

*THE MARKED ITEM TECHNIQUE: A PRACTICAL
PROCEDURE FOR LITTER CONTROL¹*

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Unobtrusively marked items of litter were placed among existing trash on the grounds of a federal youth correctional facility. Inmates voluntarily collected trash and deposited it at a central location, where they were given money or special privileges for each piece of marked litter found. A multiple-baseline design with litter counts in three areas revealed successive reductions of 55%, 88%, and 71% after 17, 22, and 36 days of baseline, respectively. A fourth area served as a baseline-only control, and revealed no systematic changes. Advantages of the procedure over previously devised techniques were discussed and applications in other areas of pollution control suggested.

DESCRIPTORS: anti-litter behavior, instructions, marked item technique, multiple baseline, prison setting, reinforcement, control of litter

Litter has been the subject of increasing interest on the part of behavioral scientists concerned with the experimental analysis of environmentally relevant behavior (Burgess, Clark, and Hendee, 1971; Clark, Burgess, and Hendee, 1972; Kohlenberg and Phillips, 1973; Powers, Osborne, and Anderson, 1973). These studies have shown that providing incentives for anti-litter (picking up) behavior results in increased amounts of trash turned in. Such procedures, while effective, involve a potential difficulty: reinforcement is dependent on the amount of trash available to be collected. Thus, the procedures can be subverted by the artificial production of trash. In the Clark *et al.* (1972) study, for example, children earned Smokey the Bear badges for turning in trash that could have been earned by tearing up newspapers and putting

them in a bag, or by emptying the ashtrays and litter bags of their parents' cars.

The "trash buying" approach does not directly reinforce collection of indigenous litter. Rather, it reinforces turning in trash however generated, and in fact, Chapman and Risley (1974) observed that some children in a public housing project emptied trash cans into collection sacks to gain a reward. This type of subversion is potentially troublesome in areas (such as housing projects or institutions) where the program participants are the same people day after day. Repeated exposure to the contingencies for trash-buying procedures should result in more frequent subversion, especially since less effort is required to fill a bag with litter from a trash can than with litter picked-up from a lawn. If such behavior is reinforced it could be expected to accelerate and thereby increase the cost of the program, perhaps substantially. Additionally, even if trash importing does not occur, one might expect that large pieces of litter would be collected more readily than small pieces, since the payoff for big pieces (which fill a bag more readily) is greater. Chapman and Risley (1974) also documented this occurrence.

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One possible solution would be to reward persons for generating a clean area, rather than for turning in trash (Chapman and Risley, 1974). However, such a procedure has several difficulties. Monitoring placement of the litter after removal from the area (*e.g.*, in a trash can or in an adjacent area) would be necessary, as would determining whether a dirty area was simply not cleaned by a participant or was cleaned but quickly littered again by a passer-by.

The present study evaluated another alternative to the trash-buying approach. A method of litter control was designed to: (a) reinforce the collection of all types and sizes of indigenous litter, (b) prevent pay-offs for the artificial production of trash (*i.e.*, subversion), and (c) penalize (or at least eliminate the possibility of indirectly reinforcing) the distribution of additional litter on the ground.

The procedure involved having persons pick up trash to earn money or special privileges. The pay-off, however, was distributed according to how many marked items of litter had been collected, not according to the quantity of trash collected. These marked items were identifiable only to the experimenter, who surreptitiously distributed them throughout the experimental areas.

METHOD

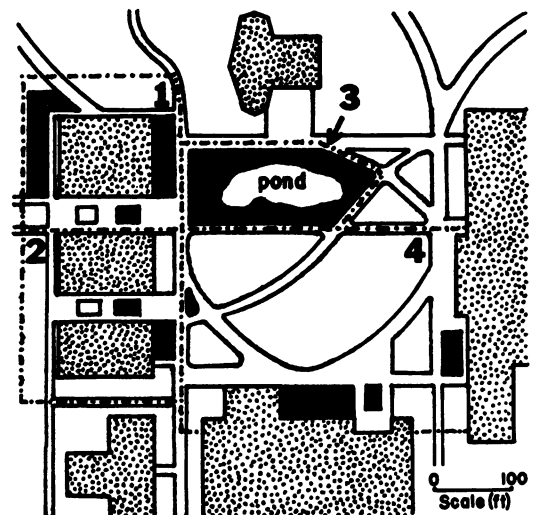
Subjects and Setting

The project was conducted at Robert F. Kennedy Youth Center (KYC), a federal prison in Morgantown, West Virginia. KYC houses 350 offenders from 13 to 28 yr of age. It is an open, coeducational facility, with modern buildings arranged in a campus-like setting. The students (inmates) have almost complete freedom to move about the institution. Cigarettes, soft drinks, candy, and paper goods were available as reinforcers in the general KYC program, and a considerable amount of litter generated from these products (*e.g.*, candy wrappers) was distributed on the grounds. There were many trash receptacles available, but litter remained a

serious and unattractive problem that prompted the administration of the center to search for noncoercive ways of controlling the situation. The assignment of students to chore details did little to alleviate the problem, in the opinion of the KYC administration.

Data Collection

Ten separate grass areas were monitored, but were grouped into four main areas for analysis in the multiple-baseline design employed in the study. Figure 1 shows the four areas and the monitored lawns within each. Litter counts were made on all 10 lawns each day, weather permitting. Counts were not made when there was snow on the ground or when the temperature was below freezing. The definition of litter was very similar to that used by Finnie (1973). Items were counted if they were as long, wide, or as great in volume as a closed matchbook. Broken glass that appeared to be from one bottle was counted as one piece. Items specifically not counted were: animal droppings, nails, string, wire less than 12 in. (31 cm) in length, cellophane tear strips and tops from cigarette packages, cigarettes, cigarette butts, rocks, twigs, or tabs from beverage containers. KYC students



■ Buildings ■ Monitored lawns - - - - Area boundaries

Fig. 1. The location of the four main areas and the monitored lawns within each.

were not informed of the definition of litter, or the exact areas being counted. Thus, litter of all sizes in the general area was collected.

A total of 32 counts was made during the 43 calendar days covered by the project. Primary counts were taken by one of two observers who had experience in counting litter. Both observers had participated in collecting pilot data. On 13 occasions, the primary counts were checked against those of a naive observer. Several different naive observers were used for the reliability counts. Naive observers stayed some distance away from the primary observers to avoid an artificially inflated correspondence in their data.

Interobserver agreement was calculated between the primary and naive observers' totals for the four areas for each of the 13 days ($N = 4 \times 13 = 52$ calculations). The smaller sum was divided by the larger and multiplied by 100, resulting in values that ranged from 62% to 100%, with a mean agreement of 91%.

Procedure

A baseline period was in effect for 17, 22, and 36 days, respectively, in Areas 1, 2, and 3. Area 4 remained a baseline-only control area throughout the experiment.

Area 1, which bordered on Cottage 1, was the first in which the experimental condition was implemented. Pieces of trash were collected, marked unobtrusively so as to be identifiable only to the experimenter, and surreptitiously placed in the area. Students in Cottage 1 (60 males) were informed by means of a flier that the area around their cottage was being planted with undetectably marked items of litter. Paper bags and a special trash can were placed in the cottage. Students could voluntarily pick up litter (on their own time, during free periods), place it in one of the paper bags provided, write their name on the bag, and deposit it in the designated trash can. The contents of the bag were inspected daily, and those students whose bag contained a marked item were given their

choice of a quarter or participation in one of a list of special privileges (of the 32 participants, 11 chose access to a weekend "coffeehouse", two chose late bedtime, all others chose the money). Students automatically received a quarter for each additional marked item in their bag on that day regardless of their initial choice, due to the difficulty of keeping track of a backlog of special privileges.

To test the possible effects of simply asking subjects to pick up litter, the original flier told students in Cottage 1 that Area 2 was also their "area of responsibility", although it would not be planted with marked items. Five days later a second flier informed these students that the planted area had been expanded to include Area 2.

Fourteen days later the experimental condition was implemented on Area 3, and a second cottage of students was involved. The arrangements were identical to those in the first cottage, except that money was the only available reinforcer (25¢ per marked item) due to the difficulty in arranging for special privilege access with the cottage administration. The students in Cottage 2 (70 males) were told of the exact location of the marked area because it was quite large and was several hundred yards from their cottage. They were also told that Area 4 was their "area of responsibility", although it would not be planted with marked items.

Marking Items

A variety of methods were used to mark items. Small tears in a particular pattern or a dot of ink were used on cigarette butts or paper items. Specific brands of match books or candy bar wrappers were noted and creased in an identifiable way. Colored paper was put through a paper shredder and the strips distributed. At least one but no more than four marked items were present on each grass island in the experimental phase after each day's litter count. Area 3 was an exception to this rule. Because of its large size, it was planted so as to have eight marked items present each day.

RESULTS

The number of pieces of litter for the four grouped areas across days is shown in Figure 2. Only primary counts were used in the analysis. The results for Days 17 to 22 in Area 2 and 36 to 43 for Area 4 showed that exhortation alone did not decrease litter. However, implementation of the marked item technique rapidly reduced litter in planted areas.

The mean number of pieces of litter was 106 for Area 1 in the 17-day baseline phase (range = 82 to 142, $N = 8$ counts). The mean dropped to 48 (range = 8 to 269, $N = 24$ counts) for the 26-day marked item phase. Litter in Area 2 was reduced from a mean of 164 pieces (range = 51 to 256, $N = 13$ counts) in the 22-day baseline phase to 20 (range = 2 to 112, $N = 19$ counts) for the 21-day marked

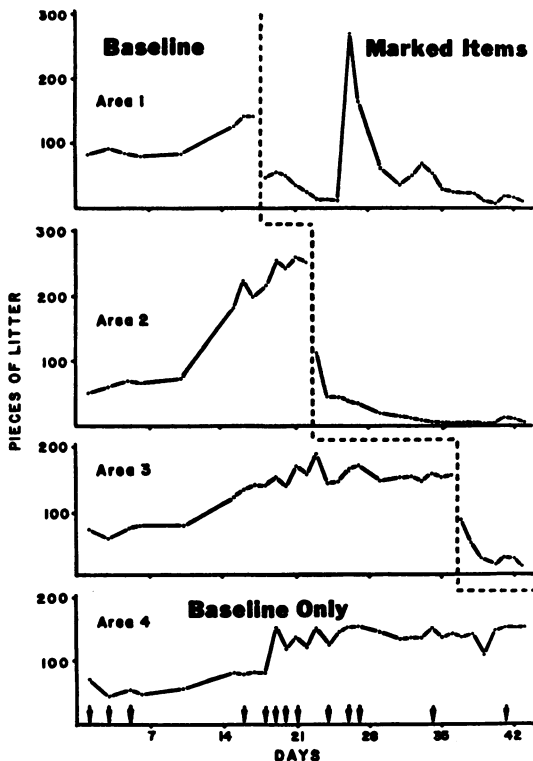


Fig. 2. Total pieces of litter on the monitored lawns in each area across days in the baseline and treatment phases. The small arrows above the abscissa for Area 4 indicate days on which reliability counts were made in all areas.

item phase. Area 3 went from a mean of 138 pieces (range = 73 to 188, $N = 25$ counts) in the 36-day baseline phase to 40 (range = 18 to 98, $N = 7$ counts) for the seven-day marked item phase. Expressed as a per cent of baseline litter, average reductions were 55, 88, and 71% respectively, in Areas 1, 2, and 3.

The peak in the litter count for Area 1 on Day 26 was due to a windstorm blowing over a trashcan full of paper strips. The data show that the trash was removed within three days. This inadvertent formal probe indicated that the low litter counts were due in part to the antilitter behavior generated and not to the elimination of littering. Whether actual littering behavior was affected by the marked item procedure cannot be determined.

Thirty-two persons participated in the project, many turning in several bags of trash. Thus, 25% of those eligible to participate did so. In addition to the special privileges, a total of \$14.50 was earned by the participants.

Of the 97 items planted, 71 (73%) were returned. The percentage of items returned was high due to the practice of waiting until items were picked up from the islands before new items were planted, thus avoiding a higher payoff for sporadic collection. If all the items planted had been picked up each day, a total of approximately 400 marked items would have been planted.

DISCUSSION

The dependent measure in the present study, like those of Powers *et al.* (1973) and Finnie (1973), was an actual count of the litter present, enabling a direct assessment of the impact of the technique on indigenous litter. The marked item technique appears to be an effective procedure for generating the removal of litter already on the ground.

Although there are no precise data on the rate of littering during the experiment, the design of the technique was such that littering could not have been reinforced. Each piece of

trash thrown down decreased the probability that any given piece would be a marked item. If littering stopped entirely, every piece of trash on the ground would be a marked item and worth money or special privileges. Thus, by controlling their littering behavior students could control the average amount of work needed to gain a pay-off.

Such a procedure should be contrasted with the more common practice of buying trash by offering an incentive for litter deposited at a designated point. Under such contingencies, if littering stopped, so would the pay-off. Thus, over the long term, more litter would actually have to be produced in order to maintain access to potential reinforcers.

The present procedure has an additional advantage over previously devised techniques. As pointed out by Burgess *et al.* (1974) and Chapman and Risley (1974), the size of litter collected can vary according to the litter control procedures used. In the present study, all litter, no matter how small, was a potential marked item. Thus, even cigarette butts and paper clips were collected and turned in. While very small items were not counted in the present study due to reliability concerns, the number of very small items turned in (including small marked items) indicated that the marked item technique generated the collection of all types and sizes of litter.

One might be tempted to simplify the procedures by telling participants that marked items are being planted, but actually paying off for bags of trash on a variable schedule without bothering to check for marked items. Such contingencies would eventually become clear, however. In the present study, at least two bags of trash were turned in that obviously did not contain any ground litter (*i.e.*, the trash was clean and dry). Had these instances of subversion resulted in a pay-off, they could have been expected to increase and ultimately jeopardize the effectiveness of the program.

The method of marking items was not entirely satisfactory, and could be improved. Each

bag had to be examined by a person who knew the type of marked items planted. While this took only about 5 min per day, in a very large-scale project (*e.g.*, city wide) such a procedure would be impractical. The use of clear fluorescent paint and a black light, isotopes and geiger counter, magnetic fluid or tape and a steel collector, or other materials enabling the mass screening of litter should make a very large-scale project feasible. If such a screening method could be found, it might be possible to automate the screening of trash and delivery of the reinforcer. Perhaps several automated bins could be placed in a city, for example, and reinforcers delivered mechanically for bags of trash containing the specially marked items. Even before the development of such marking methods, however, the procedure should be immediately applicable to institutions, parks, housing projects, and other small to medium-size programs.

The marked item technique seems to be a general procedure that may have wide applicability to various environmental eyesores or hazards. It would be possible, for example, to mark several junk cars throughout a county or state and pay persons reporting the presence of these cars a large bonus in addition to the small fee usually rendered. A similar incentive could perhaps be used for reinforcing the report of violations of antipollution laws or the removal of campaign posters after elections.

It should be noted that nothing in the procedure requires a sophisticated understanding of reinforcement techniques. In fact, unlike Clark *et al.* (1972) and Chapman and Risley (1974), there was not even the necessity of personal contact with the participants and, therefore, any particular social skills were not a variable. The program was promulgated by means of fliers and with the exception of the collection of data could be run routinely by nonresearch personnel with a minimum of training.

The effectiveness of the marked item technique for litter control, especially in the long run, needs to be compared with other litter

control procedures, and its cost effectiveness (in parks and other more traditional settings) calculated. It compares favorably with the percentage reduction obtained in the "payment-for-clean-yards" condition (68% of baseline litter eliminated) by Chapman and Risley (1974) and is superior to their findings of a 28% reduction under "payment-for-volume" conditions. In terms of cost, one important advantage of the marked item technique over other incentive procedures is that the program administrator can control the upper limit of funding by controlling the number of items marked. Further, the program administrator can deal with special problem areas by varying the density of marked items, weighting the areas according to importance.

Application of the experimental analysis of behavior has led to major strides in the development of methods of modifying environmentally relevant behavior, especially littering. One of the main tasks ahead is to begin to refine these procedures and to expand them to more vital environmental problems.

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