

Toward a Technology of Generalization: The Identification of Natural Contingencies of Reinforcement

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Applied behavior analysts have directed a growing effort towards the development of a technology for behavioral generalization and maintenance over the past decade. Among the list of potential generalization promoters thought to exist is the natural contingency of social reinforcement (i.e., a behavioral trap) for new behavior in its untrained form or setting, or over time. Although past researchers have noted a need to program for the generalization and maintenance of behavior change, the current understanding of behavioral traps precludes the use of these contingencies to support behavioral changes when interventions are not in operation. This article describes five forms of evidence useful for the identification and analysis of natural contingencies of reinforcement. Examples from the applied research literature are provided to illustrate the kinds of studies that would greatly enhance our knowledge of behavioral traps and improve our ability to understand and program the generalization of trained behaviors across diverse forms and settings, and over time.

Applied behavior analysis has concerned itself with a technology for behavior change—a set of techniques already demonstrated as workable and awaiting application outside the realm of science (Baer, Wolf, & Risley, 1968). Within this technology exists one group of procedures, not fully developed, referred to as the promoters of generalization. When fully developed, these procedures will ensure that deliberate behavior changes occur within a number of diverse settings, will generalize to other forms of behavior, and will be maintained after the initial change agent and procedures have been removed. Although a variety of maintenance and generalization procedures seem promising at this time (i.e., Stokes & Baer, 1977), an effective technology has yet to fully emerge (e.g., Agras & Berkowitz, 1980; Cochrane & Sobol, 1976; Keely, Shemberg, & Corbonell, 1976). Indeed, the field of behavior analysis has often been crit-

icized for the lack of persistent and durable behavior changes (e.g., Atthowe, 1973; Borkovec & Bauer, 1982; Repucci & Saunders, 1974).

One approach to this problem of generalization was stated early on by Baer and Wolf (1970): "for some problems there exists already an effective community of fellow behavior modifiers, their programs well practiced, effective, and running, waiting only for an introduction to the subject" (p. 320). The authors suggested that the social contingencies provided by a group of preschool children (i.e., prompts, smiles, approval, etc.) could occasion and reinforce various peer behaviors. Perhaps most intriguing is their assertion that although a small number of responses might be necessary to enter a behavioral trap, general behavioral changes across responses, settings, and time are ensured once the trap is entered. For example, Baer and Wolf (1970) describe numerous cases where a preschool teacher shaped a single response and peers may have provided the social stimuli necessary to maintain these and other responses in the absence of experimental contingencies.

Other early researchers also recognized the importance of reinforcement contingencies operating within the natural environment. For example, Patterson, Jones, Whittier, and Wright (1965) noted the need to reprogram children's peer

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groups so that their adaptive behaviors would be trapped and maintained by these natural agents. Furthermore, the authors recommended that researchers examine the impact that various child behaviors produce upon a peer group and train only those behaviors that reliably produce positive peer reactions. Similarly, Ayllon and Azrin (1968) suggested that intervention agents train only those target responses that would be maintained after the intervention was terminated.

Collectively, Baer and Wolf (1970), Patterson et al. (1965), and Ayllon and Azrin (1968) all recognized that an analysis of behavioral traps was essential to program the generalization and maintenance of treatment gains. Two primary directions for future analyses were recommended: (a) to identify existing behavioral traps operating within natural settings, as well as the entry responses for these traps, and (b) to develop a technology to reprogram the existing traps that either support problematic behaviors or fail to maintain the behaviors that society considers important.

Fifteen years later, however, an adequate analysis of behavior traps remains lacking. For example, Paine, Hops, Walker, Greenwood, Fleischman, and Guild (1982) stated that "while entrapment has been used to explain maintenance, no systematic effort has been made to replicate the entrapment effect, to expand its applicability to other treatment populations, target behaviors, or intervention procedures; or to determine in more detail how, why, or under what conditions the effects can be obtained" (p. 174). Similarly, Greenwood and Hops (1981) indicated that the processes through which children's social behaviors are "caught" and maintained by peers have not been adequately analyzed. Kazdin (1980) argued that although the procedures for increasing target behaviors are well developed in applied behavior analysis, a similar technology for promoting maintenance through peer reinforcement is not yet available. Kazdin and Geesey (1977) recommended that future researchers examine the ways in which children reinforce and punish the behav-

iors of their peers. Strain and Fox (1981) and Strain, Kerr, and Ragland (1981) suggested that researchers could obtain superior maintenance effects by altering the social ecologies and friendship networks within classroom settings. Together, these recent conclusions sound similar to the earlier proposals of Baer and Wolf (1970), Patterson et al. (1965), and Ayllon and Azrin (1968). Thus, a complete understanding of behavioral traps continues to elude behavior analysts. It is our view that this problem is due in part to the paucity of studies that have identified and analyzed the reinforcement contingencies operating within the natural environment.

The objective of this paper is to present five types of evidence that permit the identification and analysis of behavioral traps in natural settings. Numerous studies will be described to illustrate each form of evidence, but a comprehensive review of the behavior analysis literature is not the objective of this paper. Although some researchers have distinguished between several types of natural reinforcement contingencies (cf. Baer, Rowbury, & Goetz, 1975), this paper will focus on natural contingencies of peer reinforcement. However, the research paradigms described here also apply to the analysis of social contingencies provided by other agents (e.g., parents, spouses, teachers, etc.) or to behavioral traps made up of nonsocial stimuli. In this context, the phrase "natural contingency of reinforcement" or "behavioral trap" will refer to any social stimuli that occasion, reinforce, and/or punish a behavior. We use the term "natural" to describe the status of peer stimuli. It is our view that "natural stimuli" are those that fall outside the set of experimental variables used to produce the initial behavior change and that are under the control of the peer group. In this sense, natural stimuli take control of a response through social processes largely outside of the control of the experimenter. Natural, from this point of view, refers to the agent who has control of the stimuli in question and not to the operation of these stimuli in other settings.

FORMS OF EVIDENCE FOR THE IDENTIFICATION OF BEHAVIOR TRAPS

Based upon a review of the behavior analysis literature since 1964, the following five forms of evidence are regarded as useful to analyze and confirm the features of a behavior trap.

Form 1: A Demonstration of Generalization

A first type of evidence is the demonstration of generalization across behaviors or settings. Generalization, as discussed by Stokes and Baer (1977), refers to the occurrence of a relevant behavior change without scheduling of the original training conditions. The term "generalization" is used in that same context throughout this manuscript; it refers only to the occurrence of a behavior change across any number of untrained forms or settings and is not meant to imply the presence or absence of natural reinforcement contingencies for that behavior.

Many studies have offered the entrapment hypothesis as an explanation when generalized behavior changes occur. For example, Buell, Stoddard, Harris, and Baer (1968) shaped a child's use of outdoor play equipment and found that her untrained social interactions with peers also increased. Patterson et al. (1965) increased a child's attending behavior within a special classroom for handicapped children. After obtaining generalization across settings, the authors speculated that peer reinforcement influenced the child's behavior. Allen, Hart, Buell, Harris, and Wolf (1964) reinforced a girl's standing within three feet of another child, and within six days this child was consistently interacting with her peers. Norquist and Bradley (1973) increased a child's verbalizations to peers by modifying only her cooperative (parallel) interaction with other children. Finally, Johnson, Goetz, Baer, and Green (1981) increased a child's rate of cooperative play within a classroom setting through the use of an experimental "game" in a training setting.

By achieving a type of generalization, each of these studies met the first criterion for demonstrating the existence of a behavioral trap. The peer entrapment hypothesis is plausible in each case above, as the necessary contingencies *may* lie within the novel setting or operate on the novel behavior. Additional evidence, however, must be pursued to further investigate the operation of a natural contingency of peer reinforcement.

Form 2: Maintenance of Behavior Over Time

The second form of evidence for a natural contingency of reinforcement is behavioral maintenance after the original training stimuli have been removed from all other settings and behaviors. Unfortunately, the optimal length for this maintenance period cannot be specified, since the criterion for a "sufficient duration" will probably vary across individual researchers and experimental studies. Some investigators may conduct follow-up probes immediately after treatment (i.e., one to two months), while others may assess maintenance six months to a year after cessation of intervention. Because the case for a behavioral trap grows stronger over time, however, demonstrations of long-term maintenance are more convincing than shorter demonstrations.

To date, only a handful of studies have reported long-term maintenance data. In one study, Hall and Broden (1967) used adult attention to modify the social behavior of a child, and found that these improvements were still obvious six months later. Similarly, Harris, Johnston, Kelley, and Wolf (1964) reported that the behavioral changes obtained with a preschool child were maintained a full year after intervention.

Such reports of long-term follow-up results are rare. In a review of 146 studies within the *Journal of Applied Behavior Analysis, Behavior Therapy, and Behaviour Research and Therapy* for reports of follow-up data collected six months or longer after treatment, Keely et al. (1976) found that only 11% of the studies met

the six month criterion for "long term maintenance." Moreover, only 53% of these studies provided data based upon systematic and objective observations. Similarly, Kauffman, Nussen, and McGee (1977) found that only 28% of pre-1974 studies conducted within educational settings reported follow-up data. Although this percentage has probably increased during recent years, a small percentage of studies clearly report behavioral changes that persist longer than one year after the termination of intervention. The paucity of information does not necessarily indicate that target behaviors are rarely trapped, but more likely suggests that researchers are not assessing the long-term maintenance of their treatment effects.

As indicated above, generalization and maintenance have both been used to speculate on the existence of a behavioral trap. Although most studies provide only one form of evidence, some researchers have demonstrated both generalization and maintenance within a single study. For example, Cooke and Apolloni (1976) taught handicapped children to direct four prosocial behaviors to their peers during freeplay activities. Several children demonstrated generalization of at least one untrained behavior after smiling was taught (Form 1 evidence). Furthermore, three trained behaviors were maintained during four weeks of follow-up observations for all subjects (Form 2 evidence). This integration of behavioral generalization and maintenance within a single study provides further support for the operation of a peer reinforcement contingency.

Two forms of nonexperimental evidence have been described thus far: the generalization of behavior change and the maintenance of this change after the removal of training stimuli from all other settings and behaviors. Although neither form proves the existence of a natural contingency of reinforcement, they establish the necessary "baseline" conditions by which natural reinforcement variables may be identified. The first type of evidence—generalization—permits speculation that natural reinforcement

contingencies are operating. Since Stokes and Baer (1977) list eight alternative promoters of generalization, however, one cannot be certain whether generalized changes are being maintained by (a) a natural contingency of peer reinforcement or by a training technique that (b) programs common stimuli, (c) trains loosely, or (d) trains a sufficient number of exemplars. The second form of evidence—maintenance—attempts to answer that question by providing a sufficient amount of follow-up data, which does strengthen the case for a behavioral trap (cf. Hops, Walker, & Greenwood, 1979). An increased level of plausibility, however, does not necessarily blossom into a proof and a third form of evidence must be sought.

Form 3: Temporal Covariation Between a Behavior and Peer Stimuli

This form of evidence seeks to identify and describe the social stimuli that are presumed to exist after the demonstration of behavioral generalization and maintenance. More specifically, data must demonstrate that natural social stimuli, delivered by peer agents, consistently precede and/or follow behavior in a typical maintenance fashion. To the extent that social stimuli are observed to operate in this manner, they may be presumed to function as the discriminative stimuli, reinforcers, and/or punishers for the behavior of interest.

Some researchers have used naturalistic observations to analyze potential behavioral traps. For example, Tremblay, Strain, Hendrickson, and Shores (1981) conducted observations in a normal preschool classroom to assess the effects of 14 child social initiations upon their peers. Children responded differentially to the various types of initiations—responding positively to some, negatively to others, and ignoring the remainder. Similarly, Buehler, Patterson, and Furniss (1966) examined the social interactions of delinquent girls within an institutional setting. They found that the girls consistently provided a variety of putative reinforcing stimuli contingent upon

the deviant behaviors of their peers and delivered aversive stimuli contingent on compliance to institutional rules.

Other studies have combined two or more forms of evidence to seek a natural contingency of peer reinforcement. For example, after training two classes of pro-social behavior to elementary-aged girls, Kohler and Fowler (1985) discovered a positive relationship between their reciprocity from peers (Form 3 evidence) and maintenance over time (Form 2 evidence). Target behaviors that were consistently reciprocated by untrained peers were subsequently maintained for six to eight week baseline periods. Conversely, those responses not reciprocated by peers decreased to lower levels after training. These results suggest that children's delivery of certain social behaviors (i.e., share offers) could function to occasion and/or reinforce the share offers of their peers. By combining a demonstration of maintenance with the existence of reciprocal peer share offers, Kohler and Fowler (1985) integrated two forms of evidence for behavioral traps within a single investigation.

All of the above studies found positive relationships between the frequency of some target behavior and the social stimuli that consistently preceded and/or followed that behavior. This form of evidence provides additional empirical support for the hypothesis that peer social stimuli serve as a natural contingency of reinforcement for the behavior in question. Unlike its predecessors then, this third type of evidence identifies existing social stimuli that could be maintaining a behavior in its natural environment.

Form 4: Functional Analysis of Peer Social Stimuli

The fourth type of evidence requires a functional analysis of the peer stimuli (e.g., prompts, attention, approval, etc.) previously revealed by the third form of evidence. In this case, using reversal designs, one must turn off the presumed natural communities reinforcement, or make them contingent on alternative

child behaviors, and observe the subsequent frequency of the original response in question. If the behavior decreases to lower levels, the peer stimuli may again be made contingent upon the target behavior in a typical ABAB design fashion. This fourth form of evidence is indeed conclusive, for if the behavior reverses in the predicted directions with the removal and later re-application of the stimuli provided by a natural community, then its operation as a behavioral trap has finally been demonstrated.

Numerous studies have conducted functional analyses to examine the effect of peer social behaviors. For example, after finding that five children exhibited high rates of disruption in a sixth grade classroom, Solomon and Wahler (1973) trained five peers to ignore these problematic responses and attend instead to more appropriate classroom behaviors. An ABAB design demonstrated the effectiveness of this strategy: The disruptive behaviors changed in the predicted directions with the removal and later re-application of peer attention. Similarly, after increasing the smiling behavior of a retarded child, Hopkins (1968) found that this response failed to decrease despite the removal of experimental contingencies (Form 2 evidence). Suspecting a natural community of reinforcement for the newly trained behavior, Hopkins (1968) then had the subject wear a sign instructing those in the immediate environment (e.g., institutional staff) to interact with the subject contingent upon a variety of non-smiling behaviors (Form 4 evidence). After this strategy reduced the boy's smiling, the sign was changed to make social interactions contingent upon smiling. Results indicated that smiling, which had been initially increased with candy reinforcement, could be altered only by "turning on" and "turning off" a natural community of social reinforcement. Finally, Van Houten and Van Houten (1977) observed that several special education students provided evaluative comments regarding the reading performance of their classmates (Form 3 evidence). By teaching these children to provide and withhold these

statements systematically, the investigators demonstrated that the reading of several students was under the control of peer comments (Form 4 evidence).

Each of these studies demonstrated a functional relationship between a specific behavior of interest and the social reinforcers that natural agents made contingent upon that response. Furthermore, Hopkins (1968) and Van Houten and Van Houten (1977) integrated two different forms of evidence into a single study. Although we consider the functional analysis of peer social stimuli to be the most convincing form of evidence available for the *identification* of natural communities of social reinforcement contingencies, a fifth and final form of evidence is important to the generality of this finding.

Form 5: Systematic Replication

The fourth form of evidence indicated that certain peer delivered social stimuli function as discriminative stimuli and/or reinforcers for *one* subject behavior within *one* particular setting. The fifth and final form of evidence for behavioral traps requires the application of these same peer stimuli contingent on a variety of other child behaviors within other settings. Although this form of evidence does not reveal the existence of a natural reinforcement contingency, there are several important reasons for its demonstration. First, recall that the fourth type of evidence required the deliberate testing of certain peer stimuli—these were removed and later readministered while the original response of interest was monitored. Although this demonstration is convincing when it succeeds, one must be cautious about interpreting any failure to show causal effects. For example, perhaps the behavior of interest has a variety of existing reinforcers. If so, then its maintenance after the removal of one such stimulus (e.g., peer prompts) does not necessarily prove that these stimuli are non-functional. Instead, it could mean that more than one discriminative stimulus or reinforcer exists for that particular response. In this event, the final form of evidence assesses the function of peer social stimuli on alternative subject behaviors—perhaps those less likely to have

a history with peer reinforcement. If this strategy demonstrates control of the subject's behavior, then the researcher has discovered social stimuli that could occasion and reinforce children's target behaviors in natural settings.

This evidence also may hasten the development of effective behavior change procedures. In recent years, children have frequently served as primary behavior change agents for their peers (e.g., Strain, 1981). For example, elementary-aged children have successfully provided social initiations (Strain, 1977), corrective feedback (Delquadri, Greenwood, Stretton, & Hall, 1983; Greenwood, Sloane, & Baskin, 1974), approval (Axelrod, Hall, & Maxwell, 1972; Jones & Kazdin, 1975), and attention (i.e., Lovitt, Lovitt, Eaton, & Kirkwood, 1973; Solomon & Wahler, 1973) to alter the behaviors of their classmates. Peer social stimuli that exist in the natural environment (Form 3 evidence), and function as discriminative stimuli and reinforcers for children's behaviors (Form 4 evidence) may subsequently be programmed into future behavior-change interventions (Form 5 evidence). While implementing a class-wide peer tutoring procedure, Kohler, Greenwood, and Baer (1985) discovered that several children used the untrained behaviors of assistance, praise, and prompts while tutoring their peers (Form 3 evidence). By teaching these children to provide and withhold these behaviors systematically, these investigators found that the behaviors controlled higher rates of tutee responding and greater mastery of the spelling words (Form 4 evidence). Given these results, the remainder of the class was taught to use assistance, praise, and prompts during their daily tutoring sessions (Form 5 evidence). Studies integrating the third and fourth types of evidence with the fifth may well enhance the effectiveness and generalization/maintenance outcomes of peer-mediated procedures.

DISCUSSION AND CONCLUSION

This paper has reviewed studies that relate to the peer entrapment hypothesis and discussed five types of evidence that

are useful to identify and analyze natural contingencies of peer reinforcement. The argument was made that a complete understanding of behavior traps is lacking in applied behavior analysis because few researchers have integrated various kinds of evidence into single studies, or sets of interrelated studies using similar measures and designs. Thus, the investigation of traps has been and remains incomplete.

The forms of evidence described in this paper are: (a) the generalization of behavior across untrained settings or responses; (b) the maintenance of behavior change over time; (c) temporal covariations between a behavior and peer stimuli; (d) a functional analysis of the peer social stimuli; and (e) systematic replication of the peers' stimuli function with other behaviors and settings.

These forms of evidence, particularly within the context of a single study, provide a powerful paradigm for identifying and analyzing behavioral traps. It is well past the time when researchers can speculate that a natural community of social reinforcement is responsible for the generalization or maintenance of behavioral change; rather, nonexperimental procedures (Forms 1, 2, and 3 evidence) and experimental procedures (Forms 4 and 5 evidence) must be combined to demonstrate the existence and function of these "natural" social discriminative stimuli, reinforcers, and punishers. Research that combines the first four forms of evidence with the fifth may also hasten the development of technology for reprogramming behavior traps that either support problematic behaviors or maintain the behaviors that society considers important.

Finally, the forms of evidence listed in this paper are not limited to the analysis of peer social contingencies, but apply to the identification and analysis of any contingencies operating in the natural environment. Studies using these forms of evidence to investigate natural variables may result in a technology for promoting the generalization and maintenance of behavior change.

In conclusion, this paper has described and illustrated five forms of evidence

useful to demonstrate the existence and function of behavioral traps. Although the list provided here is not presumed to be exhaustive, it is proposed that researchers seeking these forms of evidence will contribute to the understanding of natural reinforcement contingencies. This greater level of understanding may subsequently improve our ability to promote generalized behavior change across responses, settings, and time.

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