990; Landsburg, 1993). Economic research has demonstrated that this model gives a good account of the choices people make in a wide variety of situations, including not only the goods and amounts they purchase, but life choices they make such as marrying or seeking further education (Becker, 1993). The model is consistent with the selectionist principle in that it says that people’s choices are determined by the subjective utility of the consequences of those choices. The purchase of a good or service, or engagement in an activity is predicted to increase as the cost goes down or the cost of alternative goods, services, or activities go up.

Bickel and his colleagues (Bickel & DeGrandpre, 1996; Bickel & Marsch, 2001; Bickel & McLellan, 1996; Bickel & Vuchinich, 2000; Madden & Bickel,

1999) have done some of the most valuable work at the intersection of economics and selectionist analyses. For example, Madden and Bickel (1999) showed that cigarette consumption is a function of the cost of smoking and deprivation from cigarettes. Bickel and Marsch (2001) reviewed how drug dependence could be analyzed in terms of the increased decay in the value of delayed rewards for drug users. There appears to be a general tendency for drug abusers to discount delayed rewards, but the discount is especially marked for the substance that the user most abuses.

In applied areas, economic and behavioral analyses appear to be increasingly converging. For example, the impact of costs on consumption of tobacco and alcohol has been extensively studied (e.g., Chaloupka & Pacula, 2000). So long as the cost under consideration is measured in money, these analyses might seem to be the provenance of economics. However, both behavioral psychologist and economist recognize that other costs influence behavior such as the amount of effort required to obtain the good when sales to minors are restricted or the density of liquor outlets is reduced (Chaloupka *et al.*, 1998). Both groups are working within a framework that assumes that the most effective account of behavior will come from a comprehensive account of the costs and benefits of all available alternatives. As this framework is increasingly applied to the analysis of behaviors to be prevented or promoted, interventions that more comprehensively modify consequences for behaviors are likely to emerge.

SELECTION IN BIOLOGY

A thoroughgoing account of selectionist principles in biology is well beyond the scope of this paper and the expertise of its author. However, the prominence of the selectionist principle in biology and its relationship to selection of behavior should be noted. Biology was the first science to employ a selectionist principle. Darwin began a paradigmatic revolution (Kuhn, 1970) by arguing that the characteristics of species were due to their selection by the environment. Species characteristics that fostered survival were likely to be passed on to the next generation precisely because the organism survived to reproduce. The evolution of both anatomical and behavioral characteristics can be understood in this way. Behaviors that contributed to survival were likely to survive.

To give some sense of the relevance of biological selection to prevention science, two examples of the selection of behavioral patterns will be noted here. The first concerns the possible selection of temperament. Temperament differences among infants are well established. Infants that are quick to cry, easily irritated, and difficult to soothe have been shown to be more likely to be abused (Schmitt, 1987). One might expect, therefore, that in the extreme circumstances of a famine, these infants would be the first to die. However, in a study of such “difficult” infants among the Masai, DeVries (1984) found that they were significantly more likely to survive in a famine than were infants who had previously been identified as having an “easy” temperament. Presumably, the increased tendency to cry and be difficult to console contributed an advantage to these babies in being fed during a famine. Thus, a behavioral pattern that is often a precursor to later conduct problems may exist in the population because it has a selective advantage under some circumstances.

A second example concerns the selection of anti-social patterns of behavior. Raine (1993) reviews evidence for the possible selective advantage of antisocial behavior. Computer simulations of the likelihood of survival and reproduction of individuals with varying levels of altruism and cheating suggest that a small proportion of persons who take advantage of others would be likely to survive and reproduce, especially in settings where the groups’ survival does not depend on a high level of cooperation. An especially good case can be made that a pattern of making false and exaggerated promises, cheating on sexual partners, and being transient would advantage males.

The mechanisms by which inheritance influences behavior are poorly understood. One may involve an inherited tendency to react to certain stimuli or other environmental conditions, such as deprivation. For example, the choleric syndrome, described above, may involve a greater likelihood of crying under conditions of food deprivation (Prudhomme-White *et al.*, 2000). Whatever the physiological mechanism through which it operates, it would not need to involve learning on the part of the organism. That is, a baby that responds with this syndrome of crying and fussing may be more likely to be fed than one that does not (and thereby be more likely to survive in a famine). Yet, the baby may not need to be shaped by the consequences for crying in order for this process to contribute to survival. This would constitute selection by the contingencies of survival, but not selection by behavioral consequences.

On the other hand, it is clear that much behavior is shaped by its consequences. The capacity to be shaped by the immediate consequences of behavior is itself due to natural selection (Skinner, 1969). Organisms that adjust their behavior in light of its consequences are better able to adapt to varying environmental conditions. Thus, the propensity of organisms to have their behavior shaped by its consequences is itself a biological feature that was selected by its consequences for survival and reproduction. Organisms may vary, however, in the degree to which they can be conditioned or in their susceptibility to certain types of reinforcers and this variability may result in variance in behavioral phenotypes.

There are increasing efforts to integrate biological and social–environmental accounts of the development of behavior (e.g., Fishbein, 2000). These efforts would appear to require better understanding of the way in which the contingencies of survival and the contingencies for the ongoing behavior of the organism interact to determine behavior. That is, clarifying the precise ways in which the environment selects behavior may be essential for integrating biological and environmental approaches to behavior.

THE VALUE OF EXPLOITING SELECTION OF BEHAVIOR BY CONSEQUENCES

Although the role of selection by consequences can be discerned in a diverse array of preventive interventions, the principle is seldom emphasized. As a result, we are not making as effective use of it as we might. Here are a few ways in which prevention science might be strengthened by an explicit and thoroughgoing exploitation of the principle.

Peer Influences on Adolescent Behavior

Despite substantial evidence that adolescent substance use and other problem behavior is influenced by peers (e.g., Dishion *et al.*, 1999), prevention researchers have generally failed to examine the role of consequent events in this relationship or to develop interventions that mobilize peer reinforcement for appropriate social behavior and reduce reinforcement for deviant behavior. The bulk of research on peer influences has focused simply on the question of whether peer behavior and adolescent behavior are related and has employed correlational studies of adolescent reports of their own and their peers’ behavior. Even where studies have obtained

independent measures of peers' behavior in order to disaggregate peer influence from peer assortative affiliation effects (Bauman & Ennett, 1996), the actual processes through which peers influence each other are typically not studied.

Recently, however, Dishion and colleagues directly examined the role of peer reinforcement for problem behavior. Dishion *et al.* (1996) observed interactions between 186 adolescent boys (13 or 14 years old) and a friend. They found that the rate of boys' talk about rule breaking could be predicted from the rate with which such talk was followed by laughter from the other member of the dyad. Apparently, laughter reinforced such talk. In dyads with a history of arrest, talk of rule breaking was more likely to be followed by laughter. Indeed, dyads in which there was a higher likelihood of laughter following rule-breaking talk were significantly more likely to engage in delinquent behavior over the next 2 years, even when initial levels of delinquent behavior were controlled.

Using the same sample of boys that Dishion *et al.* (1996) studied, Capaldi *et al.* (2000) coded interactions between these boys and a male friend when the boys were 17 or 18 years of age. They found that expressions of hostility toward women by each member of the dyad were highly related. That is, if one expressed hostility, the other was likely to. Presumably, then, boys who were expressing a lot of hostility were being reinforced by their friends' agreement. Capaldi *et al.* (2000) found that the observed rate of hostile talk about women predicted their aggression toward female partners 3 years later.

When the Dishion *et al.* (1996) analysis is viewed in the larger context of the substantial evidence of the influence of consequent events on behavior, it suggests that preventive interventions focusing on children and adolescents could be strengthened by practices that mobilize peer consequences. Could we increase peer recognition for adult-desired behavior? Are there ways that peer disapproval of dangerous behavior could be mobilized to prevent or reduce such behavior? Certainly, it appears possible to mobilize peer reinforcement of desired behavior among elementary students through programs such as the Good Behavior Game. Other programs that appear to mobilize peer reinforcement in elementary schools are the Positive Action program (Flay *et al.*, 2001) and Peacebuilders (Embry *et al.*, 1996).

Peer-led prevention programs (e.g., Perry *et al.*, 1980) for adolescents also appear to have some value. However, other than preventing association with deviant peers (e.g., Chamberlain & Reid, 1994), effec-

tive methods of reducing deviant peer reinforcement of deviant behavior are undeveloped. It would seem that a clear understanding of the scope and power of the principle of selection by consequences could prompt some ingenious prevention researchers to develop additional powerful methods of mobilizing peer consequences.

The Prevention of Drug Abuse in Light of the Reinforcing Properties of Drugs

There is considerable agreement that drugs are abused because of their reinforcing effects (Glantz *et al.*, 1999). Neurotransmitters that have been implicated in the drug reinforcement effect include dopamine, serotonin, acetylcholine, glutamate, and gamma-aminobutyric acid (Bardo, 1998). At the same time, there is evidence that young people who are high in sensation seeking are particularly likely to develop drug abuse (Palmgreen & Donohew, in press) and there is evidence that sensation seeking involves the dopamine system of the brain (Bardo *et al.*, 1996). Pubertal brain changes in neurotransmitter activity result in a need for stronger (or more "exciting") stimuli in order to achieve a physiologically rewarding state (Spear, 2000). These changes in brain activity have been suggested as the basis for increased levels of risk-taking or sensation-seeking behavior during adolescence.

Certain features of environments may serve to increase the rewarding properties of drugs through their effects on physiology. Recent work by Goeders and Guerin (1994) indicates that stressful events change the reinforcing properties of cocaine for rats. Rats will self-administer cocaine to raise the level of their physiological responsiveness past a particular threshold. Stress leads to a higher baseline level of physiological responsiveness, and smaller doses of cocaine have reinforcing effects. Other animal studies have shown that cocaine self-administration is particularly likely to be increased when the animal is exposed to uncontrollable or unpredictable stressors or is a witness to another animal who is exposed to such stressors.

When this evidence is considered in conjunction with evidence from the matching law, a number of implications for effective prevention can be drawn. First, it would appear that reducing stressful events might make it less likely that tobacco, alcohol, and other drugs will be reinforcing. Second, the matching law implies that the potency of drugs as a reinforcer will depend on the degree to which alternative

reinforcers are unavailable. That is, whatever the level of susceptibility of the person to drugs as a reinforcer, the behavior of taking them will be diminished to the extent that reinforcers for alternative behaviors are increased. Thus, even if a person is highly susceptible to drugs for physiological reasons, the likelihood of their engaging in drug-taking behavior will be less to the extent that they have a repertoire of behaviors that achieves other reinforcers. If the above-cited evidence is correct and adolescence is a time when risk taking is especially rewarding because of physiological changes, we may need to provide “controlled” but “risky” alternatives to substance use at least for sensation-seeking adolescents. For example, we may want to make readily available skateboarding rinks with high walls, rock climbing opportunities, amusement parks, and outdoor adventures.

Much evidence about risk factors for adolescent drug use and abuse can be organized in terms of these principles. For example, the higher likelihood of drug use and abuse among young people with poor academic performance (Glantz *et al.*, 1999) can be seen as a function of the lower probability of their receiving reinforcement for academic activities. Evidence that drug use is more likely if peers use drugs (Biglan & Smolkowski, 2002) can be understood as due, in part, to the higher likelihood of social reinforcement for drug-taking that comes from peers who use drugs. Young people come to be at risk for drug use because they and their environments are unable to ensure that they develop social and academic behaviors that lead to reinforcement for nonproblematic behavior (Patterson *et al.*, 1989). As a result, their only option is to seek reinforcement in a deviant peer group—often for problematic behavior.

Thus, ensuring that young people have ample sources of reinforcement for behavior other than drug use could contribute to preventing drug use—and other problematic behaviors. We need to nurture skills among children and adolescents that allow them to achieve nondrug reinforcers and to ensure that reinforcement for nondrug-taking activities is readily available.

Increasing Reinforcement for the Activities of the Elderly

A major problem for many elderly is the lack of meaningful activities. Inactivity is a risk factor for physical, psychological, and cognitive deterioration (Fries *et al.*, 1998). Although various interventions

to increase specific forms of social and recreational activities have been evaluated in gerontology, comprehensive interventions to increase activity levels by providing reinforcing activities and by increasing incentives for participation in activities have not been evaluated. An explicit recognition that diverse forms of inactivity stem from a curtailment of reinforcement would mobilize gerontological researchers and care providers to systematically find and implement methods for increasing reinforcement for activity among elderly persons.

Interventions to Increase Positive Reinforcement of Desired Behavior

The preventive interventions discussed thus far have typically focused on a single behavior or a small range of related behaviors. When reinforcement has been an explicit part of the intervention it has usually been implemented in a circumscribed way, such that the change agents were not encouraged to develop a general tendency to reinforce desired behaviors. However, if all human behavior is a function of its consequences, what would be the effect of efforts to massively increase the level of positive reinforcement for behavior in defined social systems such as schools, neighborhoods, work organizations, and nursing homes? If key members of these systems were educated in the general principles of reinforcement and were encouraged (richly reinforced) to find ways to reinforce others' behavior, is it likely that we would see an increase in the incidence of diverse socially cooperative and productive behaviors?

Examples of such approaches exist. Recent developments in school-wide behavior management involve efforts to massively increase positive reinforcement for pro-social behavior (e.g., Embry, 1997; Metzler *et al.*, 2001; Taylor-Greene *et al.*, 1997). Initial evidence suggests that such approaches reduce discipline referrals (Metzler *et al.*, 2001; Taylor-Greene *et al.*, 1997), vandalism (Mayer *et al.*, 1983), and aggressive social behavior (Embry, 1997). However, whether such approaches lead to significant long-term reductions in more serious problems will require further research.

Research on Resistance to Rewarding Desired Behavior

If the practice of reinforcing desired behavior is going to be promoted, we need research that identifies

ways to reduce resistance to the use of positive consequences. There remains in our culture a widespread and erroneous notion that providing children with praise and reward is bad for them (Cameron & Pierce, 1994). For example, two of the most widely disseminated parenting programs, Parent Effectiveness Training (Gordon, 1970) and Systematic Training for Effective Parenting (Dinkmeyer & McKay, 1976) tell parents that rewarding behavior will undermine children's intrinsic motivation to engage in behavior. Neither program has been shown to be efficacious by experimental evaluations (Taylor & Biglan, 1998). Similarly, the belief is widespread among educators that praise and reward undermine children's intrinsic motivation; as a result, it is often difficult to get teachers to praise and reward more frequently.

These views and the resistance they engender to the use of praise and reward should themselves become objects of study. We need to better understand how to persuade and otherwise influence teachers and parents to praise and reward desired behavior. More than likely, it will be important to increase reinforcement for praising and rewarding others. For example, some programs such as Positive Action (Flay *et al.*, 2001) encourage both students and staff to reinforce desirable behavior. This may provide reinforcement to teachers for their efforts to reinforce students. In any case, identifying effective methods of persuading people to praise and reward would contribute to more effective school and parenting interventions and perhaps to more effective media campaigns directed at encouraging effective parenting (e.g., Kelder *et al.*, 2000).

THE SELECTION OF CULTURAL PRACTICES

Selection by consequences is also an important principle for understanding the evolution of cultural practices and the practices of formal and informal groups and organizations. The cultural practices of defined populations can be characterized in terms of (a) the incidence or prevalence of individual behaviors in the population and (b) the interlocking patterns of behavior among people that constitute groups and organizations (Biglan, 1995). For example, one might characterize the cultural practices of a community with respect to tobacco use in terms of the prevalence of smokers, the marketing practices of tobacco companies, the efforts of the health care community to reduce tobacco use, the enactment of taxation on cigarettes, and so on (Biglan, 1995; Biglan & Taylor, 2000a).

Thus far in the history of prevention science, we have been interested primarily in affecting the incidence or prevalence of diseases or behaviors of individuals. However, it is increasingly recognized that in order to affect these outcomes, it is necessary to change the practices of the formal and informal organizations influencing them. Examples include reducing the proportion of tobacco outlets selling to minors (e.g., Biglan *et al.*, 1995), decreasing the prevalence of families using coercive discipline practices (e.g., Patterson *et al.*, 1992), and increasing the incidence of parents' receiving validated parenting skills training programs (e.g., Taylor & Biglan, 1998). Other practices are increasing the prevalence of schools using systematic phonics instruction to teach reading (e.g., Gunn & Kameenui, 1996) and implementing higher taxes or higher age requirements for alcohol use (e.g., Holder & Howard, 1992). As a result, there is a growing need to understand the factors that influence the practices of groups, formal organizations, and the interlocking set of groups and organizations that make up social systems (Holder, 1998).

A framework for analyzing the evolution of these practices is provided by recent work in anthropology. The evolution of the practices of human groups can be understood as a function of the interaction between the biological needs of humans, specific environmental conditions in which the group lives, and the group's technologies for wresting subsistence from the environment (Biglan, 1995; Diamond, 1997; Harris, 1979; Ponting, 1991). From the development of agriculture to that of corporate capitalism, the interlocking activities of members of the group or organization are shaped by their consequences. For example, using archeological and cross-cultural comparative data, the shift from hunter-gatherer societies to agriculture has been explained in several ways. These includes being the result of (a) groups outstripping the capacity of the local environment to support hunting and gathering (Harris, 1977); (b) the availability of cereal crops (e.g., wheat), pulse crops (e.g., peas, lentils), and animals useful in food production (Diamond, 1997); and (c) the aversiveness of infanticide and abortion as means of population control (Harris, 1979). Thus, the consequences that contributed to the selection of agricultural practices include increased caloric intake (at least at the outset of the adoption) and a reduction in infanticide and traumatic abortion.

The practice probably spread as a result of two factors: (1) other groups may have adopted agricultural methods because of their observable

benefits; and (2) more importantly, agriculturally based societies expanded in size because of increased food production and their ability to support an army that could wrest control of new lands from their neighbors (Diamond, 1997).

In general, a group or organization will tend to adopt and maintain a practice to the extent it contributes to the material well being of its members. With fundamental consequences such as food, water, and physical health, it is easy to see how groups would use the technology and resources available to achieve subsistence. Even with modern capitalist business organizations, it is easy to see how productive processes are selected by their success in achieving profits (Harris, 1979). For example, Halberstam (1987) describes how quality control procedures articulated in the United States were adopted by Japanese auto companies and were adopted by American firms only when Japanese firms began to increase their market share in the United States.

It is harder, however, to see how practices such as beliefs and rituals could be a function of the material consequences to the group. For this reason, Harris (1977, 1989) has provided numerous examples of beliefs and social practices that do not seem to maximize material well being, but can ultimately be understood in terms of their contribution to subsistence. For example, hunter-gatherer groups' success in killing big game is vital to the band's subsistence. One might expect, therefore, that a successful hunter would be lionized. However, group norms typically oppose making the hunter a hero. The reason seems to be that a set of cultural practices that maximized hunting activities runs the risk of depleting the available game entirely, thereby bringing on starvation. Harris (1985) suggests that what has been selected is a set of social practices, including rituals, beliefs, and norms, that restrain hunting so that the group maintains an environment in which there is sufficient game. Presumably, groups that did not develop such conservationist practices outstripped the carrying capacities of the environments and perished.

In general, one can understand the beliefs and rituals of human groups—including modern organizations—in terms of the contribution that they make to the productive practices that are fundamental to their survival. This is not to say that those practices benefit all members of the group. Slavery, infanticide, cannibalism, male domination, and oppressive working conditions are not in the interest of particular group members. Nevertheless, they will survive as a part of the group or organization's practices if they

contribute to it achieving the material results needed to maintain the organization in its current form.

For readers unfamiliar with this line of reasoning, this brief description of the role of selection of cultural practices by their consequences is probably insufficient to convey the success of the principle in accounting for group and organization practices. However, it is vital that at least some prevention scientists develop expertise in analyzing the factors that shape organization practices. Otherwise, the prevention science field will continue to be characterized by interventions of tremendous potential that are seldom adopted by the organizations that could bring their benefit to human populations. More extensive discussions of the role of consequences in selecting organizational practices can be found in Biglan (1995) and Biglan and Taylor (2000b).

Consistency With Selection at the Behavioral and Biological Levels

The selection of cultural practices by material consequences derives from the selection of behavior by its consequences, which in turn derives from the selection of biological features of organisms. The contingencies of survival have shaped the nutritional needs and reproductive proclivities that humans must satisfy and the disease vulnerabilities with which they must cope if they are to survive. The behavior that they engage in to do so is shaped by reinforcing and punishing consequences whose effects on behavior are a function of the contingencies of survival. That is, the fundamental consequences that shape behavior are those associated with the nutrients needed to survive and the aversive events associated with danger to the organism. The power of other effective consequences such as social attention and approval may derive from their conditioned associations with more fundamental reinforcers such as food, water, sex, and escape from danger (Biglan, 1995). The complex practices of groups and organizations are ultimately selected by their effect on the group or organization's survival. However, the behavior of specific group members that make up these complex practices are shaped and maintained by reinforcing and punishing consequences. Indeed, one set of group practices that are necessary for the group to survive are those involved in socializing its members to engage in the necessary practices. Thus, the practices of groups and organizations can be seen to ultimately derive from the biological propensities of human organisms, which include susceptibility to consequent events.

Implications for Achieving Effective Preventive Practices in Organizations

Despite the substantial success of selectionist accounts in biology, behavior, and the evolution of cultural practices, the value of the selectionist principle for developing effective methods of influencing organization practices has hardly been explored. If preventive interventions are going to be implemented widely and effectively, then prevention science must question how the practices of relevant organizations can be influenced. This requires pinpointing manipulable variables influencing organizations' adoption and maintenance of effective preventive practices. Yet, a straightforward theoretical analysis of how consequences affect organization practices has been lacking, despite many other successes of selectionist analyses.

Consider the organizations whose practice must be affected if reductions in the incidence or prevalence of human behavior problems are to be achieved. They include service-providing organizations such as health and mental health clinics, government-run family welfare and child protective agencies, churches, civic organizations such as Rotary Clubs, and legislative bodies such as city councils and legislatures. (The list is not exhaustive. Indeed, one of the impediments to advancing effective preventive practices is that there is little empirical evidence about which organizations influence particular aspects of human behavior.)

Although we tend to emphasize the public welfare mission of these organizations, they require a steady stream of funding to exist. This then would appear to be the critical consequence for the practices of organizations. Let us examine two types of organizations relevant to the prevention of youth problems and consider how the principle of selection by consequences might apply. Given that families and schools appear to be the two most important influences on child development, we will consider the practices of school organizations themselves and one type of organization that appears to affect family functioning, namely child protective agencies.

Consequences Influencing the Practices of Schools

Judged by both international comparisons and trends over time, American public schools have not been as effective as they could be (Biglan, 1995). One reason is that schools have generally failed to adopt

the instructional practices that the empirical evidence indicates are most effective (Watkins, 1988). Indeed, schools have often shown a perverse fascination with maintaining ineffective and empirically unsupported instructional practices (Hirsch, 1996). Effective analyses of how to influence schools to adopt better effective instructional practices are needed.

One reason that schools have not adopted effective instructional practices is that their funding is not contingent on their use of empirically supported practices or on the academic outcomes for the children they teach (Chubb & Moe, 1990). Public school funding is contingent on a political process whose decision making is dominated by an educational establishment that includes teachers' unions, professional educators, and schools of education. Hirsch (1996) has documented how these groups tend not to be dedicated to the use of empirical evidence or to systems of accountability.

(Space prevents thorough analysis of reasons for this opposition to accountability and effective instructional practices. However, opposition is not irrational. Accountability systems may subject some educators to aversive consequences if the methods they use or advocate are found ineffective. Moreover, the most effective instructional practices are very labor intensive and, absent considerable training and practice, can prompt behavioral problems among students.)

Chubb and Moe (1990) describe how school governance became walled off from outside influences through the bureaucratization of existing practices. School system insularity can itself be seen as a matter of selection by consequences. By putting decisions about instruction in the hands of educators, schools decrease the risk that outsiders could deliver aversive consequences such as reductions in funding or requiring unwanted instructional practices to be used.

A variety of schemes have been proposed for bringing the consequences to bear on educational productivity (Walberg, 1984). Friedman and Friedman (1990) proposed a voucher system in which parents would receive a fixed amount of money per child that could be spent on any school they chose. Some states are adopting a modified version of this approach. According to the U.S. Charter Schools (n.d.), 34 states have implemented charter schools arrangements. These schools aim to increase the quality of education by giving choices within the public school system to both parents and students. Typically, the state or local school district grants a charter to a school. The school has considerable autonomy in defining its curriculum and methods, in exchange for which it must

demonstrate its impact on students. Charters are typically granted for 3–5 years. In addition, many school districts have created magnet schools that have unique emphases such as intensive instruction in a foreign language; parents throughout the district may choose to send their children to that school. At the same time, there has been a movement to more carefully and frequently assess educational progress and make schools' aggregate performance publicly available.

All of these arrangements are designed to create contingencies between school practices and consequences. In the voucher and charter systems, funds will accrue to a given school to the extent that parents prefer their practices and/or outcomes. The same is true for the magnet arts schools, although the extent to which their practices can vary from a district standard is more constrained. Making schools' academic performance data public presumably exposes teachers and administrators to social consequences, including praise and recognition when results are favorable and complaints or disapproval when they are not. The arrangement may even make the termination of employment more likely in cases of particularly poor performance.

To date there is limited evidence on the effect of these arrangements on educational productivity. Moe (2001) reviewed available evidence, mostly from a set of recent studies in which private organizations set up voucher systems and made them available to poor families. Seemingly, parents are more satisfied with schools they choose. However, evidence on the effects of voucher systems on student success remains limited. Moe concludes, "at this stage the weight of the research—including the most recent work, based on the best data and methods—leads to the tentative conclusion that voucher students do indeed learn more" (Moe, 2001).

Recent federal education legislation is moving to support contingencies to promote practices. The *Safe and Drug Free Schools* legislation makes funding to states and local schools contingent on their use of science-based programs (U.S. Department of Education Safe and Drug-Free Schools Program, n.d.).

The Selection of Practices of Child Protective Agencies

Child protective agencies typically are government agencies whose mission is to identify specific instances of child abuse and prevent further abuse. Like the criminal justice system (Biglan & Taylor, 2000b),

these agencies usually lack a public health perspective in which the ultimate goal is reducing the incidence of child abuse in the entire population. Indeed, the adoption of such a goal might be the first practice that we attempt to increase among child protective agencies (Biglan & Metzler, 1998). That is, in seeking to improve the public benefit of child-welfare agencies, a first step might be to prompt them to adopt an explicit goal of lowering the incidence of child abuse—not simply preventing additional abuse in identified abusing families. Formally adopting such a goal would create a context for the adoption of other practices that are likely to achieve that goal.

Other practices that child protective agencies engage in to stop child abuse include removal of the child and interventions with the family designed to make abuse less likely. There has been relatively little experimental research on whether removal is an effective strategy. There has also been little research on the family interventions that might reduce the likelihood of further abuse. Despite the fact that experimental evaluations of parenting and family interventions have shown that they can reduce parents' coercive discipline including spanking (e.g., Webster-Stratton & Herbert, 1994a,b), I could not find a single experimental evaluation of these interventions that was conducted with abusive parents. Nonetheless, let us assume for the moment, that experimentally validated parenting interventions are a practice that should be adopted by all child protective agencies.

The straightforward implication of a selectionist analysis of organizational practices is that child protective agencies will adopt and maintain a practice to the extent that their funding is contingent on doing so. If we want them to systematically assess the incidence of child abuse in their state or community, funding will need to be made available for this practice and at least some of their funding will need to be in jeopardy if they fail to do so. If we want them to provide and assess the value of empirically based parenting skills interventions for abusing parents, we will have to arrange the contingencies so that funds continue to be available only if they begin to adopt these programs and set up procedures to assess their value.

The General Value of the Selectionist Principle for Achieving Effective Dissemination

Although the preceding deals with only two aspects of dissemination, I would argue that the

program of research on the influence of financial consequences on the practices of organizations is essential for achieving widespread, effective adoption of effective preventive practices. In a sense, this assertion may seem both mundane and obvious. Of course, schools and child protective agencies will implement empirically based practices if their funding sources require it. However, such arrangements are seldom discussed in the literature on dissemination. Rather, the focus is on identifying champions for the practice to be adopted, packaging the advocated practices in a way that it can be tried on an experimental basis, and making the innovation one that is easily adopted (Rogers, 1995). Such steps may facilitate an organization adopting a targeted practice. Yet, there is little evidence from experimental studies showing that these steps reliably influence organizations to adopt targeted practices and one can question how effective they will be in the absence of financial arrangements that require the adoption of new practices.

As noted, it is customary in dissemination literature to emphasize that, for adoption to proceed, people in the organization must have attitudes favorable to the proffered practice. Presumably, agencies employing those with strong commitments to the use of empirically based practices and evaluation of outcomes will be more willing to adopt these practices. Yet, over time, organizations may have people who value these practices because the economic growth and survival of their organization depend on such practices. Rather than waiting for organizations to hire people favorable to science-based prevention practices, perhaps we should demand that the funding of public agencies be contingent on their use of the best available scientific practices—including the ongoing evaluation of the effects of their programs and policies.

The strategy of making funding contingent on the adoption of targeted practices of course has its difficulties. Rather than relying solely on persuasion to foster the adoption of empirically based practices, we alter the contingencies for organizations' practices. The difficulty is that such a strategy assumes we can gain control of the funding decisions. This may seem to be a bigger challenge than persuading the organization members to adopt the targeted practice. Certainly, it is a major challenge. However, it may be that the legislatures and regulatory agencies can be more readily persuaded about the importance of empirically based practices than can the providers. Even if it proves difficult to influence such decision makers, the payoff for doing so may be much greater than for influ-

encing a similar number of organization members. For example, convincing the 30 members of a child protective agency to implement empirically based parenting skills training may lead to one agency adopting these practices. Convincing a similar number of legislators to do the same may lead to change in the practices of all child protective agencies in a state.

THE VALUE OF A SELECTIONIST FRAMEWORK FOR PROGRESS IN PREVENTION SCIENCE

The principle of selection by consequences has broad scope. It accounts for the evolution of species, the shaping and maintenance of behavior, and the evolution of cultural practices—including the practices of organizations. Arrangements of consequent events are a key feature of most preventive and treatment interventions, but the importance of the principle has been obscured due to a history of controversy. As a result, we are not making as effective use of consequent events as we might in efforts to promote positive youth development and prevent problem behavior. This paper has illustrated the likely value of such analyses in a few areas—countering deviant peer influences, preventing drug abuse, increasing desirable behavior generally, and improving the life of the elderly, but a systematic and thoroughgoing analysis is needed in every area of prevention. Research is also needed on how we might overcome resistance to use of reinforcement.

The exploitation of the selectionist principle will also be of great value for understanding how to affect the practices of organizations. This is a central problem for prevention science because the adoption and maintenance of effective preventive practices require influencing the practices of organizations and there has been little theoretical or empirical attention to the problem. It is argued here that the material consequences to organizations are a fundamental feature shaping their adoption and maintenance of practices. Theoretical and empirical analysis of the role of these contingencies would enable effective widespread dissemination of effective preventive practices.

At a theoretical level, selection by consequences provides a crosscutting principle that identifies a similar influence on diverse behaviors and actions of groups and organizations. At the practical level, it can prompt investigators, policy makers, and practitioners to look for the effects of consequences where we have not done so previously or have not done so as thoroughly as we might. Ultimately, the thoroughgoing

pursuit of this principle could lead to a society that much more systematically and generously reinforces desirable behavior and more effectively consequences the desired practices of groups and organizations.

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