

## PROMOTING PAPER RECYCLING ON A UNIVERSITY CAMPUS\*

E. SCOTT GELLER

JEANNE L. CHAFFEE

RICHARD E. INGRAM

*Virginia Polytechnic Institute and State University*

### ABSTRACT

Behavioral effects of an individual and a group reinforcement contingency for encouraging paper recycling were compared. During a Raffle condition residents of university dormitories were given a lottery coupon upon delivering at least one sheet of paper to a designated collection room. In contrast, a Contest contingency provided \$15 for the treasury of the dormitory whose residents collected the most paper in a week. During the Raffle and Contest contingencies, nearly twice as much paper was delivered to the collection centers at designated times than during Baseline. The greatest number of paper deliveries was consistently made during the Raffle contingency, although nearly twice as many deliveries were made during the Contest condition as during Baseline. The Procedures and results implied that community programs for recycling solid waste materials would be practical, economical, and efficacious.

It has been estimated that the average American disposed of approximately five and one-half pounds of solid waste per day in 1970 and by 1980 this daily rate of waste disposal is expected to reach eight pounds [1]. Indeed much of this daily waste material can be reused in the production of new commodities, but recycling requires a "reverse-distribution process" wherein the household consumer becomes the first (rather than the last) link in the distribution channel [2]. Hence, foremost among the problems in implementing a practical recycling system is the development of economical pro-

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cedures for getting reusable waste from the consumer to a Recycle Center capable of transporting large quantities of reusable materials to appropriate industries. For example, The American Paper Institute has estimated that more than 90% of the cost of recycling paper is the cost of redistributing used paper from consumer to paper mill [3]. Consequently, given the occurrence of periodic paper shortages and the ecological need to save trees, the development of methodologies for recycling paper products is a special problem demanding immediate attention. The present research was designed to study two large-scale behavioral technologies for initiating a reverse-distribution process of paper.

A majority of the recent applications of behavioral technology to ecology have focused on environmental clean-up and may be dichotomized according to which aspect of an operant learning paradigm was emphasized: a) the discriminative stimulus preceding the desired response or b) the positive reinforcer consequating the desired response. Approaching litter control by manipulating the environmental conditions preceding opportunities to litter, Finnie [4] decreased littering by increasing the number of trash receptacles along a highway and a city sidewalk; Dodge [5] increased the frequency of appropriate waste disposals in a small community by instituting an antilitter campaign with informative pamphlets, newspaper announcements, promotion posters, and window displays, Geller [6, 7] and Geller, Witmer and Orebaugh [8] increased the proportion of handbills deposited in trash receptacles by including antilitter instructions on distributed handbills.

Several recent investigators have applied the principle of positive reinforcement in economical, litter-control programs. For example, Burgess, Clark, and Hendee [9] motivated children to pick up litter from a movie theater by offering 10 cents or a movie ticket for a bag of litter; Clark, Burgess, and Hendee [10] induced children to collect litter from a large forest campground by promising them a choice from a variety of small prizes; Powers, Osborne, and Anderson [11] influenced visitors to gather litter from an unsupervised U.S. Forest Service area by consequating certain litter collecting with 25 cents or a lottery ticket; Kohlenberg and Phillips [12] provoked some patrons at a free-admission zoo to deposit litter in a particular trash barrel by intermittently reinforcing such behaviors with a ticket exchangeable for a soft drink; and Chapman and Risley [13] motivated children to collect litter from the yards in an urban low-income housing project by offering 10 cents for cleaning a yard to specified criteria.

In addition to environmental clean-up, two other categories of ecology-related behaviors have been modified with operant technology. Geller, Wylie, and Farris [14] and Geller, Farris, and Post [15] applied prompting procedures to increase the probability that grocery-store patrons would purchase their soft drinks in returnable rather than throwaway bottles; and Everett,

Hayward, and Meyers [16] applied both prompting and reinforcement to increase the probability that university students would ride a particular campus bus. The present study applied procedures of prompting and reinforcement to increase yet a fourth ecology-improving response pattern: the response of bringing paper materials to a campus Recycle Center during certain critical time periods. In the study by Everett et al., bus ridership was prompted with advertisements in the campus newspaper and reinforced with tokens (exchangeable for a variety of back-up reinforcers) when students boarded a specially marked bus. Analogously, in the present study college students were prompted to bring paper to a campus Recycle Center by means of posted announcements and were rewarded for delivering paper to a Recycle Center under either an individual or a group reinforcement contingency. Economics and large-scale practicality were considered in the contrivance of these contingencies so that the present investigation might provide information for developing community programs to serve an urgent ecological function: the recycling of solid waste.

## Method

### SUBJECTS AND SETTING

The residents of six dormitories (dorms) on the campus of Virginia Polytechnic Institute and State University served as subjects. The dorms were located as three pairs, matched on the basis of resident population and interior floor plan. One dorm of each pair housed only males and the other housed only females. The relative proportions of students at each class ranking were approximately equivalent across all dorms, with a majority of freshmen and a minority of seniors.

All large dorms on the VPI & SU campus (i.e., a total of 23) had one room designated as a paper-collection center, and throughout the school year students were to bring paper to that room (e.g., newspapers, magazines, computer readout). Every Saturday a group of students, forming a Committee for Ecological Rebalance (REBAL), collected the paper that was stored in each dorm's collection room and sold it to a paper mill at \$15 per ton. The paper-collection rooms for the three pairs of dorms in this study were located in the basement of each building, and also served as the students' storage area.

For four months preceding the present study and throughout the six weeks of the present investigation special 76.2 × 81.4 cm posters were tacked to the bulletin boards on each dorm floor and conveyed a general plea for paper recycling as well as the location of the dorm's collection room. For the six dorms in this study the REBAL poster was placed on four to seven bulletin boards per floor and on the door to the collection room. Also, for certain weeks a special 21.6 × 35.6 cm poster announcing a contingency contrived to

increase paper recycling was located next to each of the REBAL posters in the experimental dorms. Periodically (at least twice a week) the condition of these posters in the six experimental dorms was checked and posters were replaced when necessary.

**EXPERIMENTAL CONDITIONS**

In each dorm three different experimental conditions occurred for two consecutive weeks, and the three different two-week periods alternated among the three dorm-pairs according to a Latin Square design. Thus as shown in Figure 1, each of the three conditions occurred once at each dorm-pair and once at each of the three possible two-week periods.

		LATIN		SQUARE		DESIGN			
		(BETWEEN SIX CAMPUS DORMITORIES)							
		B = BASELINE		R = RAFFLE		C = CONTEST			
		MILES	JOHNSON	LEE	WEST AJ	WILLIAMS	SHANKS		
		222	185	845	902	332	303		
		MEN	WOMEN	MEN	WOMEN	MEN	WOMEN		
WK	1	B	B	R	R	C	C	WK	1
WK	2	B	B	R	R	C	C	WK	2
WK	3	R	R	C	C	B	B	WK	3
WK	4	R	R	C	C	B	B	WK	4
WK	5	C	C	B	B	R	R	WK	5
WK	6	C	C	B	B	R	R	WK	6

Figure 1. The Latin Square variation of three, two-week experimental conditions among three pairs of dorms. The resident population of each dorm is given below its name.

For **BASELINE**, the situation in the pair of dorms was exactly as it had been during the previous four months, except that one or two data recorders sat at a desk in the paper-collection room from 5:00 to 7:00 p.m. on each weekday (Mon. thru Sat.) and received the paper brought by students with a verbal "Thank you." Whenever someone asked what they were doing, the data recorders replied that they were helping the campus **REBAL** committee with their paper-recycling program.

For the **CONTEST** condition, 21.6 × 35.6 cm posters announcing a paper recycling contest between two particular dorms were tacked next to the larger **REBAL** posters of the relevant dorm-pair. This poster emphasized that the contest was between a men's and a women's dorm, that paper should be brought to the collection room Monday thru Saturday between the hours of 5 and 7 p.m., that the winning group would receive \$15 for their dorm's treasury, and that specific contest rules were posted on the door to the collection room. The announcements for a particular contest were posted on Saturday evenings (7:30 p.m.) and removed on the following Saturday.

As shown in Figure 2 the Contest rules (posted on the collection-room door) specified the type of paper materials accepted, the time that paper would be received, the time period for each of two contests between two dorms, and the nature of the reward for the winning dorm. The \$15 reward for the winning dorm was procured from funds earned by selling the collected paper to a paper mill at \$15 a ton.

During the **RAFFLE**, two data recorders sat at a table in the collection rooms from 5 to 7 p.m. and rewarded each student with a raffle coupon when bringing at least one 21.6 × 27.9 cm sheet of paper or a cardboard box to the collection room. These coupons were purchased from the Standard Theater Supply Company (Greensboro, N.C.) at \$3 per 1000, each coupon consisting of a pair of theater-type tickets with identical six-digit numbers and a space for the contestant's name.

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### RULES FOR RECYCLING *CONTEST*

1. ONLY PAPER MATERIALS WILL BE ACCEPTED (e.g., NOTEBOOK PAPER, NEWSPAPERS, MAGAZINES, COMPUTER OUTPUT AND CARDBOARD BOXES).
  2. MATERIALS MAY BE BROUGHT TO THIS LOCATION BETWEEN THE HOURS OF 5 AND 7 P.M. MONDAY THROUGH SATURDAY.
  3. THE DORM WITH THE MOST POUNDS PER CAPITA WILL WIN.
  4. THE WINNING DORM WILL RECEIVE \$15 WITH WHICH TO DO AS IT WISHES.
  5. CONTEST 1—MONDAY TO SATURDAY *Feb. 18th-23rd*  
CONTEST 2—MONDAY TO SATURDAY *Feb. 25th-30th*.
  6. THE WINNING DORM FOR EACH WEEK WILL BE ANNOUNCED IN THE *COLLEGIATE TIMES*.
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Figure 2. The rules for the Contest condition that were posted on the collection-room door during the two, one-week contests at each dorm.

The Raffle condition for a pair of dorms was announced with 21.6 X 27.9 cm posters positioned next to the REBAL posters on the relevant dorm bulletin boards. This poster indicated the procedure for obtaining raffle tickets and the location of the raffle rules. The Raffle rules were located on the collection-room door and as shown in Figure 3 included a specification of the contingency for obtaining raffle coupons and selecting prizes, the day and time of the raffle drawing, and a list of the four prizes for each of the two weekly raffles.

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### RULES FOR RECYCLING RAFFLE

1. ONLY PAPER MATERIALS WILL BE ACCEPTED (e.g., NOTEBOOK PAPER, NEWSPAPERS, MAGAZINES, COMPUTER OUTPUT AND CARDBOARD BOXES).
2. EACH INDIVIDUAL PARTICIPATING MUST BE A RESIDENT OF THIS DORM.
3. MATERIALS MAY BE BROUGHT TO THIS LOCATION BETWEEN THE HOURS OF 5 AND 7 P.M. MONDAY THROUGH SATURDAY.
4. ONE COUPON WILL BE GIVEN TO EACH INDIVIDUAL PER VISIT (VISIT = A TRIP TO THE COLLECTION POINT AND DELIVERY OF AT LEAST ONE 8 ½ X 11 IN. SHEET OF PAPER OR A CARDBOARD BOX).
5. RAFFLE 1—MONDAY TO SATURDAY *Feb. 18th-23rd*  
RAFFLE 2—MONDAY TO SATURDAY *Feb. 25th-30th*
6. FOUR PRIZES WILL BE AWARDED PER RAFFLE (THE FIRST PLACE WINNER WILL CHOOSE AMONG 4 ALTERNATIVES, THE SECOND PLACE WINNER AMONG THE REMAINING 3 ALTERNATIVES, ETC.).
7. THE DRAWING WILL BE HELD SATURDAY EVENING AT 7:00 P.M.
8. PICTURES AND NAMES OF THE WINNING INDIVIDUALS WILL APPEAR IN THE *COLLEGIATE TIMES*.
9. PRIZES FROM WHICH THE WINNERS MAKE THEIR SELECTIONS ARE:

WEEK 1	WEEK 2
<ol style="list-style-type: none"> <li>1. <i>\$10. Parsons Table From Guynn Furniture</i></li> <li>2. <i>\$10. Gift Certificate From Davidson's Men's Store</i></li> <li>3. <i>\$10. Food Certificate From Mr. Fooz</i></li> <li>4. <i>\$2.50 Food Certificate From Ray's Hamburger</i></li> </ol>	<ol style="list-style-type: none"> <li>1. <i>\$30. Sleeping Bag From Appalachian Outfitters</i></li> <li>2. <i>\$10. Food Certificate From That Steak Place</i></li> <li>3. <i>\$10. Gift Certificate From TG&amp;Y</i></li> <li>4. <i>\$2.00 Dinosaur Necklace From The Turtle</i></li> </ol>

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Figure 3. The rules for the Raffle condition that were posted on the collection-room door during the two, one-week raffles of each dorm. The prizes listed were those for the last two raffles, of the project (i.e., the raffles for Williams and Shanks).

The twenty-four raffle prizes for the present study were donated by local merchants in the town of Blacksburg, Va. The value of these prizes range from \$2 to \$30 with a mean value of \$8.98, and the nature of these prizes

varied considerably as the following examples illustrate: sleeping bag (\$30), photo portrait (\$17), lamp (\$15), leather belt (\$12), candle (\$12), tennis set (\$10), steak dinner (\$10), styled haircut (\$4.50), gallon of apple juice (\$2), dinosaur necklace (\$2). Four prizes were assigned to each of the six raffles in an attempt to balance the prize-values across weeks. For the first five weeks the prizes were balanced quite well with the mean weekly prize-value ranging from \$7.25 to \$8.50. However, for the sixth raffle the average value of the four prizes was \$13.00 due to the extremely high value of one prize (i.e., a \$30 sleeping bag).

The raffle prizes were donated as the result of solicitation by the authors. More specifically, the authors made personal contacts with the owner (or manager) of 31 different business enterprises in Blacksburg: including clothing stores, restaurants, grocery stores, gift shops, pharmacies, furniture stores, a hair stylist, and a bicycle shop. The solicitors asked for a contribution to a worthwhile, campus project: a project to find ways of solving the pressing problem of a paper shortage. The business managers were told that each week the campus newspaper would publish a picture of the first-place raffle winner receiving his prize from the business that donated the first prize and would mention the names of each contributing merchant for that week. In addition, the solicitors promised that after six weeks a report of the recycling program would be written (listing the names of all contributing merchants) and submitted to the local newspapers. Of the 31 merchants contacted, 23 donated at least one raffle prize.

## DATA RECORDING

From 5 to 7 p.m. at least one data recorder sat at a table in each of the six collection rooms and recorded the individual contributions of each student. For the Raffle condition, two data recorders were always available so that the additional procedural details for this condition could be handled conveniently and reliably. The data recordings for each collection session were made on a special daily data form that included the following frequency categories:

1. the number of visits, i.e., the number of times a student entered the collection room and delivered at least one  $21.6 \times 27.9$  cm sheet of paper or a cardboard box,
2. the number of repeated visits per individual i.e., the frequency of repeated paper deliveries by each individual within the two-hr. collection period,
3. the number of visitors, i.e., the frequency of different students to enter the collection room with an appropriate paper contribution within a given two-hr. session,
4. the weight of *regular* paper, i.e., the paper contributed during the two-hr. period, figured to the nearest pound, and

5. the weight of *extraneous* paper, i.e., the paper contributed on a given day but not within the two-hr. collection period.

The *extraneous* paper was that found outside the locked door of the collection rooms when the data recorders reported for duty at 4:45 p.m.

At the end of the daily collection period, the data recorder and the collection-room manager weighed the *regular* and *extraneous* paper with a common bathroom scale. When a day's paper contribution was small (i.e., less than ten pounds) the weight was derived by the data recorder weighing himself with and without the paper in possession and the weight difference was recorded as the weight of the paper. The daily weighings of both *regular* and *extraneous* paper were only made twice if both results were similar or repeated until two results matched. After a day's collection was weighed, the *regular* and *extraneous* papers were stacked separately with the rest of the week's contributions. When the campus REBAL committee arrived to collect the paper at the end of each week (i.e., on Saturday evening), the room manager and one of the authors weighed the *regular* and *extraneous* paper for the week and recorded the results on a summary data sheet.

#### MEASUREMENT RELIABILITY

All weight measurements were taken in the presence of at least one observer, and the weighing procedure for particular paper was repeated until two results matched. It was never necessary to repeat the weekly weighings more than thrice. The sum of the daily weighings was remarkably similar to the weekly weights even though the daily weighings were rounded to the nearest pound. In particular, the weekly weights were within three pounds of the sum of the respective daily weights for 78 per cent of the weighings, and the difference between the weekly weighings and the corresponding seven-day totals was never greater than six pounds. For the analyses of the weekly data, the weights derived at the end of each week were used rather than the sum of daily weights.

The relatively low rate of visits made it possible to reliably record the visitation frequency. The frequency of repeated visits was easily recorded since relatively few individuals made repeated visits, and when repeated visits occurred they usually did so in large blocks within a short time span and were often accompanied with an appropriate verbal expression like, "Hello, again, I'm back." Indeed, repeated visits were only prominent during the Raffle condition and the procedure for that condition provided for a reliability check. That is, the number of daily coupons with the same name represented the frequency of repeated visits by a particular individual; while the number of coupons on a given day with different names indicated the visitor frequency. Comparing the daily tabulations of visits and visitors with the results of daily coupon-counts demonstrated measurement reliability. Specifically, the two measurement



procedures gave exact results on 94 per cent of all comparisons, and were never different by more than three.<sup>1</sup> In all cases, the daily tabulations by the data recorders were used for the analysis of visit and visitor frequency.

## PERSONNEL

The authors were the field supervisors of the present study and checked the research activities during every 2-hour collection period and the summary measurements at the end of each week. Six room managers, advanced undergraduate students in psychology, were directly responsible for all experimental procedures in their assigned dorm. Included among their duties were: keeping the *regular* and *extraneous* paper organized, instructing and supervising the daily procedures of the data recorders, verifying the daily measurements, changing and replacing the dorm posters that prompted paper recycling, maintaining a complete log of the daily research activities occurring in their collection room, and attending weekly seminar meetings with the field supervisors to discuss methods and results of the ongoing program. The work of the room managers fulfilled the major requirements for an advanced undergraduate research course.

The data recorders were undergraduate students from two large social psychology classes taught by the first author. The data recording for two 2-hour collection sessions fulfilled a class requirement. For their social psychology course, the data recorders were required to write an evaluation of their field experience, describing any unusual and/or interesting observations.

## Results

### POUNDS OF PAPER

For each dorm-pair, Figure 4 depicts the total pounds of paper collected each week, with the parameter referring to the time when the paper was delivered, i.e., *regular* paper delivered between 5 and 7 p.m. Mon. thru Sat. (when data recorders were on duty) versus *extraneous* paper delivered at all other times.<sup>2</sup> Regardless of the order of the three experimental conditions, more paper was delivered between 5 and 7 p.m. during the Raffle and Contest than during Baseline, and there was a tendency for more *extraneous* paper to be delivered when no contingencies were in effect (i.e., during Baseline).

<sup>1</sup> Most of the disagreements between the data recorders' tabulations and daily coupon-counts were due to a few students writing illegible or incorrect names on the lottery ticket.

<sup>2</sup> Comparisons between the daily measurements showed no consistent variations as a function of the day of the week.

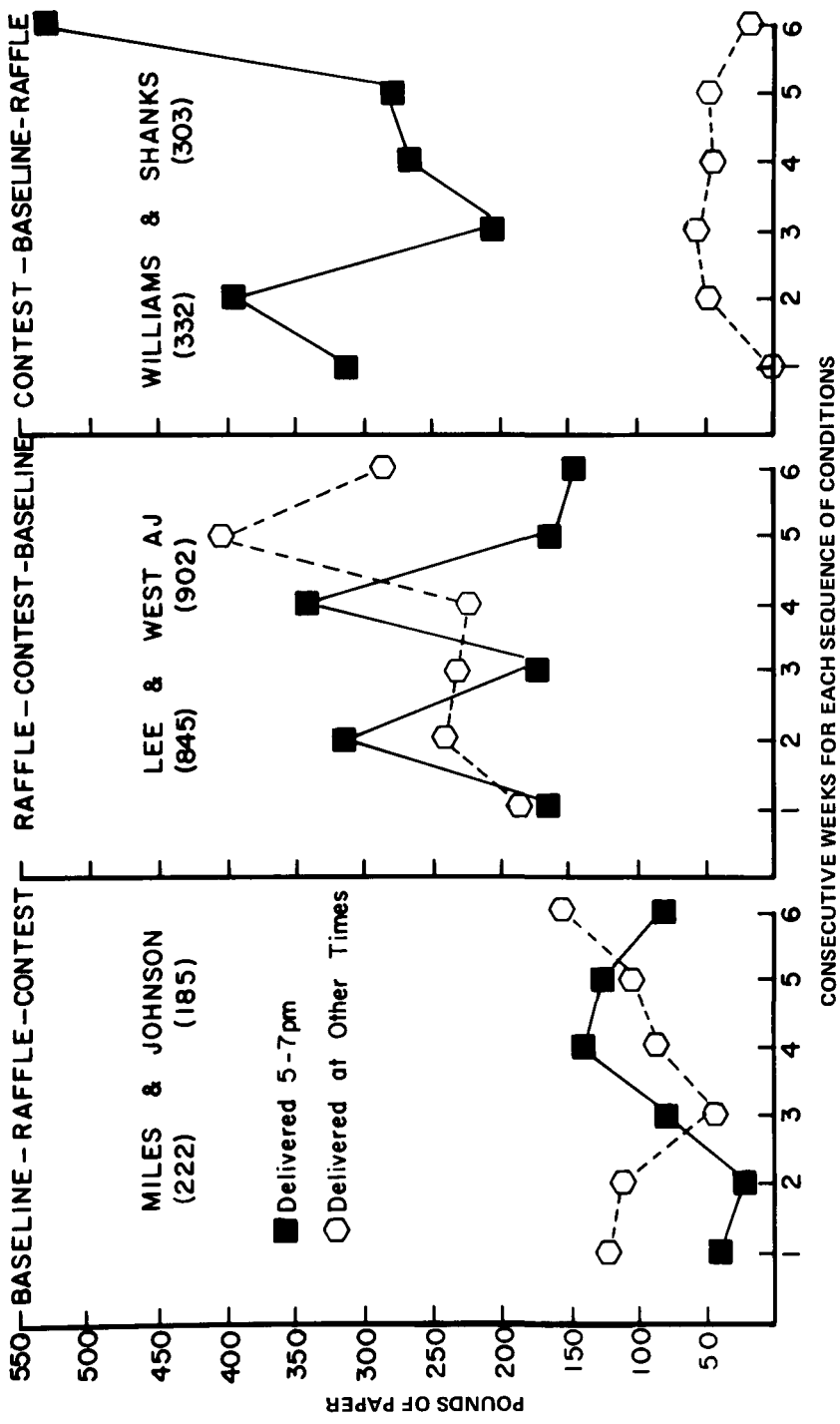


Figure 4. The total pounds of paper collected for consecutive weeks at each pair of dorms.

For the six-week study, the total pounds of paper delivered Mon. thru Sat. from 5 to 7 p.m. was 845 during Baseline, 1420 during the Contest, and 1515 during the Raffle; while the total pounds of paper brought to a collection room at other times was 1050 during Baseline, 765 during the Contest, and 605 during the Raffle. Thus, the Contest and Raffle conditions increased the probability that paper would be delivered during a particular time period and decreased the probability of paper-delivery at other times. It is noteworthy that the pounds of *regular* paper delivered were prominently greater during the second than the first week of a Contest or Raffle (except for the contest between Miles and Johnson). Also of interest is the observation that the greatest weekly total (i.e., 529 pounds) occurred during the second raffle for residents of Williams and Shanks, when the most valuable prize was raffled off (i.e., a \$30 sleeping bag).

The average amount of paper delivered to the collection room in one visit was studied by dividing the weekly totals for each dorm by the respective number of weekly visits, and then comparing the men and women dorms for each experimental condition by averaging the appropriate weekly means. Note that the weekly visits for a given dorm included the repeated visits of each weekday. As shown in the left graph of Figure 5 the average amount of paper delivered per visit was markedly smallest during the Raffle condition, and was slightly greater during the Contest than during Baseline. Sex effects are suggested by the observation that in five out of six cases the average weight of paper per visit was slightly higher for men than for women.

The right graph of Figure 5 depicts the average weight of paper collected during each of the two weeks of the experimental conditions, with a control for the differing number of residents in each dorm. That is, the weekly weight totals for each dorm were divided by the respective number of residents per dorm, and for each experimental condition the weekly pounds of paper per capita were averaged separately for the men and women dorms. As illustrated in the right graph of Figure 5, the mean amount of paper collected per capita was generally larger for men than women, was larger during the Contest and Raffle than during Baseline, and was consistently larger during the second than the first weeks of the Contest and Raffle.

Comparisons between the left and right graphs of Figure 5 indicate that a relatively low proportion of dorm residents actually brought paper to their collection room. That is, when the weekly amounts of collected paper were adjusted to account for the dorm population, the values were much lower than the average amount of paper carried to the collection room per delivery (e.g., an overall average of .278 pounds of paper per capita versus an overall mean of 4.65 pounds of paper per visit). The low percentage of resident participation was even more obvious from a study of the daily frequency of visits and visitors to the collection room.

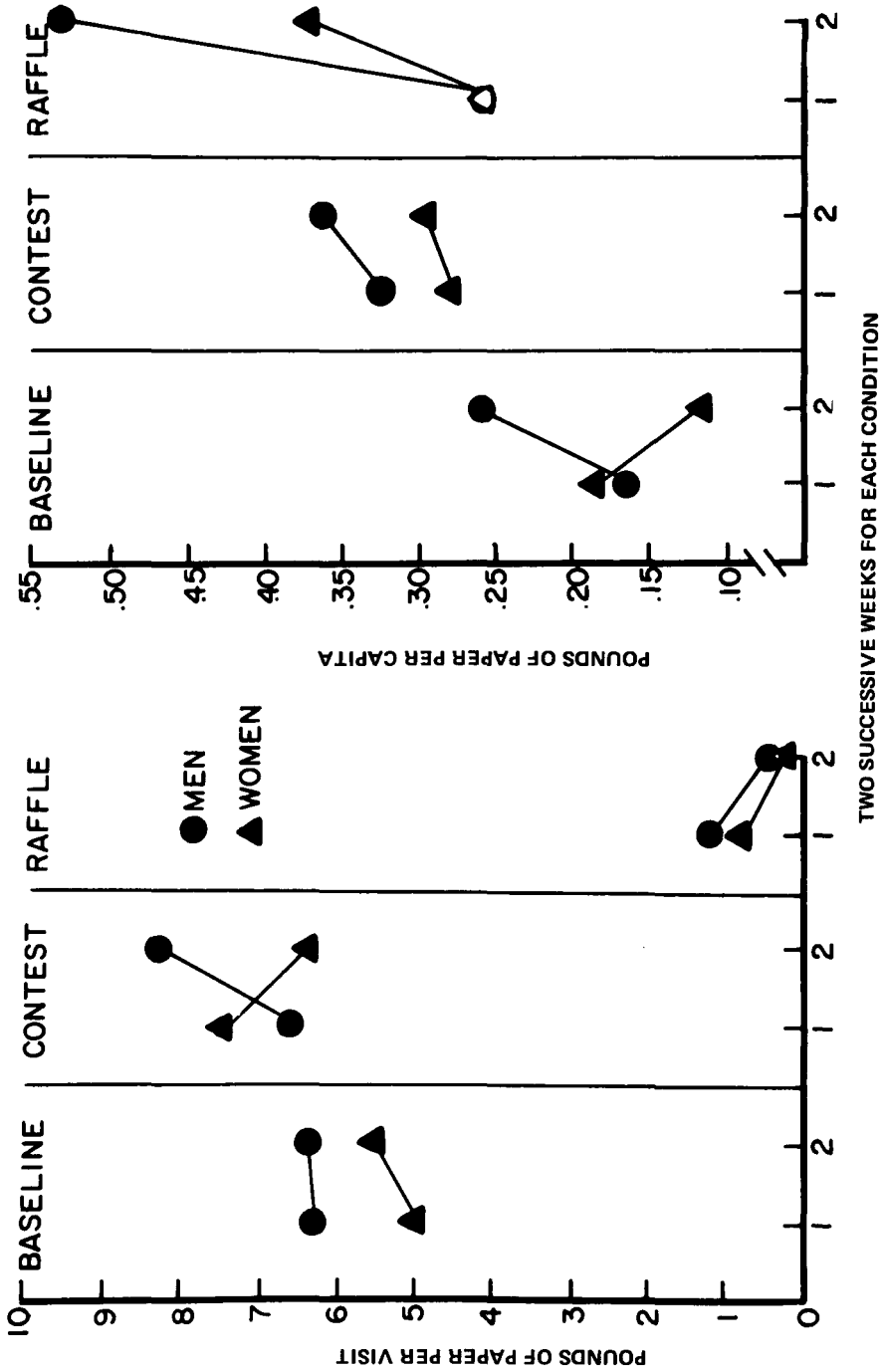


Figure 5. Pounds of paper per visit and per capita, averaged across the three men and the three women dorms for the two weeks of each experimental condition.

## VISITS AND VISITORS

A visit was defined by any individual's delivery of at least one 21.6 × 27.9 cm sheet of paper or a cardboard box to the collection room between the hours of 5 and 7 p.m., Mon. thru Sat. On the other hand, the number of visitors during a particular collection session was determined by counting the number of different individuals that made paper deliveries on that day. The average frequency of weekly visits and visitors per dorm-pair was calculated by totalling the visits and visitors across each pair of dorms and dividing by two; and as shown in Figure 6, a prominent difference between the number of visits and visitors was only apparent for the Raffle condition. Regardless of the order of the experimental conditions, the mean numbers of weekly visits and visitors were prominently greatest during the Raffle condition. For both the Baseline and Contest conditions few individuals made more than a single paper delivery in one day, but the average number of weekly visitors was markedly greater during the Contest than during Baseline for two out of three dorm-pairs. The overall total number of visitors and visits respectively for each of the experimental conditions was as follows: Baseline—124 and 126, Contest—204 and 233, Raffle—406 and 9744.

For consecutive weeks in each experimental condition the frequencies of weekly visitors were summed separately for the men and women dorms and means were calculated. The left graph of Figure 7 depicts these means, illustrating a prominently greatest frequency of visitors during the Raffle condition. The average number of weekly visitors was greater for women than men during the Contest and Raffle conditions, but not during Baseline.

The right graph in Figure 7 was determined by dividing the weekly visit totals by the number of weekly visitors for each respective dorm and then calculating the average weekly visits per visitor for the men and women dorms. During the Baseline and Contest conditions few men and women made more than one visit per day, but repeated visits in one day were common during the Raffle. A finer analysis of this data showed that the mean numbers of visits per visitor during the Raffle condition are inflated because several individuals made great numbers of repeated visits. For example, 24 men made more than 80 repeated visits in a single day, the five largest frequencies of repeated visits being 290, 230, 220, 165, and 145. Likewise, during the Raffle condition 18 coeds made more than 80 visits per day with the highest frequencies being 270, 219, 193, 175, and 164. It is noteworthy that 27 of the 42 "greater-than-eighty" repeated visits occurred during the last raffle when the \$30 sleeping bag was a prize. Consequently, the two graphs of Figure 7 indicate that a relatively low-number of different individuals brought paper to the collection room each day, and that the Raffle provoked several individuals to make repeated paper deliveries.

The majority of repeated visits occurred in a short period of time as a long

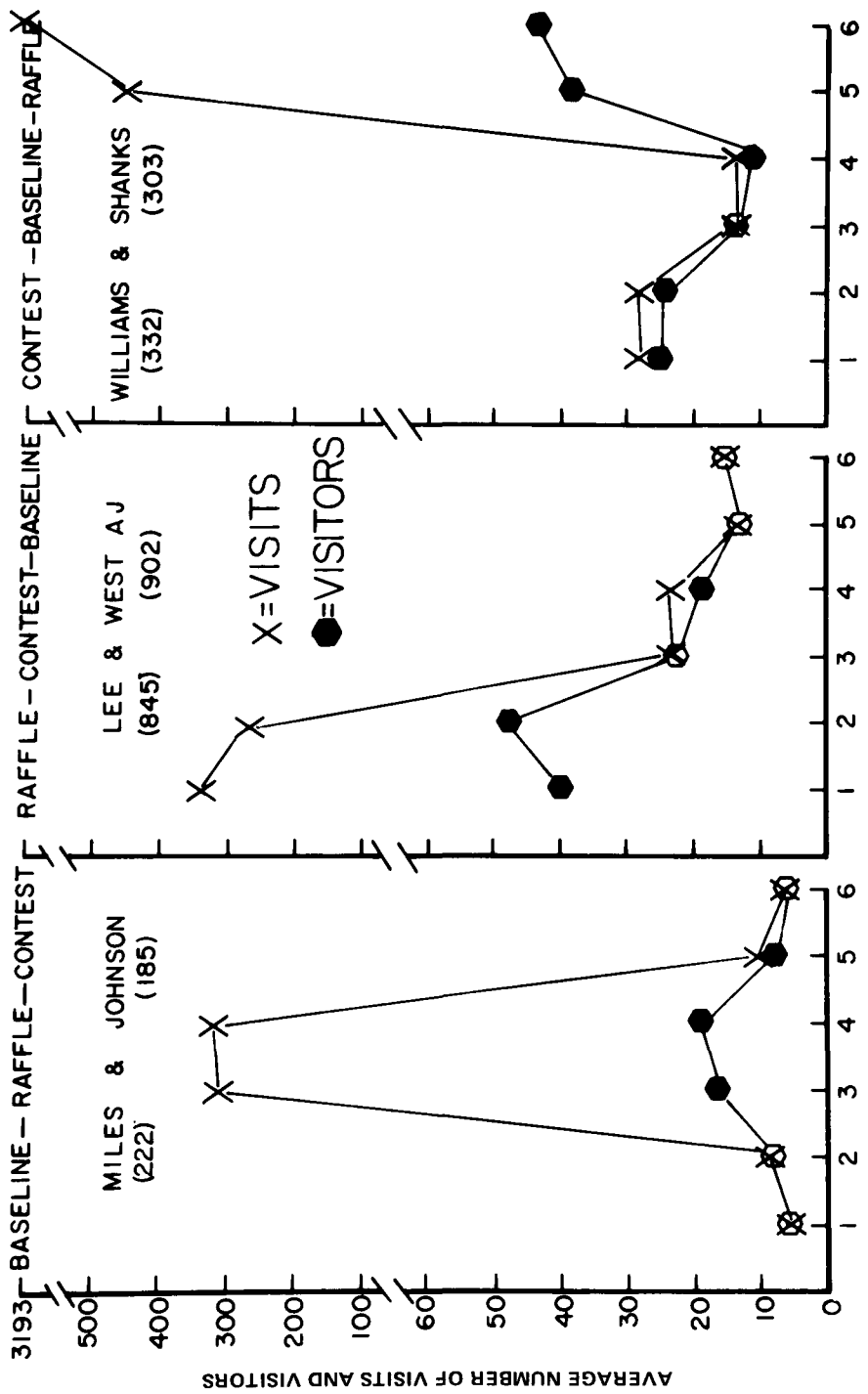


Figure 6. The average number of weekly visits and visitors for each pair of dorms.

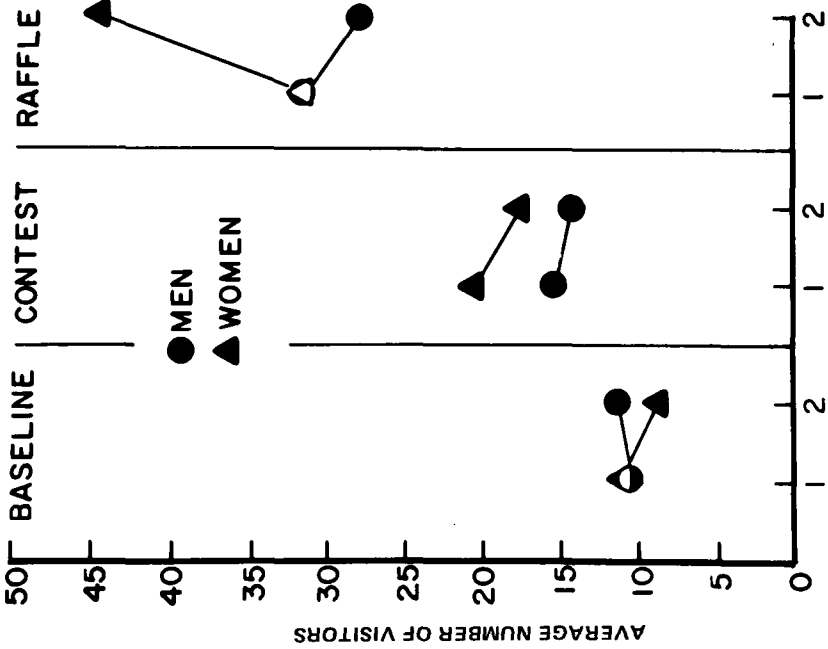
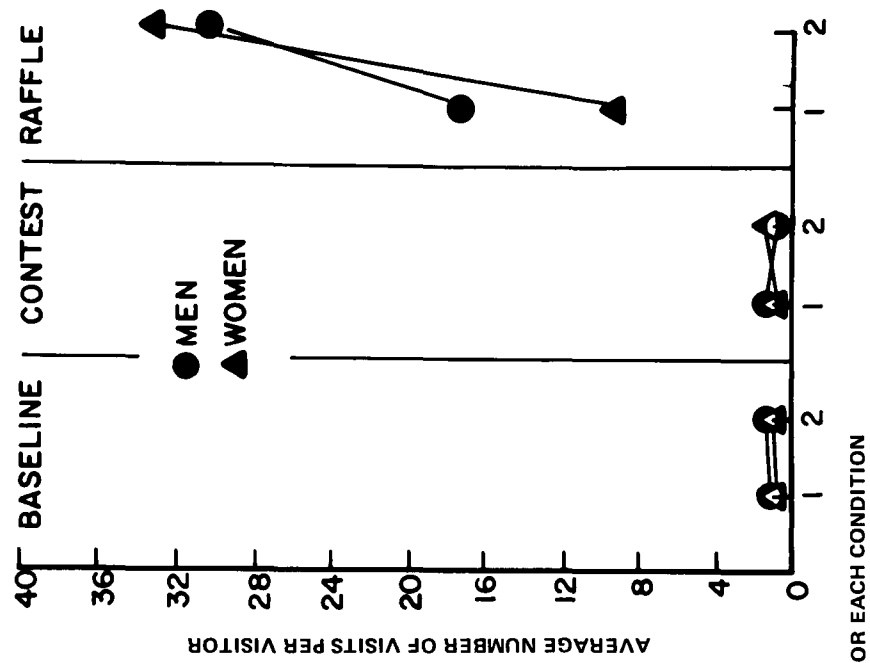


Figure 7. The frequency of visitors and visits per visitor, averaged across the three men and the three women dorms for the two weeks of each experimental condition.

chain of responses. Specifically, the repeater typically started a series of paper deliveries by stacking his paper in the hall adjacent to the collection room entrance, and then proceeded to walk in and out of the collection room with deliveries of single sheets of paper. The chain of responses for each delivery was as follows:

1. the resident picks one sheet of paper from the stack, often tearing a page from a magazine or a newspaper,
2. carries the sheet of paper into the collection room and places it on top of a designated pile of paper,
3. receives a raffle coupon from the data recorder,
4. signs his name to one half of the coupon,
5. tears the coupon along the perforated line,
6. drops the half with his signature into the raffle box, and
7. leaves the collection room to pick another sheet of paper from the stack in the hall, thus initiating another chain of delivery responses.

Modelling effects were clearly implicated by the frequent observation that a student bringing a stack of paper to the collection room would see the behavior pattern of a repeater and then instead of delivering his whole stack at once, he would place it in the hall and become a repeater. Such modelling behavior was typically preceded with verbalizations like, "Is that fair?" or "So that's how to beat the system."

## Discussion

The general results of the study were neither unusual nor unexpected, but demonstrated the efficacy of applying simple reinforcement principles to improve ecology. Both the Raffle and the Contest contingencies increased the amount of paper delivered at times when reinforcers were available. The probability of a paper delivery was highest during the Raffle condition because that was the contingency which most directly reinforced the actual behavior of bringing paper to the collection room (i.e., a raffle coupon consequated a visit). Indeed the emphasis on the visit itself rather than the paper contribution in the Raffle contingency resulted in vast numbers of repeated visits with minimal amounts of paper. Under the group contingency (i.e., the Contest) the reinforcer was dependent upon the amount of paper contributed, and although the difference between the frequency of collection-room visits during Contest and Baseline was not nearly as large as that between Raffle and Baseline, the total amount of paper collected during the Contest contingency was almost equivalent to that collected during the Raffle contingency, and was almost twice as large as that collected during Baseline. Consequently,



the results of the experimental manipulations in the present field study were predictable by the particular nature of the reinforcement contingency prescribed by the rules of the Contest and Raffle.

The finding that the contrived contingencies had greater effects during the second rather than the first week of each condition suggests the importance of prompting techniques in large-scale applications of behavioral technology. Thus, it is probable that more dorm residents were aware of the particular reinforcement contingency during the second weeks of the Contest and Raffle. Just as the success of positive reinforcement procedures for increasing bus ridership [17] and litter pick-up [18, 19] was dependent upon the investigators' ability to make the public aware of the behavioral contingencies (through newspaper advertisements or printed signs), so were the affects of the present contests and raffles dependent upon the number of dorm residents that became aware of the particular paper-recycling contingencies. Actually it is possible that a minority of the dorm residents learned of the reinforcement contingencies, given the limited prompting and the brevity of each contingency. Thus, the relatively low number of program participants may have been due to a lack of contingency *awareness* rather than a lack of contingency *effectiveness*.

In the authors' opinion, the utility of the present research rests on the demonstration of an economical plan for inducing large-scale recycling of resources. The only expense in the present recycling project was manpower. The contest money was procured by selling the collected paper to a paper mill, and the raffle prizes were donated by community merchants, presumably in return for expected "good will" to accompany their public association with an ecological rebalance program. Certainly some of the procedures implemented in the present study could be applied successfully and economically in community-wide programs for recycling resources. For example, community paper-recycling centers might offer lottery coupons for particular amounts of paper, and given the behavioral effects of the raffles in the present study and the results of a lottery system for motivating environmental clean-up [20], such a contingency should provoke a substantial number of paper deliveries. As a result of the present investigation the authors predict that community merchants would willingly donate raffle prizes, and that local newspapers would not only print free advertisements of the program contingencies but would also publish the names and pictures of both donators and winners of raffle prizes. Thus, with the availability of community support (following tactful solicitation) and model techniques for modifying ecology-related behaviors on large scales [21-29] the most challenging feature of the urgent task to implement community programs for increasing the frequency of ecology-improving behaviors becomes one of prompting and reinforcing the necessary personnel to develop, maintain, evaluate, and refine such programs.

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Direct reprint requests to:

Mr. E. Scott Geller  
 Department of Psychology  
 Virginia Polytechnic Institute and State University  
 Blacksburg, Va. 24061