DOCUMENT RESUME

ED 088 700 SE 017 358

AUTHOR Baltes, Margaret M.
TITLE Operant Principles Applied to the Acquisition and Generalization of Nonlittering Behavior in Children.
PUB DATE 73
NOTE 69p.; Ph.D. Dissertation, West Virginia University

EDRS PRICE MF-$0.75 HC-$3.15
DESCRIPTORS *Behavior Change; Behavior Standards; Doctoral Theses; *Early Childhood Education; Educational Research; *Environmental Education; Operant Conditioning; *Pollution; *Social Influences; Wastes
IDENTIFIERS Littering; Research Reports; Solid Wastes

ABSTRACT

The investigator felt that littering is a behavior contingent upon certain environmental conditions and that these conditions should be examined systematically. Specifically, this study sought to examine the effects of a behavior modification approach to littering with eight four-year-old subjects. Using token positive reinforcement, token punishment, rule reinforcement, and rule punishment as the experimental conditions, token positive reinforcement was most effective in gaining control over nonlittering behavior in terms of acquisition, maintenance, and generalization. (Author/LS)

OPERANT PRINCIPLES APPLIED TO THE ACQUISITION AND GENERALIZATION OF NONLITTERING BEHAVIOR IN CHILDREN

DISSERTATION

Submitted to the Graduate School
of
West Virginia University
In Partial Fulfillment Of The Requirements
For The Degree Of Doctor Of Philosophy

by

Margret M. Baltes, M.A.

Morgantown
West Virginia
1973

Acknowledgements

In the conceptual framework of operant psychology a response, be it a bar-press or a dissertation, is always influenced by environmental contingencies, physical as well as social ones. It is impossible for me to identify or monitor all contingencies, -- in particular the persons, whose ideas have directly or indirectly acted upon me --, involved in the shaping process of this dissertation.

I wish to express my thanks to the members of my committee: Dr. Charles D. Corman, Dr. Gabriel A. Nardi, Dr. Hayne W. Reese, and Dr. James N. Shafer, and particularly to Dr. John D. Cone, my adviser, who provided a highly supportive and competent guidance throughout the dissertation project.

Miss Jo Ann Koch, Mr. Martin Ford, Mr. Henry Sosinski, and Mr. William Spangler were most valuable testers during the data collection, which was made possible by Dr. Don L. Peters and Mrs. Katherine Stooksbury and Dr. Sherry Willis. I appreciate their help and cooperation.

In particular, I feel indebted to the teachers in the preschool program, who, despite the long-range intrusion, never ceased to lend their support.

Finally, I wish to thank my husband, Paul, not only for his intellectual but also for his emotional support during the strenuous phases so characteristic of most dissertation endeavors.

Table Of Contents

List Of Tables

List Of Figures

Introduction

Until recently most Americans have been largely unconcerned about the ecological destiny of their nation. It was not before the late 1960s that the environmental crisis catapulted ecology to public prominence. By now, ecology has become a household word which for some people seems to carry ideological or even religious connotations. This development, however, has created a time lag between the public prominence of the term ecology and its status as a scientific concept. Particularly in the behavioral sciences one has barely started to delineate its meaning and to explore the potential usefulness of behavioral principles for a description, explanation, and prediction of ecology-related behaviors (e.g., Studer, 1970a, 1970b, 1971; Wohlwill & Carson, 1972).

The first root (oikos = house) of the compound term ecology suggests a concern with the earth as the home of all living things. In many ways, then, the term ecology seems to represent a resurrection of the concept of "environment" and it is this pretheoretical status that leads to the accumulation of many diverse meanings and usages. It should suffice here to note that the discrepancy in meanings and the diversity of "ecological" variables (see Cartwright, 1969) seems indeed largely due to the fact that the sciences dealing with ecology as a subspecialty are numerous and that these subspecialties have not yet crystalized from both a conceptual and methodological viewpoint. Thus, in human ecology we may find specialists in anthro-

pology, biology, geography, sociology, psychology, etc.

Within psychology Lewin (1944) was one of the first to use the term psychological ecology. He employed the term ecology when referring to influences of nonpsychological facts (environmental conditions, such as climate, landscape, food) upon psychological determinants and correlates (e.g., emotions, attitudes, motivation) of behavior. This type of one-sided influence of the environment upon organisms expressed by the term ecology is probably the most common connotation used within psychology. Such a one-sided perspective of environmentally oriented researchers has many drawbacks and overlooks the mutual relationships involved in the environment-man interchanges, particularly those of the man-environment type. This emphasis upon the dynamic interdependence of organism-environment interactions had been stated already by J. Muir in 1892 (Mitchell & Stalling, 1970): "When we try to pick out anything by itself we find it hitched to everything else in the universe." A similar view seems not only to be the focus of one subcategory of current ecological research dealing with the "ecosystem" (Borgatta, 1969), but also intrinsic to an operant view of ecology-related behavior to be described in a later section.

The term ecosystem then centers around the dynamic qualities that characterize the interdependence and interaction of the entire biosphere. The biosphere itself is seen as consisting of consumers and producers (Mitchell & Stalling, 1970). Most living things at some point in time in their existence are both consumer and producer and this largely in a decompositing or recycling manner.

Man, though he acts as a highly efficient producer and consumer, has had a devastating effect on the ecosystem, since he contributes little to the process of decomposition. On the one hand, the concentration of his natural waste cannot cycle fast enough through the ecosystem, thus leading to exploitation of his environment. On the other hand, the accumulation of his synthetic wastes quite often even resists the recycling process or, worse, produces negative by-products endangering the environment.

Attempts at controlling man-produced waste can proceed on many levels. Thus far, it seems fair to argue that the focus has been on sociological or institutional intervention by introduction of educational and legislative action programs. The theme of the present work, however, is to concentrate on an individual-based level of analysis. First, it is argued that individuals indeed do contribute a major share to environmental pollution in the form of littering and other behaviors. Second, it is maintained that such waste-producing behavior can be studied by the application of an operant learning model, thereby emphasizing the dynamic interplay between organisms and environment. Finally, it is hoped that by studying littering behavior, which lends itself to a more manipulative and controllable analysis, we might learn some things about the dynamics, and "behavioral contingencies," that potentially monitor environmental pollution at the macro-ecology level.

Littering Behavior: Why Use a Behavioral Approach?

The most common class of activities associated with waste production in individuals seems to be littering. In other words, littering behavior contributes to environmental pollution, since it involves the production of material that, within the existing ecosystem, is potentially not consumed or recycled. From a psychological viewpoint, one may argue that littering behavior represents an instrumental act, which is acquired, maintained, and extinguished in correlation with environmental contingencies (positive and negative reinforcements, punishment).

What are some of the issues in defining littering behavior? In a discussion of the term "environmental pollution" Quigley (1970) spoke of degrees of pollution acts ranging over a continuum from least to most objectionable. This continuum is supposed to reflect both a historical and an ontogenetical development of pollution behaviors. Littering behavior in this context would be located near one extreme, in general not being injurious but merely violating the amenities and aesthetic qualities of life.

This approach at defining littering behavior suggests that characterization of littering behavior implies the application of an external value system which is dependent upon the situational context and the person involved. An empty can of beer on the dining table is not immediately objectionable, but alongside the highway it is undesirable to many people. An adult throwing a piece of paper in a river would usually be considered a

litterer, but a playing child potentially ascribing boat properties to the piece of paper would not necessarily be called a litterer. Thus, the usual "social" definition of littering is not intrinsic to the act but, at least to a certain degree, is based on social norms and values. The fact that similar behaviors are variably characterized as littering or nonlittering behavior (dependent upon the situation, location, social class, culture, etc.) is an important feature of the topic and, though little desirable from an experimental view, needs to be reckoned with.

Heberlein (1971) approached the phenomenon of littering from a similar angle. In stating three criteria for the delineation of littering behavior, however, he hoped to reduce definitional vagueness: (a) the actor has to rid himself of material; (b) this material has to be of no value to the actor and others; and (c) the location of disposal has to be socially defined as being inappropriate. Note again the implication of rules, norms, standards, and the necessity to define the activity separately for each person, situation, material, etc., involved. Note also the "man-centrism" associated with Heberlein's proposition, since the term "others" does not seem to include all living organisms in the ecosystem.

This type of "social" definition of littering behavior, dwelling on values, norms, rules, etc., has a serious drawback, in addition to being subjective and nonoperational. Such a definition follows the conventional R-R paradigm and is, at best, descriptive and, at worst, simply redundant. Concepts such as values,

attitudes, are shorthand descriptions of behavioral events, not explanations. The attempt to change behavior via values, is only to say that changes in behavior must occur and the question still remains: How can these changes be brought about? Values, attitudes, etc., are intervening constructs inferred from observations of behavior. Since values, can be operationally defined only in terms of behavior, it seems reasonable to choose behavior as the unit of analysis for the problem at hand.

Consequently, it seems fair to conclude that a more direct approach to the analysis of littering behavior is more likely provided by an experimental behavior-oriented approach. Such a view is not only apt to free the investigator from value-ridden issues of definitions, but also to offer a powerful model for the description and modification of the behavior class under consideration here. Like Bijou (1970), who in another context asked the question, "What has psychology [in specific he meant the operant model] to offer education--now?", we might want to ask the question "What has the operant model to offer ecological or environmental psychology now?" particularly where polluting behavior is concerned. The urgency of this question will become even more obvious after a review of the literature on the control of littering behavior, which shows how inefficient existing littering controls appear to be.

Literature Review

The scarce literature on littering behavior can be divided into two research approaches. A first, more traditional one, is aimed at the isolation of subject-related and situational variables associated with littering behavior. This type of research is widely descriptive in nature and based on noninterventive survey approaches or the application of questionnaire-type measurement instruments. A second, only very recent approach follows a process-oriented research paradigm. The very few studies within this framework are aimed at examining situations of littering behavior with a focus on environmental conditions and contingencies which monitor the probability of its occurrence. Since the latter studies are of primary significance for the present work, they will be described and discussed in greater detail.

Subject and Stimulus Variables

Survey data (Heberlein, 1971; Seed, 1968) seem to suggest that there is no litter-prone vs. not litter-prone person. Even though everybody questioned held to the knowledge that littering is bad and that a littering person is slobby, selfish, thoughtless, etc., 50% of the sample population (Seed, 1968) littered sometime during a one-month period. It appears, however, that often the awareness of having littered is lacking (Heberlein, 1971), which suggests that littering behavior might become a habit being performed automatically when cued by certain external stimuli. Furthermore, awareness of negative effects of littering on other people seem to be of

little importance or even overruled by the immediate positive consequences for the litterer himself.

According to Campbell, Hendee, and Clark (1968) and Clark, Hendee, and Campbell (1971) campers show differential rates of littering when rate is plotted against the dimension of time (first day vs. last day of camping), in that there is a large increase in rate with the approach of the date of departure.

Survey research (Seed, 1968) further indicates an interaction of age with littering behavior. The data seem to support an inverted U-shaped function showing the highest frequency of littering behavior for the age range between 21 and 35. This result stands somewhat in contrast to data on environmental awareness. Allen (1972) reported a survey study recording data about awareness and participation in environmental awareness week in Humboldt County (Eureka, California). His findings suggest that high school and college students and old people (over 55 years of age) show a higher degree of awareness when compared to middle-aged persons. Thus, if we assume that awareness would correlate with nonlittering behavior, we would expect according to Allen's data that younger and older persons are less litter-prone. Thus, Seed's and Allen's data would confirm each other at the upper end of the age dimension (old people) but would be in contrast in the young adult age bracket. The higher frequency rate in littering for younger people might be explained, however, by a third confounding variable, namely the higher frequency of possible littering situations. This latter variable (frequency of occurrence of situations

eliciting cues for littering behavior) appears to show up also in data (Heberlein, 1971) suggesting that people involved in outdoor activities (boating, fishing, swimming, etc.) litter more than people who rarely engage in such activities.

Besides the age variable, data (Heberlein, 1971; Seed, 1968) seem to argue for a sex difference, in that men litter twice as much as women. On the one hand, this sex-related difference might be due to sex-related situational parameters (men encounter more litter eliciting situations than women). On the other hand, it seems reasonable to postulate sex-related differences in the social learning history, since women are supposed to be cleaner, thus encountering more situations in which cleaning behavior (non-littering behavior) is reinforced.

Heberlein (1971) reported that people will litter more often when alone than when in groups, which might partially explain findings by Seed (1968) showing that big-city dwellers litter less often than residents of small towns.

Finnie (1972) designed a series of field experiments in an attempt to discover interrelationships between littering rate and both physical variables, such as number of trash receptacles, environmental appearance, and organismic variables, such as race, social class, age. He reported positive correlations between number of receptacles and littering rate and between dirty environment and littering rate. In addition littering rate correlated positively with subject-related variables such as black people, blue collar workers and adolescents. Due to the correlational nature of the studies the above relationships

are not to be mistaken as causal relationships. It is highly plausible for instance, that the dirty environment is the only salient variable and that the concomitant organismic variables represent nothing more but a sampling artifact because of the location of the dirty environment. That is to say that white, middle class young people put in a dirty environment might show an equally high littering rate.

Although research on the effect of public litter controls is not convincing by standards of rigorous designs, there appears to be meager evidence to suggest that number of signs, written messages, advertisements, trash receptacles, etc., have a significant effect on littering vs. nonlittering behavior (Heberlein, 1971; Keep America Beautiful, 1969, 1971). Effectiveness of these environmental cues (S^Ds) appears not to be inherent in their existence or nonexistence but rather to be dependent on other coexisting variables (e.g., possible reinforcing or punishing consequences; see Burgess, Clark, and Hendee, 1971).

In summary, these data on variables pertaining to subjects and stimulus parameters seem to lead to the conclusions that (a) anybody will engage in littering behavior sometime and (b) the frequency of littering behavior is mainly dependent upon the number of litter-prone situations a person encounters in his daily life. If the number of situations eliciting littering is a salient independent variable, we can assume that for the most part littering behavior is indeed under external control, namely control by discriminative stimuli (S^Ds = occurrence of waste-byproduct) and

control via consequences contingent upon littering behavior. It appears that our prevalent socialization process has been successful in setting up the environmental contingencies in such a way that they increase the probability of littering behavior. It will be argued later in the paper that the contingencies programmed to increase nonlittering behavior and to decrease littering behavior have failed or are at least limited in their effect because the spatial-temporal relationship between behavior and consequences is too vague and too remote to be acted upon.

Thus, the question arises as to the environmental conditions and contingencies that set the occasion for littering and nonlittering behavior and affect the probability of its recurrence. In the following sections, those studies will be reviewed which have been conducted with such a framework.

Process Research

Some Operant Principles. Process-oriented research to be reviewed here has been conducted within an operant framework. Since this approach will also be advocated in this study as a useful research model for ecological problems, it seems reasonable to elaborate briefly some of the major issues and objectives of an operant view.

According to an operant model, the determinants of human action (including littering and nonlittering behavior) are found in learning principles and their operation within the social context. Focused on a dynamic organism-environment interaction, the acquisition, maintenance, and modification of behavioral events are expressed

in a spatial-temporal relationship between behavior and environmental consequences. This particular arrangement or programming of the consequences (S^Rs = positive and negative reinforcers, and punishers) made contingent upon specific behaviors (Rs) will lead to control of those behaviors. To indicate, however, that a behavior does not occur at all possible times, the notion of discriminative stimuli (S^Ds) is introduced. These environmental stimuli allow for the explanation that a given behavior is appropriate only in a given situation. Appropriate here means that only in the presence of certain S^Ds will the behavioral event be followed by the specified consequences.

Thus, the paradigm of the operant model, describing learning as the interplay of the three variables, $S^D - R - S^R$, Allows for a functional, explanatory analysis. The joint analysis of what conditions (antecedents) go with what behavioral events (consequents) makes it possible to set up immediate environmental contingencies of reinforcement in order to produce immediate behavioral change.

Such an operant view of the acquisition, maintenance, and extinction of behavior is powerful, since it yields a set of principles derived entirely from the experimental analysis of behavior, which leaves no gap between the concepts and the methodology for practical application of these concepts. The application is usually subsumed under the concept of behavior modification.

Behavior modification can be geared toward acquisition of new behaviors, maintenance of already existing behaviors but under new stimulus control, and/or reduction of behaviors. In the case of littering

and nonlittering behavior, we would argue that the behavioral act as such does not need to be acquired (unless we work with infants), but new contingencies have to be set up to control the target behaviors.

Given the above outlined objectives and implications of the operant model, it may also be useful to consider the relationship between such an operant view and the term ecosystem. It was stated that the term ecosystem focuses on the dynamic interplay between organisms and their environments. Accordingly, it seems only too obvious that the operant model is very well suited for research within the ecosystem as well. Furthermore, the urgency of the problems and the necessity for quick and effective intervention indeed seem to force upon the researcher an analytic behavioral approach.

Operant Research on Littering Behavior. The first three studies to be reviewed concentrated on manipulating the consequences contingent on the behavioral event, that is on the S^R variable. Burgess, Clark, and Hendee (1971), Clark, Burgess, and Hendee (1972), and Marler (1971) manipulated consequences upon nonlittering in an attempt to find explanations for the high failure rate of typical anti-littering strategies using physical environmental cues (S^Ds) for nonlittering behavior.

Burgess, Clark, and Hendee (1971) manipulated six different environmental conditions (provision of extra trash cans, provision of litterbags, showing anti-litter filmstrips, provision of litterbags plus instructions, of litterbags plus 10 cents, and of litterbags plus free theater tickets) and measured their effect on the amount of litter in two movie theaters. The subjects

were children attending Saturday children's matinees. The results indicated that nonlittering increased only under conditions using incentive procedures (litterbags plus 10 cents or plus theater ticket). Only the arrangement of immediate, tangible reinforcement contingencies increased the probability of nonlittering behavior (90% reduction of litter in the theaters).

The effectiveness of reinforcement contingencies was replicated in the studies by Clark, Burgess, and Hendee (1972), and Clark, Hendee and Burgess (1972), working with children in a campground setting in hiking areas and car camping areas. The study showed that children can be easily and effectively induced to pick up litter when incentives are provided (again immediate and tangible reinforcers).

In a similar vein, Marler (1971) used leaflets which specified either positive or negative consequences stated either in behavioral objectives or neutral abstract facts about littering behavior. She found that behavioral change (increase in nonlittering behavior) was most effectively produced in adult persons via negative contingencies stated in the leaflets. The results have to be taken with caution, however, since Marler was working in a campground setting and apparently had difficulties controlling for sampling biases.

Whereas the above studies manipulated environmental consequences and their effect upon change in littering behavior, there are two studies which were aimed at manipulating environmental conditions or S^Ds in an attempt to delineate situational stimuli which elicit nonlittering behavior or littering behavior, respectively.

Cone, Parham, and Feirstein (1972) manipulated two environmental S^Ds: environmental cleanliness and model behavior. The subjects were preschool children ranging in age from 3 to 4 years. After baseline assessment of littering behavior, the environmental S^Ds were arranged in such a way that the children watched a model performing a task in a littering or nonlittering manner, in a clean or dirty environment. The children then performed the same task in a dirty or clean environment.

The data from this study indicated that the children's behavior was highly affected by the model's behavior. A clean model in contrast to a dirty model reduced littering behavior in children when compared to baseline data. In addition, the effect of the model's behavior was independent of the second S^D manipulated, namely physical environment. The latter exerted no reliable influence on littering.

In a second study again with preschool children as subjects Cone (1972) manipulated three environmental S^Ds: physical environment, model's behavior, and verbal instruction (do with the trash what one is supposed to do with it). In contrast to the first study (Cone et al., 1972) the physical environment variable appeared as the strongest S^D in the second study. That is, clean environment reduced littering behavior in all treatment groups. This overall effect, however, can be enhanced or dampened by the model's behavior and also by verbal instructions as shown by a second posttest session. Consequently, the greatest behavior change is obtained when all environmental conditions (all S^Ds)

are consistent and coherent; that is, clean model and clean environment, or clean environment and verbal instruction reduce the littering behavior most drastically. A clean environment with a dirty model is less effective, as are verbal instructions (to do with the trash what one is supposed to) given in a dirty environment. This discrepancy between the two more or less identical studies might be due to the fact that in the first study only one measurement device for littering was used in contrast to five different tests in the second study. Supposedly, the second study should yield more generalizable results as to littering and the environmental conditions acting upon it.

Illustrative of the effectiveness of operant principles in naturalistic settings is a series of studies conducted by Geller and coworkers. Geller et al. (1971, 1972) chose beverage buying as their target behavior. The effectiveness of a prompting procedure (handing out circular) combined with reinforcement (social approval after purchase) (Geller, Wylie, & Farris, 1971) and different prompting procedures (Geller, Farris, & Post, 1972) in increasing the probability of buying returnable bottles were examined. The first study (1971) using an ABA design indicated that buying behavior could indeed be influenced by the treatment procedure, which combined manipulation of S^D (confronting people with the circular) with manipulation of S^R (approving and congratulating the people after having purchased returnable bottles). Geller et al. (1972) tested seven different prompting techniques (prompting via circular plus public charting of each customer's bottle purchases - prompting and charting by three males - prompting and

charting by three females). Observations were recorded for a two hour period each day. Two Latin Square Designs made systematic variations of treatments over weekdays and over four different observation times per day possible. The findings confirm the effectiveness of operant principles on a community level for pollution control. As to the different prompting techniques there was no consistent differential effect. Prompting via circular alone was sufficient to modify bottle-buying behavior. Besides the highly probable contamination and generalization effect between the treatment conditions (same customer shopping more than once a week) the lack of an increase or at least differential effect of treatments might simply be due to a ceiling effect (each customer only buys a certain number of bottles each week).

Conclusions and Perspectives for Operant Research on Littering Behavior. The following statements seem to be warranted in light of the existing body of data.

First, littering behavior can be affected or changed by environmental conditions and consequences; thus, littering behavior is emitted only under certain conditions when followed by certain consequences. Consequently, littering behavior as an "operant," which is acquired, maintained, and extinguished dependent upon the environmental contingencies. These environmental contingencies have become so arranged in our culture that only positive and immediate consequences of littering behavior are available to the litterer. The littering event is instrumental in removing an aversive stimulus (litter product) and thus is immediately consequated by negative reinforcement. Punishing consequences which might lead to the ex-

tinction of littering are at best delayed and at worst not experienced as behavior-related any longer.

Second, nonlittering behavior may be acquired, and/or maintained, when it is followed by positively reinforcing events. Consequently, nonlittering behavior as well as littering behavior can be shaped. The customary solution to regulating and increasing the probability of nonlittering behavior has failed for three reasons: (a) the punitive consequences contingent upon littering behavior are delayed and seldom experienced at all due to difficulties in monitoring littering behavior; (b) the positive consequences contingent upon nonlittering behavior are also delayed and very often not concrete, but rather abstract in character; and (c) the positive consequences on littering behavior are immediate and tangible. Thus programs, either using punishments or reinforcements as consequences in the attempt to establish nonlittering behavior, are seldom based upon genuine experience of the consequences. The latter, however, is one of the major prerequisites in the process of acquisition of a desired behavior, or more specific, in the process of restructuring a desired chain of behaviors. Instead, both acquisition programs depend upon S^Ds (maxims, rules, verbal instructions, model behavior, etc.) which specify the reinforcement and/or punishment contingencies.

Skinner (1966) distinguished here between contingency-shaped and rule-governed behavior. Rules are considered as descriptions or injunctions of contingencies in that they specify occasions (S^D), responses (R), and consequences (S^R). Behaving according to rules thus implies that the organism "knows" about

the contingencies.

The extent to which behavior is contingency-shaped or rule-governed is often a matter of convenience. In the case of rule-governed behavior, acquisition is supposed to take place in a shorthand fashion replacing prolonged and direct contact with the contingencies. Thus, behavior is controlled by S^Ds. In the case of contingency-programmed behavior, in contrast, S^Rs are the main controlling variable. In addition, rules tend to bring remote consequences into play whereas contingency-programmed behavior depends on immediate consequences. The latter clearly creates a better start for a learning situation. Contingencies are private and individual-specific, however, whereas rules once acquired can be transmitted and used by more than one individual (e.g., traffic rules).

Thus, contingency-programmed behavior is characterized by immediate availability whereas rule-governed behavior requires time, since rules will have to be consulted and reasons examined before behavior can be exhibited. The same consideration might apply for Cone's (1972) findings which indicated the greatest behavioral change under the condition of consistency and coherence among all three environmental S^Ds. There is, however, also the possibility that group averaged data may have obscured individual control of specific conditions and that the cancellation effect of group averaging could only be overcome by a common tendency in all three S^Ds. If we agree to consider a model's behavior as incorporating or representing a rule, we would expect that in the case of consistency among the S^Ds the rule becomes more distinctive and

obvious, thus allowing for a quick and unambiguous decision as to the behavior to be exhibited.

When we look at the acquisition of nonlittering behavior we will very likely find either a rule-governed learning program or contingency processes using long-term reinforcing events. In contrast, when we look at acquisition of littering behavior we find a contingency program dependent upon immediate negative reinforcement. Considering this state of affairs, it is not surprising that acquisition and maintenance of littering behavior is more easily accomplished than nonlittering behavior.

Statement of the Problem

It has been noted throughout the literature review that, although littering behavior has received some attention as a source of man-made waste, the majority of the work in the area can be characterized as representing conventional R-R research. Little emphasis has been placed upon an analytical, experimental approach geared toward immediate behavioral change via immediate environmental interventions.

If littering behavior can be conceptualized as behavior that is acquired, maintained, and modified by the same principles as other learned behaviors, it is conceivable that an individual can learn constructive, socially acceptable, anti-litter behaviors as well.

Throughout the literature analysis it was emphasized that the discrepancy in degree of control over littering vs. nonlittering behavior is due to the difference in programming or spatial-temporal arrangement of the three sets of variables: $S^D - R - S^R$. Littering behavior is contingency-shaped behavior, under the control of immediate negative reinforcement contingencies (escape from or avoidance of aversive stimuli).

The negative consequences of littering behavior are delayed to a point where they may not be seen as behavior-related. Nonlittering behavior is rarely shaped by contingencies but is generally socialized via maxims, rules, etc., specifying punishing consequences for littering or positive consequences for nonlittering, such as beautification of America. Neither condition, however,

represents a powerful learning situation.

Accordingly, it is argued that the prevalent failure to develop nonlittering behavior in people is due to an insufficient programming of the environmental contingencies and the choice of inefficient reinforcers.

To establish high and stable stimulus control over nonlittering behavior, there are essentially three possibilities: (a) a positive reinforcement contingency which provides for immediate, tangible (at least a the outset) reinforcers upon nonlittering behavior; (b) a punishment contingency, which delivers immediate aversive consequences for littering behavior; (c) a combination of these two contingencies; namely a positively reinforcing nonlittering while simultaneously punishing littering behavior. Which strategy is most effective must be decided by empirical research.

Following the above discussion an attempt was made in the present study to test two hypotheses: (a) modification of littering and, or acquisition of nonlittering behavior is achieved when contingency programs are used as the learning procedure; and (b) less modification of littering behavior results when verbal rules are used as learning devices.

The procedure depending on rule-governed behavior specified a verbal instruction emphasizing the necessity to discard waste material in the socially desired manner. Social consequences likely to follow littering vs. nonlittering behavior were enumerated (see page 29). The procedure using contingency programs as the learning device employed both positive reinforcers and punishers as consequences. In order to ensure a rapid change in littering rate

both consequences were programmed on immediate and continuous schedules at first. Delayed continuous schedules (delayed consequences) followed in order to establish generalization and self-regulation. Both environmental contingencies were geared toward increasing the probability of nonlittering behavior: the punishment program via decrease of littering behavior, the positive reinforcement program via increase in nonlittering behavior.

Delayed consequences were introduced in an attempt to program cross-situational and temporal stimulus generalization (O'Leary & Drabman, 1971) of nonlittering behavior. Research in programming and testing generalization are scarce. Among the few attempts (see Kazdin & Bootzin, 1972 for a review) emphasis has been put on manipulation of consequences. Fading out tokens (Schaefer & Martin, 1969), delaying reinforcement (Atthowe & Krasner, 1968), and/or delaying the exchange of tokens for back-up reinforcers (O'Leary & Becker, 1967) are some of the procedures that have been used. Direct programming of generalization seems to be highly important, since generalization is not an automatic consequence (Kazdin & Bootzin, 1972; Baer, Wolf, and Risley, 1968) particularly with the present target population.

Method

Subjects and Setting

Eight four-year old children participated in the experiment. They were pupils from a nursery-school operated as a laboratory preschool by the Division of Individual and Family Studies at The Pennsylvania State University. The preschool population, consisting of 72 two to four-year old children, is separated into three different educational programs based on different theoretical orientations: (a) Piagetian, (b) operant, and (c) open classroom. In order to ensure a minimum of uncontrolled extra-experimental confounds, only children from the Piagetian and the open classroom group were included in the subject population.

The initial random sample encompassed 2o four-year olds. Ten children had to be dropped for reasons such as irregular attendance at school, extreme resistance to one or more experimenters, motoric difficulties in handling scissors and/or exhibition of nonlittering behavior. During the two months of testing two more subjects had to be excluded because of prolonged illness. Thus, the final sample consisted of eight children, all females.*

The experimental setting for this study consisted of two research rooms located in close proximity to the facilities of the

---

*Due to the composition of four-year olds in the preschool program more female children were in the initial sample (16 females and four males). It might be of interest to the reader that the twelve dropouts contained all male subjects. One boy, although being tested only sporadically because of frequent absence, was nevertheless included in the testing. He belonged to the PR-Group and exhibited quite discrepant results from the two girls in that treatment condition.

nursery-school. The 13 x 15 foot rooms could be observed inconspicuously from a one-way observation booth. The research rooms contained only furniture and equipment directly related to the research described here. Observations during a pilot study which was run on six subjects, made it desirable to soften the laboratory-like atmosphere of the two rooms. The sterile and bare look of the rooms was not conducive to a playlike, relaxed behavior. Thus the rooms were given a somewhat 'messy' touch by hanging up wallposters and leaving bits of paper carelessly on the floor.

Experimental Design

Strategy. A single-subject design and A-B-A-B reversibility method (Sidman, 1960; Sherman & Baer, 1969), was used. Two additional testing sessions were scheduled, the first to test for cross-situational generalization, the second to test for generalization over time.

The criteria for number of sessions within each experimental condition had to be compromised with the rigid laboratory requirement for stable rate. Findings from the pilot study (probability of satiation and reduced cooperation over long periods of time) and also external time limitations made some accommodations unavoidable. Thus, behavioral stability was often replaced by behavioral 'trend'. This appears to be not only legitimate but also desirable to naturalistic research settings. Sidman (1960, p. 268) argues that the demonstration that a variable is effective does not require the attainment of a stringently defined stable state as long as the demonstrated change is large enough to override the baseline 'poise'. In the same vein, Bijou, Peterson, Harris, Allen, & Johnston, (1969) cautions researchers using an ABAB design not to

wait too long before reversing, since the behavior might come under the control of new conditioned reinforcers and thus not reverse. The total number of testing sessions varied from 18 to 23.

Each child was individually escorted to the experimental room where she was informed about the situation in general followed by specific instructions pertaining to each task. Appendix A gives the full wording of the instructions used. Each experimental session took about 15 minutes per child per day.

The subjects were assigned randomly to one of the testers and one of the experimental rooms for each testing session. This systematic change in experimenter and room not only controlled for any systematic experimenter effect, but also sustained the curiosity of the subjects and their cooperation for the two-month testing period. The experimenters were kept uninformed about the hypotheses concerning the differential effect of the treatment conditions.

Treatment Conditions. The experimental design included four independent treatment conditions with two subjects randomly assigned to each. The token positive reinforcement contingency will be referred to as PR, the token punishment contingency as PU, the reinforcement rule learning group as RLR, and the punishment rule learning group as RLP.

a) Token Positive Reinforcement: The PR group was set on a continuous positive reinforcement schedule; that is positive reinforcement in the form of a token was made contingent upon any occurrence of the

desired nonlittering behavior. The token could be exchanged for back-up reinforcers at the end of each task within each experimental session. Thus, this program was aimed directly at increasing rate of anti-litter behavior.

The rationale for using a token program was mainly to eliminate the high intra- and intersubject variability of reinforcers when used with humans. Baer (1971) and O'Leary and Drabman (1971) have argued that the token system, furnishing the possibility of a large variety of back-up reinforcers, is apt to eliminate the intra- as well as inter-subject variability of unconditioned as well as conditioned reinforcers with human subjects. In addition, the tokens can be made immediately contingent upon the desired behavior. The token allows for an immediate and nondisruptive availability of the reinforcer.

To ensure the effectiveness of the token as a reinforcing event the children were made familiar with the token prior to the experiment. They were shown the back-up reinforcers (which were available from a little store set up in one corner of the experimental rooms which could be covered and uncovered at will) which were available to them only via the use of tokens. The following instruction was used to facilitate understanding of the relationship between token and back-up reinforcers, followed by an actual play-out:

"During the next days we will play different games in which you will be able to earn tokens. With the earned tokens you can buy any of the little rewards you can see here. You can choose whatever you want. One token will buy you one reward, two tokens two, and so on. It will depend on

the number of tokens how many of the rewards here you can get."

Then the children were handed tokens which they could exchange for a back-up reinforcer.

b) Token Punishment. The PU Group was exposed to a punishment contingency aimed at reduction of littering behavior. Punishment was programmed continuously. The punishment event was defined as the removal of a token from a pile of tokens on the child's working table. The removal was contingent upon each occurrence of littering while the child was performing.

At first it was intended to expose the children in the PR and PU Group to the two contingency programs without telling them which behaviors were being consequated. During the pilot-study difficulties were encountered, however, in that subjects inquired directly about the nature of the target behavior for which tokens could be earned or lost. In line with arguments in the literature (e.g., Tharp and Wetzel, 1969, p. 99) calling such tactics uneconomical, cumbersome and artificial at least when dealing with age groups who have a certain verbal repertoire, it was decided to give the following instruction preceding the task instruction:

"Before I explain to you the rules of the next game, I have to tell you something else. When you play the game, you will make some litter or trash. Now look here, I have a lot of tokens. You know that you can buy the little things, I have over here in the store, with these tokens."

PR-Group: "Well, you can earn tokens, when you play the next game.

Every time you put the litter you make in the trashcan I will give you a token. When the game is over you can exchange them for something you like in the store."

PU-Group: "Well, before you start the next game I will give you these tokens here. They all belong to you. But you can loose them during the game. Each time you do not put the litter in the trashcan, I will take a token away from you. If you don't have any left, you cannot exchange them for something in the store."

c) Rule-Learning: For both rule learning groups, RLR (reinforcement rule learning) and RLP (punishment rule learning) verbal instructions only were manipulated. They differed from the verbal instructions given to the two contingency programs in that the verbalizations here contained specifications of consequences. The instructions (given at the start of the littering tasks) were formulated as follows:

"I have just explained to you the game you are going to play now. During the game, you will make some trash or litter. Now, I want you to do with the trash what you are supposed to do with it. You will put it in the trashcan, that's right."

RLR-Group: "If you do not litter you know very well that your parents, your teachers, your friends, everybody will be very proud of you. They will smile at you, will like you and will praise you. Now remember, not to litter during the game."

RLP-Group: "If you do litter you know very well that everybody, your teachers, your friends, your parents will punish

you. They will frown upon you, scold you and perhaps even spank you. So, do remember not to litter."

Measurement.

a) Tasks. Littering can be tested by a multitude of tasks. As of now, clearcut taxonomic criteria which would render some tasks more appropriate or more valid than others are still lacking. Thus, selection of littering tasks depends on gross guidelines such as, for example, the classification given by Cone (1972), who distinguishes between environmentally protective and destructive behaviors. In Cone's framework littering would fall in the category of environmentally destructive behaviors, defined as "those observable organismic changes which result in the reduced viability of our natural, physical environment" (Cone, 1972, p. 3).

The main criterion for selecting littering tasks for the present study was that they contain many cues facilitating littering behavior. A first set of tasks had to be eliminated. The pilot study pointed out several deficiencies, such as lack of a final product of interest to a four-year old, potential similarity between litter and nursery- or home-material often the target of nonlittering training. Thus a new set of tasks was designed, evaluated and judged as adequate after yielding consistent high frequency of littering behavior and ensuring the interest of the children. Five tasks were used: Weight Balancing, Decorating, Playplax, Cut-Outs, and Match-Ups. A full description of the tasks is provided in the Appendix B. In the case of Weight Balancing, Playplax, and Match-Ups commercial toys were used, whereby one part was wrapped in paper or put in envelopes (the latter providing

the litter). The Decorating task used commercial colored paper-dots which can be stick on all kinds of objects after the backing is peeled off (the latter presenting the litter). The Cut-Out task simply used sheets of paper showing a certain shape (square, circle, rectangle, triangle, etc.) and a dotted line. The shapes were supposed to get sorted after the dotted line was cut off (the trimmings yielded the litter).

Five tasks had to be completed for first baseline and time-generalization testing, two of the five tasks for the treatment conditions and second baseline measurement and the remaining three tasks for cross-situational generalization testing. The littering tasks were completed by each child during each experimental session. Each run was given in random order to avoid any systematic order effects. An effort was made to run all children each day in order to control for possible internal error variance related to extraneous conditions as described by Campbell and Stanley (1963). External factors such as absence of the child because of illness, field trips, and occasional refusals to cooperate on a particular day interrupted the usual testing routine.

b) Scoring. The dependent variable was the frequency of littering responses, operationally defined as the disposal of litter some place other than in the wastebaskets. All data were recorded by the author and one tester working with individual data sheets, watch and counter. The observations were made with the experimenter being present in the same room with the child, since she/he also was responsible for the handing out and removal of tokens. The author observed from the observation booth. An attempt was made to restrict experimenter-

child interactions to the experimental conditions described above.

To control for experimenter effects four students (three males, one female) were trained as experimenters prior to the beginning of the actual experiment and after the pilot study. In order to assess interrater reliability all experimenters plus the author recorded the data on all five tasks during trial testing sessions (five sessions, five subjects). The littering and nonlittering scores obtained for each child per task per session were compared and the same scores were recorded by all four testers and the author, indicating perfect interrater reliability. It appeared that the behavioral events, littering and nonlittering, were defined unambiguously and thus were easy to score.

Phases. Table 1 presents the sequence of experimental sessions for the PR, the PU, the RLR and RLP groups. Each experimental session consisted of one run through various littering tasks.

a) Baseline I. The first four experimental sessions were employed to obtain baseline measurements on littering behavior under normal conditions for all subjects and for all five littering tasks.

b) Treatment Immediate. In the fifth session treatment conditions were introduced. Both token PR and PU groups experienced an immediate and continuous token reinforcement and token punishment program, respectively. The RLR and RLP programs were exposed to the verbal rules instructing the subjects about the proper disposal of trash and possible consequences. The first treatment condition extended, on the average, over three sessions (three subjects experienced four sessions).

c) Baseline II Beginning with session eight, on the average, and

Table 1

EXPERIMENTAL SESSION AND CONDITION

GROUP	Experimental Condition	SESSION 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PR and PU	Baseline	x	x	x	x				x	x	x									
	Immediate Instruction					x	x	x				x	x							
	Delayed Instruction													x	x	x	x			
	Generalization: Task																	x		
	Generalization: Time																		x	x
RLR and RLP	Baseline	x	x	x	x				x	x	x									
	Immediate Treatment					x	x	x				x	x							
	Delayed Treatment													x	x	x	x			
	Generalization: Task																	x		
	Generalization: Time																		x	x

Note..- Number of sessions depicted here represent an average of all subjects involved. The exact specification of the number of sessions per individual is shown in Figures 1 to 4.

The number of tasks varies from 5 tasks used during first baseline and time generalization, 2 tasks for all remaining experimental conditions, except for task generalization being assessed with 3 tasks.

continuing to session ten, on the average, differential treatments were withheld and conditions were returned to those prevailing during baseline 1.

d) Treatment Delayed. In session eleven, on the average, groups were reintroduced to their respective treatment conditions. With the beginning of session thirteen, on the average, the immediate treatment conditions were switched to delayed conditions. For the groups PR and PU the switch represented a change from a CRF immediate to a CRF delayed. In both groups the tokens earned or lost during a task performance were handed out or taken away after the task was completed (delay of reinforcement). In addition the tokens could not be exchanged before the end of the entire experimental session (delay of exchange). This phase encompassed six sessions, on the average (ranging from five to eight sessions).

For the RLR and RLP Group this change meant a reduction in frequency of presenting the verbal instruction. Instead of instructing the child at the start of each task, the rule was given only once at the start of each experimental session.

e) Task Generalization. Sessions sixteen, seventeen and eighteen, on the average, were aimed at assessing aspects of generalization. In session sixteen, on the average, task generalization was tested by having all children perform on the three generalization tasks. Heretofore these three tasks had been given only during the initial baseline assessment. Task generalization was assessed on the day immediately following the last day of second treatment.

f) Time and Extended Task Generalization. Sessions seventeen and eighteen, on the average, were included to provide data on time general-

ization for the two trained tasks and observations on extended task generalization for the three untrained tasks. All subjects were retested after ten days, on the average, on two consecutive days. Each session contained one of the trained tasks and one or two of the untrained tasks. Which tasks were given in what order on which day to a subject was decided randomly. The breakdown into two sessions was done mainly in order to keep time duration and number of tasks comparable for treatment and generalization conditions.

Data Analysis

In accord with the single subject design used in the present study the data analysis was conducted for each subject separately.

The data analysis was confined to graphical representation and inspection of the data. It was intended, at first, to apply a time series analysis described by Gottman, McFall and Barnett (1972). The time series analysis, which capitalizes on the fact of interdependence of measurements over time, seemed ideal. The analysis could not be performed, however, because (a) the number of observations on a given individual was too small (15 - 20, instead of the required 50 - 75 observations), and (b) the lack of variability within the data for each experimental condition.* The latter condition hinders, at the same time, the possibility of using other statistical analyses based on the stochastic model.

The individual data analysis compared the subject's littering score over the different experimental phases (baseline I, treatment immediate, baseline II, treatment delayed and generalization). The littering

* Personal communication with Dr. Gene V. Glass, Laboratory of Educational Research, University of Colorado.

score for each subject was established by frequency count of littering events over all littering tasks used per session. Because of between task and day-to-day fluctuations within subjects and interindividual differences, however, the raw frequency scores for littering were transformed into percent values in order to avoid preexperimental differences. Table 2 shows means and standard deviations over all responses per task within each phase per subject.

Results

The relationship between independent variables (treatment conditions) and dependent variables (littering behavior) pertaining to the individual subject was graphically analyzed. Table 3 and Figures 1 to 4* show the individual littering frequencies as percent scores for each session during each experimental condition.

Figures 1 to 4 also depict the raw frequencies for littering plus nonlittering behaviors across the two tasks used during treatments. Within each subject there was only minimal fluctuation in the raw frequencies. No systematic increasing or decreasing trend could be observed over the experimental phases.

Baseline I. Not surprisingly, -- the subject pool was stratified for littering behavior --, the data indicated high and consistent littering scores for each subject. Four sessions were held to be sufficient to demonstrate stable or increasing littering frequencies.

Treatment Immediate. The shift from baseline to treatment contingency produced discrepant results depending upon the treatment condition used. Considering subject 1 and 2, --experiencing token reinforcement (PR)--, an immediate drop to zero-littering behavior could be noted

Footnote om page 36

---

*The raw frequencies in Figures 1 to 4 are based on the two tasks used during training sessions. Therefore, no score is shown for task generalization and only one combined score for extended task and time generalization.

Table 2

Percent Scores of Littering Behavior

Phase	Session	TREATMENT CONDITION							
		Token Reinforcement PR		Token Punishment PU		Rule Reinforcement RLR		Rule Punishment RLP	
		1	2	3	4	5	6	7	8
Baseline	1	65	100	100	100	100	71	100	100
	2	100	100	100	100	100	89	100	100
	3	100	100	100	100	100	100	100	100
	4	100	100	100	100	100	100	100	100
Immediate Treatment	5	0	69	100	100	100	100	90	93
	6	0	15	100	100	87	88	64	97
	7	0	0	100	77	100	100	0	97
	8			100	75		100		
Baseline	9	0	0	100	100	100	82	8	91
	10	0	0	90	100	100	100	0	58
	11	0	0	93	100	100	100	0	77
	12				100	100	100	0	
	13							9	
Delayed Treatment	14	0	0	73	18	92	73	0	0
	15	0	0	10	6	73	69	0	66
	16	0	0	9	5	38	50	0	36
	17	0	0	0	0	12	36	0	17
	18	0	0	0	0	0	0	0	18
	19			0	0	0	0	0	
	20				0	0	0		
	21						10		
Task Generalization	22	21	0	100	96	6	13	31	57
Time Generalization	23	20	7	29	100	9	11	7	0
	24	0	0	58	100	4	0	0	21

Table 3

MEANS AND STANDARD DEVIATIONS SUMMED OVER ALL RESPONSES PER TASK WITHIN EACH PHASE

		SUBJECT															
		1		2		3		4		5		6		7		8	
Phase	Task	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
	1	8.3	1.9	11.3	1.9	6.8	1.7	9.3	1.0	10.3	1.0	9.3	1.0	7.5	0.5	8.3	1.7
	2	6.8	0.5	7.8	1.0	5.5	1.0	7.3	1.0	6.5	1.0	4.5	0.6	4.8	0.5	5.0	0.0
Baseline I	3	3.5	0.6	4.5	1.3	3.5	1.0	5.0	0.8	4.8	1.0	3.0	0.0	2.5	1.0	3.5	0.6
	4	4.7	1.0	5.8	1.3	4.0	0.8	4.8	1.9	6.0	1.4	5.3	1.0	4.8	1.9	5.3	0.5
	5	7.3	1.7	6.8	0.5	6.3	1.5	8.3	0.5	6.8	1.0	7.0	1.0	5.8	1.0	6.5	1.0
Treatment	1	7.7	1.0	7.0	1.0	6.5	1.0	8.5	1.3	9.3	1.2	5.5	1.3	5.7	1.0	6.7	2.9
Immediate	4	7.7	1.5	6.3	0.6	5.0	0.0	5.5	0.6	7.0	1.7	4.8	0.5	5.0	1.0	4.3	0.6
Baseline II	1	9.0	0.0	9.4	0.6	6.0	1.7	12.0	1.8	9.3	1.0	6.0	0.8	5.6	0.9	6.3	0.6
	4	6.7	1.0	6.6	1.1	6.7	0.6	8.5	0.6	6.8	1.0	6.0	1.4	5.2	0.8	4.3	1.0
Treatment	1	8.6	1.1	8.4	0.6	5.7	1.2	10.8	2.0	8.3	1.7	5.8	0.7	6.7	0.5	6.4	1.1
Delayed	4	7.4	0.6	6.6	0.6	5.8	0.4	8.7	0.8	7.7	1.5	6.1	1.1	6.2	1.0	4.4	1.1

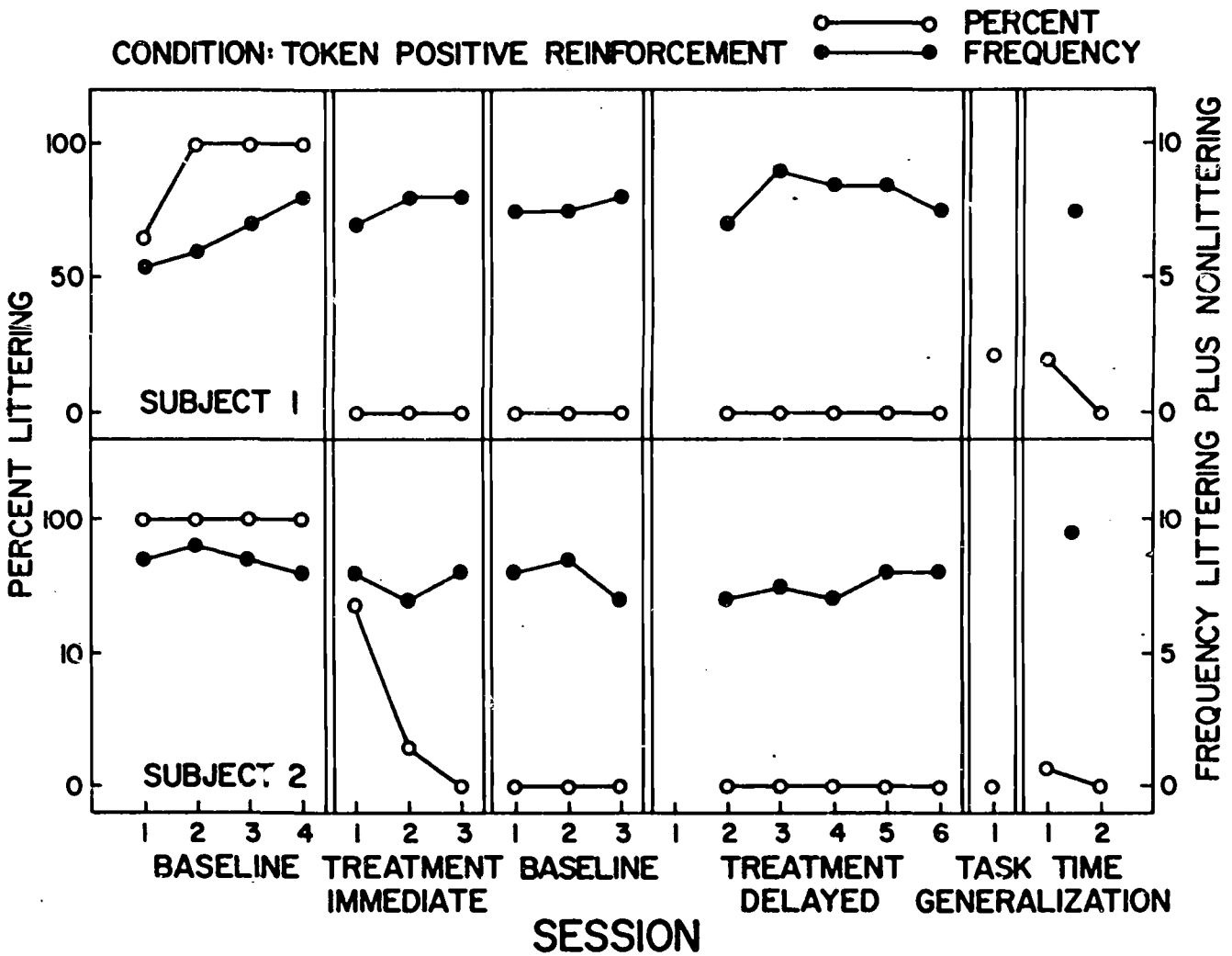
CONDITION: TOKEN POSITIVE REINFORCEMENT
PERCENT
FREQUENCY
PERCENT LITTERING
FREQUENCY LITTERING PLUS NONLITTERING
SUBJECT 1
SUBJECT 2
100
50
0
10
5
1 2 3 4
1 2 3
1 2 3
1 2 3 4 5 6
1
1 2
BASELINE
TREATMENT IMMEDIATE
BASELINE
TREATMENT DELAYED
TASK GENERALIZATION
TIME
SESSION

Figure 1

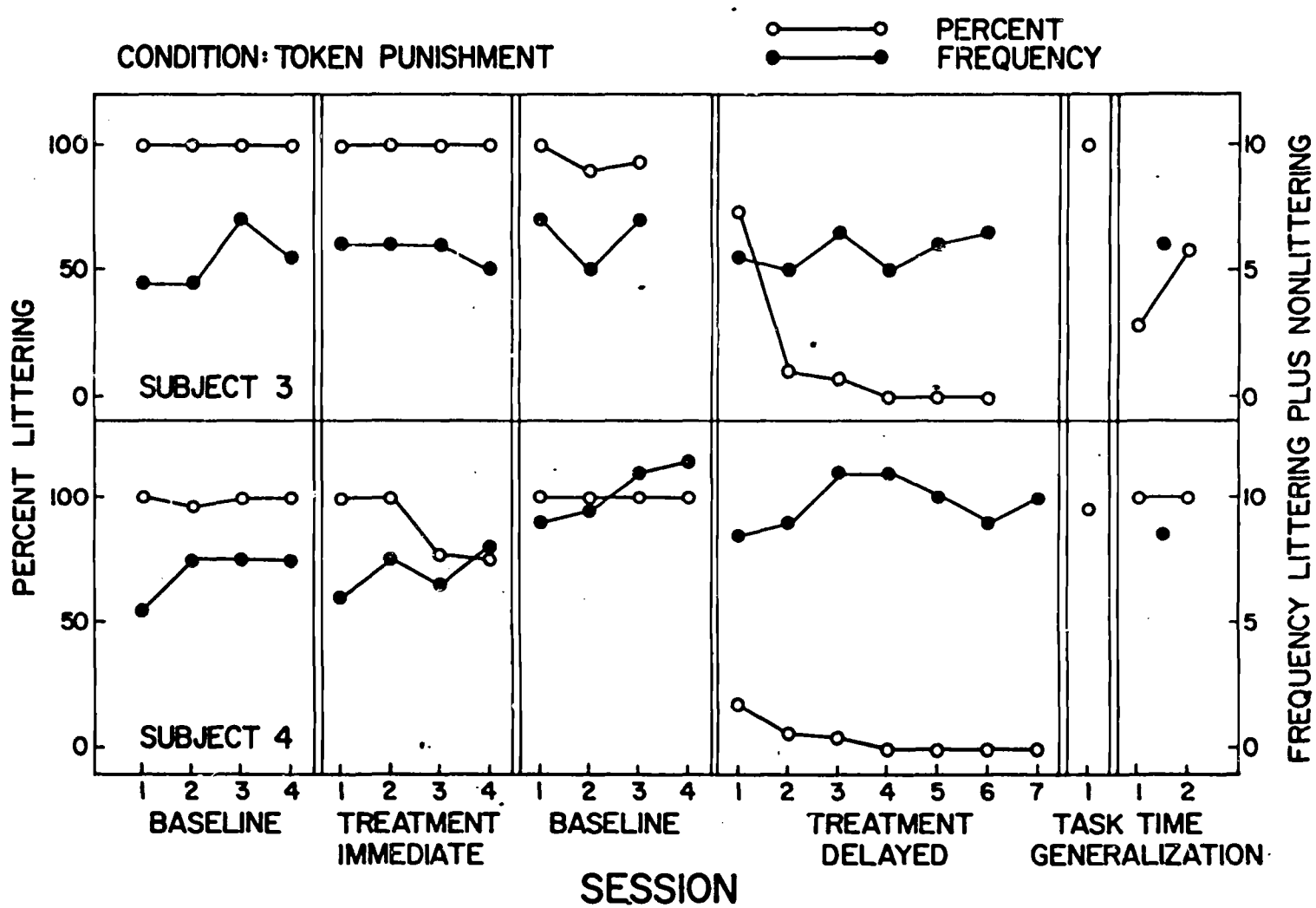
CONDITION: TOKEN PUNISHMENT
PERCENT
FREQUENCY
PERCENT LITTERING
FREQUENCY LITTERING PLUS NONLITTERING
SUBJECT 3
SUBJECT 4
100
50
0
10
5
0
1 2 3 4
BASELINE
1 2 3 4
TREATMENT IMMEDIATE
1 2 3 4
BASELINE
1 2 3 4 5 6 7
TREATMENT DELAYED
1
1 2
TASK TIME GENERALIZATION
SESSION

Figure 2

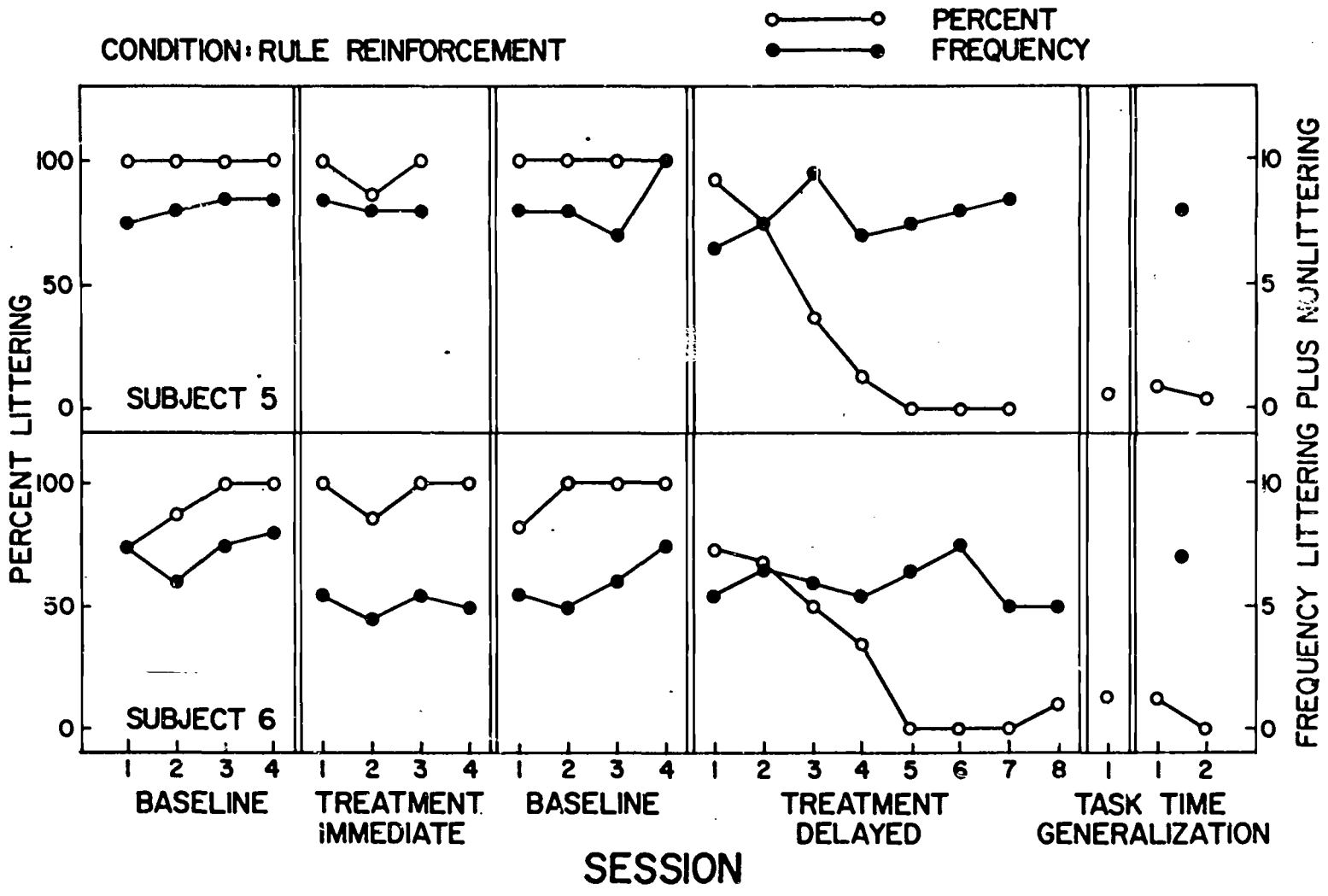
CONDITION: RULE REINFORCEMENT
PERCENT
FREQUENCY
PERCENT LITTERING
FREQUENCY LITTERING PLUS NONLITTERING
SUBJECT 5
SUBJECT 6
100
50
0
10
5
0
1 2 3 4
BASELINE
TREATMENT IMMEDIATE
BASELINE
1 2 3 4 5 6 7 8
TREATMENT DELAYED
1 2
TASK TIME GENERALIZATION
SESSION

Figure 3

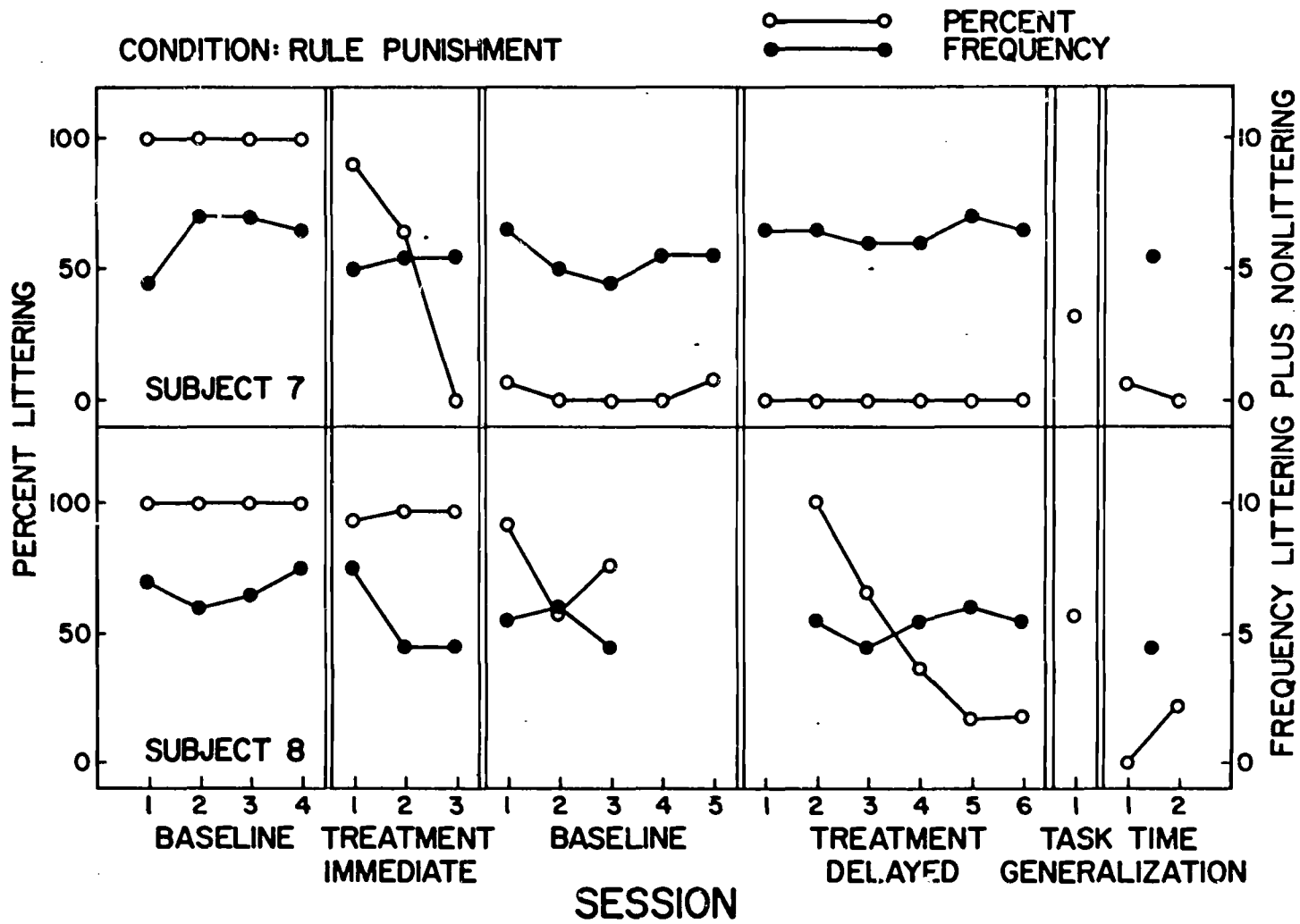
CONDITION: RULE PUNISHMENT
PERCENT
FREQUENCY
PERCENT LITTERING
FREQUENCY LITTERING PLUS NONLITTERING
SUBJECT 7
SUBJECT 8
100
50
0
10
5
0
1 2 3 4
1 2 3
1 2 3 4 5
1 2 3 4 5 6
1
1 2
BASELINE
TREATMENT IMMEDIATE
BASELINE
TREATMENT DELAYED
TASK TIME GENERALIZATION
SESSION

Figure 4

(Figure 1). Within the token punishment condition (PU), subject 3 did not show any behavioral change at all, whereas subject 4 exhibited a slow, much less dramatic behavioral change toward nonlittering behavior (Figure 2). Looking at subject 5 and 6 (Figure 3) who were introduced to the rule reinforcement condition (RLR), the treatment had no effect. Finally, subject 7 and 8, --exposed to rule punishment (RLP)--, displayed discrepant results (Figure 4). Whereas slow but then complete behavioral control over littering occurred in subject 7, variability though accompanied by a slow increase in nonlittering behavior was demonstrated by subject 8.

Due to external time limits treatment conditions could not be prolonged for subjects showing no change after session eight.

Baseline II. No reversal was obtained for subjects 1 and 2 (PR; Figure 1) and subject 7 (RLP; Figure 4) in the time limits given. All three subjects had exhibited zero-littering behavior by the end of the first treatment conditions. Subject 4 (PU; Figure 2) reversed completely to first baseline response frequencies, namely all littering behavior. Subject 8 (RLP; Figure 4) remained on a variable, unstable response pattern fluctuating between littering and nonlittering behavior. Subject 3 (PU; Figure 2) and subjects 5 and 6 (RLR; Figure 3) continued their baseline rates.

Treatment Delayed. The introduction of the second treatment condition, in contrast to the first treatment, produced stable behavioral change to nonlittering behavior in subjects 3 and 4 (PU; Figure 2), subjects 5 and 6 (RLR; Figure 3) and subject 8 (RLP; Figure 4). Subjects 1 and 2 (PR; Figure 1) and subject 7 (RLP; Figure 4) remained at zero-littering behavior.

Generalization

a) Task Generalization. Subjects 1 and 2 (PR; Figure 2), and subjects 5 and 6 (RLR; Figure 3) demonstrated a high degree of task generalization. Subjects 3 and 4 (PU; Figure 2) did not generalize at all across tasks, whereas subjects 7 and 8 (RLP; Figure 4) showed a moderate amount of task generalization.

b) Time and Extended Task Generalization. Table 1 and Figures 1 to 4 show two scores per subject, since time generalization (retest on the two trained tasks) and extended task generalization (retest on the three untrained tasks) was assessed on two consecutive days. Each subject's scores on the trained and untrained tasks given on a specific day were pooled, since there was no systematic difference apparent between the tasks. Thus, after a ten day interval, subjects 1 and 2 (PR; Figure 1), subjects 5 and 6 (RLR; Figure 3) and subjects 7 and 8 (RLP; Figure 4) demonstrated a high degree of time and extended task generalization. Subject 4 (PU; Figure 2) again showed no generalization whatsoever, whereas subject 3 (PU; Figure 2) exhibited some time and extended task generalization.

Discussion

The discussion will focus on three issues: (a) the superiority of the token reinforcement program; (b) the lack of reversal during second baseline; and (c) the differential results for generalization.

Control of Littering.

The major point of interest of the present study was the degree of effectiveness in littering control of four treatment conditions: token positive reinforcement (PR); token punishment or response cost (PU); rule reinforcement (RLR) and rule punishment (RLP). The results clearly confirm and extend findings by Burgess et al. (1971) and by Geller et al. (1971) that littering behavior can be modified markedly by reinforcement procedures. Consequently, the present data support part of the first hypothesis, that positive reinforcement would be more effective in the acquisition of nonlittering behavior. The failure of token punishment to establish and sustain stable and fast behavioral control over nonlittering is surprising, especially in light of research findings on response cost (Kazdin, 1972) presenting it as a very effective schedule with adults.

The present results also yield partial support for the second hypothesis, that rule-learning devices are comparatively ineffective in promoting control of littering. This is true despite the observed verbal imitations of the rules by the subjects in the reinforcement group. The partial success of the punishment rule learning program might be due to a carry-over effect from natural settings, where predominately negative rules are used in socializing for nonlittering

behavior. It might also reflect the notion found in the literature showing that negative verbal feedback has more effect on learning, in general, than positive feedback (Hamilton, 1969; Spence, 1966, 1970). Apparently, positive verbal feedback has less discriminative and informative value than negative verbal feedback (Warren & Cairns, 1972).

It is important to note, that the differences in effectiveness among the four different treatment conditions are washed out, to a large degree, when the second treatment is introduced after the second baseline condition. Behavioral control over littering behavior is eventually achieved for all subjects. This result suggests, that different treatments might succeed in changing littering behavior in young children, given enough time to show an effect.

This finding, however, does not diminish the fact, that the application of reinforcement principles produced superior results with regard to fast and stable acquisition of nonlittering behavior. The data, therefore, contradict the often heard opinion that contingency training is uneconomical, taking too long to achieve its effect. Just the contrary is suggested by the present data. It must be added, however, that the present findings might be restricted in their generalizability, e.g., to other age groups and/or other settings.

Baseline - Reversal.

The second point of interest relates to the failure to obtain reversal during second baseline condition (see Figure 1 and 4). The lack of reversal is not atypical for human and naturalistic research

(Kazdin and Bootzin, 1972). Nevertheless, it casts doubt on the internal validity of the treatment manipulation and on the proper choice of design, as the absence of reversal prevents attributing the observed changes to the change in contingencies (Tharp & Wetzel, 1969).

A typical explanation for nonreversal is that baseline stimulus conditions are not reinstated; that other aspects of the environment changes concomitantly with the introduction of the treatment. With regard to the present study, however, overt stimulus conditions appeared to have remained the same (same experimental rooms, same test material, same testing time, same testers).

A second potential confound is attributed to experimenter or tester behavior, which might vary with presentation and withdrawal of treatment. In the present study, an attempt was made to keep social interactions between subjects and testers the same with respect to quantity and quality of contact. Social attention and praise pertaining to the final products of the littering tasks were given during all experimental sessions and conditions to all subjects. The systematic variation of testers and the fact that they were not informed about the hypotheses also should have counteracted a systematic intra-experimenter effect. This conclusion, however, cannot be stated with absolute certainty, since experimenter variation was based on relatively few experimental units and no assessment of the actual experimenters' expectations was conducted either before, during, or after the experiment.

A third explanation relates to the possibility of the development of self-reinforcement during treatment conditions. If this is a viable explanation, it might be argued that the ABAB design is not the most adequate one to use under such circumstances. It might be more feasible to use a variation of the multiple baseline design, which would allow the comparison of different subjects along the experimental treatment continua. This strategy has been recently proposed (see Kazdin & Bootzin, 1972 and also Risley & Wolf, 1973) whenever intersession or intertreatment confounds relative to carry-over and testing or observation effects are a major issue.

Generalization Effect

The third major issue that deserves close attention refers to the present findings on generalization. In the framework of a token system, -- described by Lindsley (1964) as a prosthetic environment --, it seems particularly urgent to program for generalization to other environments. The present study was interested in stimulus generalization: nonlittering behavior acquired under a certain situation (task) should (a) transfer to other tasks, and (b) be maintained over time. The present data on generalization allow, however, only suggestive conclusions due to insufficient experimental control.

The present data seem to confirm findings by Atthowe and Krasner (1968) and by O'Leary and Becker (1967) who manipulated delay of exchange of tokens. Behaviors learned under delayed contingencies are to resist extinction longer, probabely coming under the control of natural reinforcers. However, these effects differ among the treatment groups. The manipulation of immediate vs. delayed contingencies appears not to be the only variable responsible

for resistance to extinction. Generalization seems to be facilitated when the behavior is learned under reinforcement as opposed to punishment conditions. Furthermore, the amount of learning (complete and stable nonlittering behavior prior to generalization testing) appears not to be sufficient to guarantee generalization. Again, it depends on the conditions under which the behavior has been acquired. As mentioned already, an evaluation of the differential importance of the two variables — treatment condition and timing of treatment — is not possible, since all groups experienced the change from immediate to delayed treatment.

In hindsight, one could argue that the inclusion of a generalization assessment after the first B-phase would have been desirable for the clarification of this issue.

In summary, the data reported here lend support to the view that the most common socialization practices relative to littering and nonlittering behavior (assumed to consist primarily of verbal rule instructions and punishing events) seem to be less effective methods in the production, maintenance, and generalization of nonlittering behavior in young children. Preventive as well as corrective anti-littering strategies, emphasizing verbal rule learning, should be reprogrammed in reinforcement contingencies, in order to be more effective.

In the same vein, the present study represents another example illustrating the usefulness of the deployment of principles derived from the experimental analysis of behavior for issues of environmental management. As stated at the outset, environmental management research has, for the most part, focused on technological control,

and, thereby, neglected the human element in the generation as well as in the control of man-made waste. It is hoped, that the present study can contribute to a better understanding not only of the role of operant principles in the acquisition of nonlittering behavior, but also to a widening of our perspective with regard to man-environment research.

In addition to exemplifying the applicability and usefulness of operant principles for the study of littering behavior, the present study also points to additional research needed before social and educational policies (intervention programs) can be formulated and put into practice. Thus, one final word of caution and a suggestion for future research seem in order. It is apparent that the external validity of the present findings needs examination, particularly, as it relates to generalizability across experimenters (socializers), settings, and such subject-related variables as sex and age. Consequently, a program of research seems desirable that would focus on aspects of generalization to naturalistic settings. Topographies of littering and nonlittering behavior in naturalistic settings, such as streets, playgrounds, schools, parental homes, should be assessed and examined as to their operant control by naturalistic reinforcers and socializers such as peers, parents, and teachers.

References

Allen, G. H. How deep is environmental awareness. Journal of Environmental Education, 1972, 3, 1-3.

Atthowe, J. M. & Krasner, L. Preliminary report on the application of contingent reinforcement procedures (token economy) on a chronic psychiatric ward. Journal of Abnormal Psychology, 1968, 73, 37-43.

Azrin, N. H. & Holz, W. C. Punishment. In W. K. Honig (Ed.), Operant behavior: areas of research and application. New York: Appleton-Century-Crofts, 1966. Pp. 380-447.

Baer, D. M., Wolf, M. M., & Risley, T. Some current dimensions of applied behavior analysis. Journal of Applied Behavior Analysis, 1970, 3, 65-71.

Bijou, S. W. What psychology has to offer education -- now? Journal of Applied Behavior Analysis, 1970, 3, 65-71.

Bijou, S. W., Peterson, R. F., Harris, F. R., Allen, K. E., & Johnston, M. S. Methodology for experimental studies of young children in natural settings. Psychological Record, 1969, 19, 177-210.

Borgatta, E. F. (Ed.) Sociological methodology. San Francisco: Jossey-Bass, Inc., 1969.

Burgess, R. L., Clark, R. N., & Hendee, J. C. An experimental analysis of anti-litter procedures. Journal of Applied Behavior Analysis, 1971, 4, 71-75.

Campbell, D. T. & Stanley, J. C. Experimental and quasi-experimental designs for research. Chicago: Rand McNally & Company, 1970.

Campbell, F. L., Hendee, J. C., & Clark, R. M. Law and order in public parks. Parks and Recreation, 1968, 3, 28-31, 51-55.

Campbell, B. A. & Church, R. M. (Ed.). Punishment and aversive behavior. New York: Appleton-Century-Crofts, 1969.

Cartwright, D. S. Ecological variables. In E. F. Borgatta (Ed.), Sociological methodology. San Francisco: Jossey-Bass, Inc., 1969,

Clark, R. M., Burgess, R. L., & Hendee, J. C. The development of anti-litter behavior in a forest campground. Journal of Applied Behavior Analysis, 1972, 5, 1-5.

Clark, R. M., Hendee, J. C., & Campbell, F. L. Depreciative behavior in forest campgrounds - an exploratory study. U.S.D.A. Forest Service Research Note PNW-161, 1971.

Clark, R. N., Hendee, J. C., & Burgess, R. L. The experimental control of littering. The Journal of Environmental Education, 1972, 4,

Cone, J. D. Modifying environmentally relevant behaviors. Unpublished manuscript, West Virginia University, 1972.

Cone, J. D., Parham, I. A., & Feirstein, D. B. The effects of environmental cleanliness and model's behavior on littering in young children. Paper presented at the 43rd annual meeting of Eastern Psychological Association, Boston, April, 1972.

Finnie, W. C. Field experiments in litter control. Environment and Behavior, 1973, 5, 123-144.

Geller, E. S., Wylie, R. G., & Farris, J. C. An attempt at applying prompting and reinforcement toward pollution control. Proceedings, 79th Annual Convention of the American Psychological Association, Washington, 1971.

Geller, E. S., Farris, J. C., & Post, D. S. Prompting a consumer behavior for pollution control. Journal of Applied Behavior Analysis, 197[illegible], in press.

Gottman, J. M., McFall, R. M., & Barnett, J. T. Development and analysis of research using time series. Psychological Bulletin, 1969, 72, 299-306.

Hartman, M. L. Reward and punishment in child discrimination learning. Developmental Psychology, 1969, 1, 735-738.

Heberlein, T. A. Moral norms, threatened sanctions and littering behavior. University microfilms, Ann Arbor, Michigan, 197[illegible].

Kazdin, A. E. Response Cost: The removal of conditioned reinforcers for therapeutic change. Behavior Therapy, 1972, [illegible].

Kazdin, A. E., & Bootzin, R. B. The token economy: an evaluative review. Journal of Applied Behavior Analysis, 1972, 5, 343-372.

Keep America Beautiful. A national study of roadside litter. Summary prepared by Research Triangle Institute, Research Triangle Park, North Carolina, 1969.

Keep America Beautiful. A national survey of litter law enforcement. New York, 1971.

Lewin, K. Constructs in psychology and psychological ecology. University of Iowa Studies in Child Welfare, 1944, 20, 3-29.

Lindsley, O. R. Direct measurement and prothesis of retarded behavior. Journal of Education, 1964, 147, 62-81.

Marler, Lela. A study of anti-litter messages. Journal of Environmental Education, 1972, 3, 52-53.

Mitchell, J. G. & Stalling, C. L. (Eds.) Ecotactics: The Sierra Club handbook for environment activists. New York: Pocket Books, 1970.

O'Leary, K. D. & Becker, W. C. Behavior modification of an adjustment class: a token reinforcement program. Exceptional Children, 1967, 9, 637-642.

O'Leary, K. D. & Drabman, R. Token reinforcement programs in the classroom. Psychological Bulletin, 1971, 75, 379-398.

Quigley, C. Our ecological crisis. Current History, 1970, 59, 1-12.

Seed, A. H. Jr. Who litters - and why? Environmental Education, 1970, 1, 91-92.

Sherman, J. A. & Baer, D. M. Appraisal of operant techniques with children and adults. In C. M. Franks (Ed.), Assessment and status of the behavior therapies and associated development. New York: McGraw Hill, 1969, pp. 129-219.

Sidman, M. Tactics of scientific research. New York: Basic Books, 1960.

Skinner, B. F. An operant analysis of problem solving. In B. Kleinmuntz (Ed.), Problem Solving: Research, Method, Teaching, New York: Wiley, 1966.

Solomon, R. L. Punishment. American Psychologist, 1964, 19, 237-253.

Spence, J. T. Verbal discrimination performance as a function of instructions and verbal reinforcement combination in normal and retarded children. Child Development, 1966, 37, 269-281.

Spence, J. T. Verbal reinforcement combinations and concept-identification learning: the role of nonreinforcement. Journal of Experimental Psychology, 1970, 85, 321-329.

Studer, R. G. Environmental Programming and behavioral design. Paper presented at the conference for Frontiers of Urban Planning, Rutgers University, March 24, 1970a.

Studer, R. G. The dynamics of behavior-contingent physical systems. In H. M. Proshansky, W. H. Ittelson & L. G. Rivlin (Eds.), Environmental Psychology: Man and his physical setting. Holt, Rinehart & Winston, 1970, pp. 56-75. (b)

Studer, R. G. Human Systems design and the management of change. General System, 1971, 16, 131-143.

Tharp, R. G., & Wetzel, R. J. Behavior Modification in the natural environment. New York: Academic Press, 1969.

Warren, V. L., & Cairns, R. B. Social reinforcement satiation: an outcome of frequency or ambiguity. Journal of Experimental Child Psychology, 1972, 13, 249-260.

Wohlwill, J. R. & Carson, D. H. (Eds.), Environment and the social sciences: perspectives and applications. Washington: APA, Inc. 1972.

Risley, T.R., & Wolf, M.M. Strategies for analyzing behavioral change over time. In J.R. Nesselroade & H.W. Reese (Eds.), Life-Span Developmental Psychology. Methodological Issues. New York: Academic Press, 1973.

APPENDIX A

Testing Situation

Introductory Remarks

We are going to play some very fast games today. I am indeed anxious to see how fast you can play the different games. Before each game I will explain to you the rules of that game. Once you have started a game, you cannot ask me any questions any longer. You are all on your own and you will play as if I were not in the room with you. Remember, try very hard to play very, very fast.

Specific Instructions

Weight Balancing: Here we have a fun game. See the scale here. It's a very special one, you can hang numbers on each arm and try to balance it. Now, here is the rule, how you will have to play this game: You start at this table here, you pick a bag, tear it up and take out the number as fast as you can. When you have done this you run to the table over there and hang the number on one arm of the scale. Then you run back here, pick another bag, and so on. Okay. You start, when I say: Go and play until I say: Stop. Now remember, be fast.

Decorating: See this plain box here. Well, we can make a very fine gift-box out of it. We can use these paper-dots over here for decoration. Now, here is the rule of the game: You start here, take one of the dots, peel off the backing as fast as you can. Then you run over here and stick the dot onto the box. Then you run back, pick another dot, peel off the backing and run over here and stick it onto the box. I

am really curious how many dots you can stick on the box in 2'. When I say go, you can start and I will say stop after 2'.

Playplax: Here we have a carton full of squares and rings of different colors, but they are all wrapped up. Now, here is what you will have to do: You pick one of the squares or rings, unwrap it as fast as possible, run over to the other table there where you will build something with the squares and rings. Then you run back, pick another one, unwrap it and bring the unwrapped piece over here. Then you run back, get another one and so on. You start, when I say: Go and I will tell you stop when the game is over. Work very fast so that you really can build something nice.

Cut-Outs: Well, here we have a lot of sheets of paper. On each of them is one large shape, either a circle or a square or a triangle, and so on. You also see this dotted line on the sheet, here. Now the rule is: You pick one sheet, cut along the dotted line as fast as possible, then you bring the shape over here. Then you run back, pick another sheet, etc. Okay. Now try to do as many sheets as possible. You start, when I say Go and stop when I say Halt.

Match-Ups: Here we have a very interesting game. See the different pictures here. They all have some edges cut out. This tells us that there is a missing part. Okay. Well, the missing parts to these pictures here are all wrapped up and

lying over there on the other table. The rule is: you start here, pick one of the wrapped up card pieces, unwrap it as quick as possible, then you bring it over here and try to fit it to the correct match. Okay. Then you run back, pick another one, unwrap it and bring it over here and so on. Remember try to do as many of the match-ups as you possibly can. When I say Go you start and you play until I tell you to stop.

APPENDIX B

Tasks Description

Task 1: Weight balancing: The child is presented with a scale (Add a Count Scale by Child Guidance Toys) which can be balanced by hanging equal amounts of number weights on each arm of the scale. The numbers are packed in brown bags and placed at a second table, 6 feet apart from the working table. The task requires the child to start out by picking one of the bags, opening it, taking out the number, then going over to the working table and hanging the number on the scale. During the 2' working time, the child is given a token whenever she disposes of the bag in the wastebasket (PR-Group) and is fined a token, whenever she discards the bag other than in the wastebasket (PU-Group).

Task 2: Decorating: Each child is presented with an individual plain box and is told that we want to decorate the box to make it look like a gift-box. The decoration is to be done with little colored paper dots. The task requires the child to go to one table, pick a dot, peel off the backing and then bring it to the other table and stick the dot onto the box. The child is given 2' during which time a token is handed to her when she discards the waste (backing) in the wastebasket (PR-Group) and a token is taken away whenever she disposes of the waste other than in the wastebasket (PU-Group).

Task 3: Playplax: The child is shown a carton with playplax squares and rings all wrapped up in paper. The task requires the child to go to the carton, pick a playplax, unwrap it and then carry it over to the other table, where she can start building whatever she wants. During the 2' working time tokens are handed out for each disposal of the wrapping into the wastebasket (PR-Group) and tokens are taken away for each disposal of the waste other than in the wastebasket (PU-Group).

Task 4: Cut-Outs: The child is led to a table where she finds several sheets of paper showing one large geometric shape (circle, square, triangle). Along one side of the sheet a dotted line is visible. The task requires the child to pick one of these sheets, cut along the dotted line and then bring the piece of paper with the shape on it to the other table. During 2' tokens are handed out whenever the waste (trimming) is discarded in the wastebasket (PR-Group) and tokens are taken away for each disposal of waste other than in the wastebasket (PU-Group).

Task 5: Match-Ups: The match-ups consist of two halves, which when put together represent a specific picture. The child is shown 10 halves, the match-ups of which are wrapped in paper and put at the other table. The task requires the child to pick one of the wrapped up pendants, unwrap it and bring it over to the working table and

try to fit it to one of the 10 halves laid out at the table. During the 2' the child is given a token whenever she disposes of the waste into the wastebasket (PR-Group) and is fined a token whenever she discards the waste other than into the wastebasket (PU-Group).