Motivating Proenvironmental Behavior:
Examining the efficacy of financial incentives

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ABSTRACT

A key strategy to motivate proenvironmental behavior (PEB) involves the promise of monetary rewards. Financial incentives are intuitively appealing because they can increase an individual's expected benefits for engaging in the PEB; however, there is concern that incentives can transform motivations for the PEB. The purpose of this study was to examine the role of financial incentives on behavior across time. Specifically, I used an experimental design to examine the immediate effects payments on litter-removal effort (Phase 1) followed by effort after payments were no longer available (Phase 2). Undergraduate students were recruited for a trail evaluation study and randomly assigned to a control treatment or a financial incentive treatment. In Phase 1 I asked students to pick up discarded litter during their trail evaluation (PEB). The incentive condition offered students $0.25 for each of the possible 16 items of trash planted along the trail. The control condition simply asked students to help by picking up trash. Students were again asked to collect trash in Phase 2 but the financial incentive condition was not offered a payment. In accordance with self-determination theory I expected payments to increase effort in the short term and suppress effort when the incentive was no longer provided. Although there was an overall decrease in effort between phases within both conditions, the results of a repeated-measures ANOVA indicated no difference between the control and incentive condition in either phase. Given the lack of a statistically significant finding, it is possible that there are conditions under which payments provide no greater inducement than a simple request for help. This idea is supported by a meta-analysis, which identifies a consistent

lack of effect for easily-performed tasks. Additional research is needed to further understand the conditions under which financial incentives can motivate and sustain PEBs.

Table of Contents

List of Tables

List of Figures

I. Introduction

As the human population grows, the sustainability of natural resources is increasingly threatened. Individuals can benefit from exploiting a shared natural resource, however this can deplete its availability to others; as a result, society suffers (Hardin, 1968). Prospects for sustaining natural resources increase when people engage in proenvironmental behaviors (PEB) that decrease their environmental impact or benefit the environment (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). Even though PEBs are beneficial for society and the environment, it often requires additional effort or sacrifice from the individual (Steg & Gifford, 2008). The challenge to sustaining natural resources is developing strategies that motivate people to choose to perform PEBs.

One strategy to motivate PEB involves the use of financial incentives, which are monetary rewards announced before the incentivized behavior is performed (Geller, 2014). Financial incentives can increase the individual's expected benefits for engaging in a PEB, which inturn can increase the frequency as well as the quality of the PEB. Furthermore, finanical incentives can increase one's sense of competency, especially if it a behavior-based incentive that provides feedback for task performance (Deci, Koestner, & Ryan, 1999). However, financial incentives can also have hidden costs. First, financial incentives can shift the source of one's motivation from engaging in a PEB from and internal locus (solely because it's the "right thing to do") to an external locus (earning money) (Deci et al., 1999; Frey, 1997). Second, when receiving a financial incentive for a specific PEB, a person may reduce their level of effort or discontinue performing related PEBs when the incentive is not present (Frey, 1997). A key challenge for environmental practitioners is to motivate PEB with financial incentives so that people engage in the activity without feeling a lack of choice in their actions.

The hidden costs of incentives are not necessarily inevitable (Deci, 1975; Deci & Flaste, 1995). For example, providing people with a sense of choice can reduce the controlling aspect of the financial incentive. Encouraging self-initiated PEBs enables a sense of choice in one's actions. Thus, one is likely to continue performing PEBS. Lastly, financial incentive should be downplayed to avoid shifting the person's focus from the activity to earning money.

The purpose of this study was to examine the role of financial incentives on motivation and PEB over time. For this study, the targeted PEB was litter removal on a hiking trail. As a useful measure of PEB, litter removal fixes a damaged environmental condition by reducing potential harm to wildlife and maintaining the aesthetic experience of the environment for other hikers. Even though litter removal benefits wildlife and society, removing litter is burdensome for the hiker because the trash can be inconvenient to carry for disposal, and thus negatively impact their own recreation experience.

The objective was to examine the immediate effects of payments on litter-removal effort and the delayed time-based effects on litter removal after payments are no longer available. Two hypotheses were examined. First, when the financial incentive is provided, litter removal effort will increase. Second, when the financial incentive is no longer available, participant's litter removal efforts will decrease below baseline conditions. To test these hypotheses, a field experiment was conducted in which participants were randomly assigned to either a treatment (incentive) or control condition. Each participant was asked to remove litter during both sessions. Specifically, the Incentive group was incentivized by monetary rewards during the first but not the second phase, allowing the effects of the presence and withdrawal of money to be examined. The results from this study will provide environmental practitioners with an enhanced

understanding of the effects financial incentives have on motivating immediate and sustained PEB.

Definitions

Behavior-Based Incentive – A reward announced before a behavior that is received based upon behavior

Crowding Out Effect -- When financial payments reduce or eliminate one's intrinsic motivation

Extrinsic Motivation – When one engages in an activity to gain a positive consequence or to avoid a negative consequence. These consequences can be internal, external, or a combination.

Incentive – A reward announced before a behavior

Intrinsic Motivation – When one engages in an activity for inherent satisfaction it provides

Performance – An outcome of behavior

Pro-Environmental Behavior – A behavior that benefits the environment and/or reduces environmental damage

Reward – A positive internal and/or external consequence following a behavior

II. Literature Review

Overview

This section reviews the literature relevant to this project. Self-determination theory (SDT) is the theoretical framework (Figure 1) for this study. First, the relationship between motivation and activating and sustaining PEB is discussed. Next, different types of motivation are covered, followed by an argument supporting that self-directed PEB is ideal for natural resource sustainability. The advantages and disadvantages of behavior-based incentive structures at motivating and sustaining PEB are covered, followed by a discussion of financial incentives. Finally, using litter removal as the PEB of interest, the past litter removal studies that

used incentives in an outdoor recreational setting are reviewed and the gaps in the literature are identified.

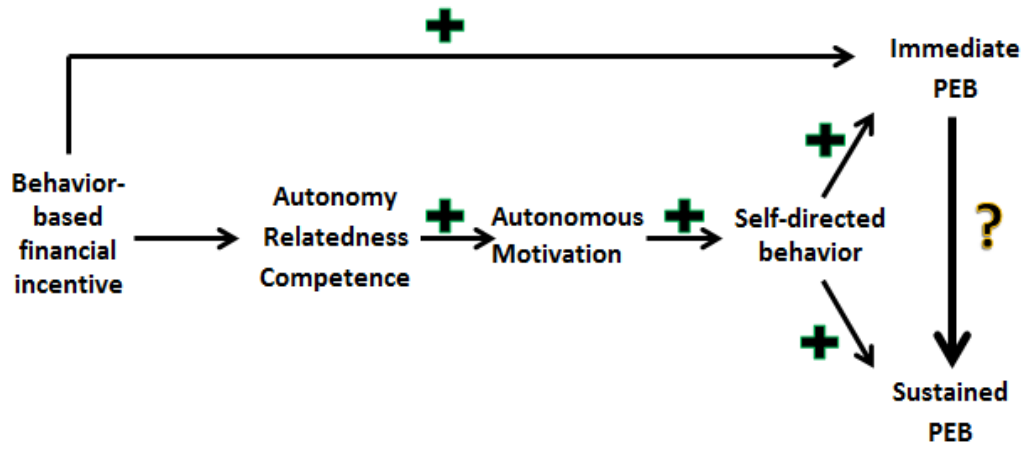

Figure 1. Self-determination theory is the conceptual framework used for this study. Positive relationship are identified with a "+" symbol. Behavior-based financial incentives can undermine autonomy and their impact can be carried throughout the diagram.

Self-Determination Theory

This study uses self-determination theory (SDT) as its theoretical framework to examine a financial incentive to motivate short-term and long-term PEBs (see figure 1; Deci & Ryan, 2008; Gagne & Deci, 2005). According to SDT, people have three needs: competence, relatedness, and autonomy. Competence is the perceived knowledge and ability to attain a desired outcome. Relatedness is the perception of being connected to others. Finally, autonomy is the perception that behaviors are self-directed. When these three needs are met, a person is more likely to be self-motivated. An individual who is self-motivated or self-directed engages in an activity for its own sake, gains the inherent satisfaction provided, so long as the individual finds the activity interesting (Deci & Flaste, 1995; Frey, 1997; Green-Demers, Pelletier, & Menard, 1997). In contrast, an extrinsically motivated person behaves solely to receive an

external reward or to avoid a negative consequence. Self-direction is at a minimal because behaviors are regulated by the reward or punishment. Lastly, amotivation is the inability to recognize motives for behavior and autonomy is lacking.

Self-determination theory focuses on human motivation by distinguishing between controlled and autonomous motivation (see Figure 2) (Deci & Ryan, 2008). Controlled motivation encompasses amotivation and two subtypes of extrinsic motivation: External

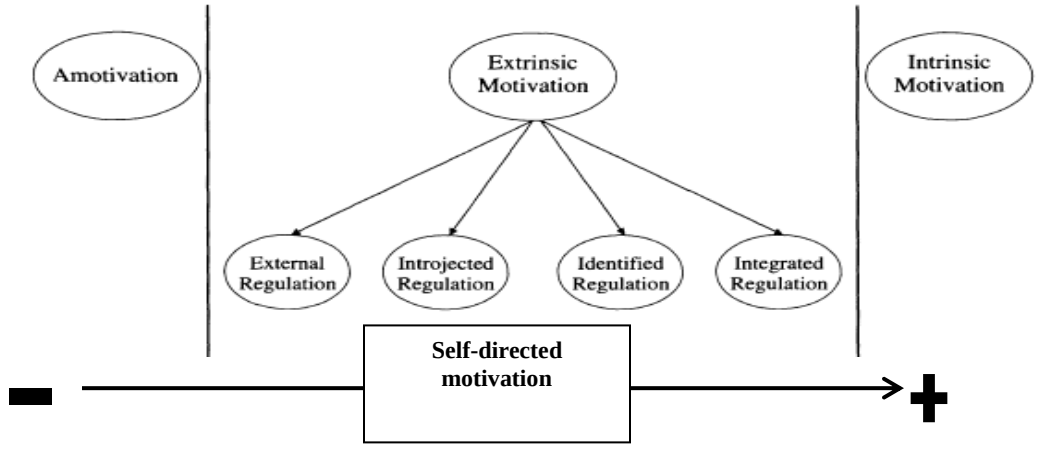

Figure 2. Motivation can vary by the degree it's self-directed. On the far left of the continuum, self-directed motivation is lacking. As the continuum moves to the right, the degree in which motivation is self-directed increases. People do not move through these categories like stages; instead, they fall into the categories depending on the extent their behavior is self-directed.

Regulation and Introjected Regulation. *External regulation* is the most controlling form of extrinsic motivation because motivation is regulated solely through rewards or penalties. When motivation is internalized, but has not been accepted as one's own, it's considered *introjected regulation*.

Autonomous motivation is comprised of intrinsic motivation and two extrinsic motivation subtypes: Identified Regulation and Integrated Regulation. *Identified regulation* is when motivation is part of one's self-selected goals and identities, as the individual begins to feel a

sense of self-direction. *Integrated regulation* is the most self-directed form of extrinsic motivation because the behavior is an integral part of one's sense of self and identity. Finally, self-directed behavior is at its highest level with Intrinsic Motivation.

A positive correlation exists between autonomous motivation and the frequency of PEB (Green-Demers et al., 1997; Osbaldiston & Sheldon, 2003; Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998). Specifically, Green-Demers et al. (1997) found this relationship to be strongest with intrinsic motivation and weaker with integrated and identified regulation. Furthermore, controlled motivation negatively correlated with the frequency of PEB. As self-directed behavior decreased, this negative correlation became stronger. Their findings suggest natural resource conservation is more likely to occur with autonomous motivation.

Incentives

The efficacy of motivating behavior with behavior-based financial incentives is unclear and often debated (Deci et al., 1999; Strombach, Hubert, & Kenning, 2015). The price effect suggests performance should increase with the increased payment provided by financial incentive strategies (Sandel, 2012). However, behavior-based incentives may reduce one's sense of autonomy and undermine intrinsic motivation (Deci et al., 1999; Frey, 1997). Conversely, competency may increase as behavior-based incentives are a form of feedback (Deci et al., 1999). Administering a behavior-based incentive in a non-controlling way can reduce its negative impact on one's sense of autonomy (Deci & Flaste, 1995).

Determinants of Litter Pick-up Behavior

The presence of litter can negatively impact a recreationist's experience (Manning, 2011), and can be detrimental to wildlife through entanglement and ingestion (Sheavly & Register, 2007). Litter control research can be divided into two categories—litter prevention and

removal. For this study, litter removal was the target PEB. Litter removal benefits society and wildlife by maintaining the aesthetic experience for others and preventing wildlife from consuming litter and becoming entangled in it. Collecting litter, however, is costly to the individual because it has to be collected, carried, and disposed of properly. Additionally, litter can be cumbersome to carry and even filthy (e.g., cigarette butts, used Band-Aids, or food scraps). Financial incentives can help offset these individual costs by increasing the benefits of engaging in litter removal.

Researchers have used a number of incentive-based approaches to motivate litter removal, including lotteries (McNees, Schnelle, Gendrich, Beagle, & Beagle, 1979; Powers, Osborne, & Anderson, 1973), direct financial incentives (Chapman & Risley, 1974; Powers et al., 1973), and non-monetary incentives such as patches, amusement park tickets, and cookies (Casey & Lloyd, 1977; Clark, Burgess, & Hendee, 1972; McNees et al., 1979). However, only two studies were found that focused on using incentives and rewards to motivated litter removal in outdoor recreational settings (e.g., campgrounds, picnic areas, and trails).

At a campground, Clark et al. (1972) incentivized children to participate in a litter pickup program. Regardless of effort and quantity of litter collected, the participating children received a non-monetary incentive (e.g., patches, pencils, and magazines) for removing litter. Researchers placed 160 pieces of litter in the test area. Before introducing the incentive program, 56 pieces of trash were removed within five days. The next week, the researchers replaced the 160 pieces of litter in the same test area. Without an incentive program, 17 pieces were removed the following day. On day three, the incentive program was initiated, 119 pieces of litter were removed. The incentive/reward program ceased for the next two days and 18 of the 24 pieces of remaining litter were removed. Compared to the five days before the

incentive/reward program, the litter program significantly increased the amount of litter removed. This study demonstrated incentivizing children to remove litter can be an effective strategy as long as the incentive is available.

The second study used a behavior-based incentive to motivate litter removal (Powers et al., 1973). During the baseline portion of the study, a sign requested visitors to pick up litter in a day-use area. Litterbags and a trash can were available. The sign was altered during the intervention informing visitors they could choose either $0.25 or a chance to win $20 for each redeemed litterbag. Compared to Baseline, the total number of litterbags redeemed was ten times higher with the incentive program. When the incentive was no longer available, the number of litterbags redeemed returned to Baseline levels. When available, behavior-based incentives were more effective at motivating recreationists to remove litter compared to a sign requesting the same behavior.

Literature Gaps

No litter removal study conducted in an outdoor recreational setting measured the residual effects a prior financial incentive has on subsequent motivation. Even though a withdrawal condition was implemented in both studies, the researchers were unable to determine if the people participated in both the Withdrawal and Incentive/Reward conditions (Clark et al., 1972; Powers et al., 1973). As a result, neither study measured changes in effort or undermining of motivation once the reward was no longer available.

Neither study discerned individual from group effort in securing litter. As a result, a small number of people could have collected a majority of the litter, or all participants could have collected the same amount of litter. If so, the dependent measure for Clark et al. (1972) and Powers et al. (1973) would have been a function of collective effort and not individual effort.

Finally, researchers commonly used children as participants in litter pick-up studies (e.g.,Burgess, Clark, & Hendee, 1971; Chapman & Risley, 1974; Clark et al., 1972; La Hart & Bailey, 1975; McNees et al., 1979). Only one study incentivizing litter removal included both adults and children as participants; however, their efforts were not distinguished (Powers et al., 1973). This is problematic as adults and children respond to incentives differently (Vander Stoep & Gramann, 1987).

Scope Conditions

This study focuses on the impacts of payments-for-behavior, but is limited to a number of conditions under which these types of payments may affect behavior. These are generally the same conditions under which many conservation incentive programs are implemented (e.g., Sorice et al., 2013).

Scope Condition #1: The PEB is likely to be considered inherently uninteresting and thus few people may be intrinsically motivated

This study examined a self-determined pro-environmental behavior that's unlikely to be interesting or followed by a naturally reinforcing consequence. Thus, participants are unlikely to be intrinsically motivated to remove trash and may need an extrinsic reward to initiate litter removal. However, if removing litter is interesting or in line with one's ethic, then one's autonomous motivation is likely to be reduced by an incentive/reward program (Frey, 1997).

Scope Condition #2: Rewards received are directly proportional to outcome

The use of behavior-based financial incentives to motivate litter removal differs from prior research conducted in recreational settings (Clark et al., 1972; Powers et al., 1973), as the amount of the reward is contingent on behavior.

Scope Condition #3: Behavior is limited to individual effort

This study focused on individual effort as opposed to group effort. This distinction is important because one person could remove all of the litter within a group and yet the outcome appears to be group effort. Furthermore, a person may alter his/her behavior based on perceived group norms. For example, La Hart and Bailey (1975) observed children would not pick up litter until one of their classmates picked up the first piece of trash.

Scope Condition #4: Behavior is limited to adults

Most litter removal research observed children's litter removal behavior or did not distinguish between the effort of children and adults. This study focuses on adult behavior because children and adults respond to incentives differently (Vander Stoep & Gramann, 1987), and adults might respond to an incentive for picking up trash as cheapening the act because it's something that should be done. However, children may not view removing litter as something that should be done and would need an incentive to encourage litter removal. Additionally, adults are generally targeted by conservation incentive programs.

Scope Condition #5: The PEB repairs a damaged environmental condition.

Unlike other conservation incentive programs that motivate individuals to perform PEBs to reduce or prevent negative environmental impact, this study used a financial incentive/reward program to motivate PEBs that repair a damaged environmental condition.

Scope Condition #6: The time period between observation sessions is limited to one week

It is difficult to say whether one week is a short or long period of time between observation sessions. However, the one week gap will allow the time-based effect of behavior-based financial incentives to be detected.

III. Method

Recruitment, Participants, and Setting

A total of 44 Virginia Tech students were recruited. This study was advertised as a trail design study. Participants were told Virginia Tech was looking for feedback on two half-mile trails within its research forest. Participants were asked to evaluate one trail on two separate visits. They were informed that the study was about providing Virginia Tech with feedback regarding two future nature trails. Furthermore, participants were told transportation would be provided, that the study takes place on two consecutive weekends, and they would receive $10 for completing the first trail evaluation and $20 for completing the second trail evaluation.

This study was conducted in Virginia Tech's Fishburn Forest which allowed the physical setting to be completely manipulated. In the Fishburn, two half-mile paths were created and marked with fluorescent flags every 30-50 feet. Both trails wrapped around a mountain ridge. This style of trail allowed the trail to be universally accessible. Logistically, the trail's start and end points could be positioned relatively close but separate, preventing participants from seeing each other and allowing research technicians to move quickly between the stations if needed. Finally, setting the trail slightly downhill from the ridge created a barrier that prevented participants from seeing each other or the research technicians during the experiment's execution.

Experimental Design

To compare the immediate and delayed impacts financial incentives have on litter pickup behavior, each participant visited the Fishburn on two separate occasions (Table 1). A different trail was evaluated in each Phase of the study. Participants were randomly assigned to either the Control or Incentive condition. In Phase 1, participants in the Incentive condition were offered a $0.25 per littered item found. One week later in Phase 2, the same participants were told the litter removal program no longer had funding to pay for trash removal, but were again asked to

remove litter. Participants in the Control group were asked to remove litter during both Phases without the offer of a financial reward.

Table 1
Subjects were randomly assigned to each condition and participated in two phases of the study that were one week apart.

	Phase 1	Phase 2
Control	No Incentive	No Incentive
Incentive	Incentive	No Incentive

Procedure

Because this study' purpose was examining the effects financial incentives have on an individual's motivation to pick up litter, concern existed that participants would alter their behavior knowing the true purpose of the study. To address this concern, a cover story was used (see script in Appendix A). Participants were told that Virginia Tech's Department of Forest Resources and Environmental Conservation would like to receive feedback regarding two trails they proposed to construct in the forest.

Prior to the study, research technicians removed all litter from the test area. Next, technicians planted litter in designated areas along the marked trail. Large rocks were partly buried on the trail to benchmark the location of each littered item. The litter used was primarily indigenous litter found in the Fishburn forest, related settings, and the author's recycling bin. A combination of 16 trash items was used as litter (Table 2). These items were advantageous because they are 1) wind and water resistant, 2) commonly recognized, and 3) not too difficult to see and carry. To prevent participants from detecting the study's true purpose, the 16 littered items were placed in a different configuration for the second trail (Appendix B).

To measure effort in collecting litter, the size and placement of litter were manipulated. Four types of litter items were evenly distributed into four litter categories based on size (large or

small) and distance from the trail (close or far) (see Table 2). Small items were approximately the size of a matchbook (Finnie, 1973; Hayes, Johnson, & Cone, 1975), and large items were beer cans. Close items were within one foot of the trail and distant items were placed approximately two and a half feet from the trail. In all cases, efforts were made to maintain trash visibility while still trying to convey the items as "naturally occurring".

Table 2
Effort to secure litter was manipulated by the location and size of litter. Four different kinds of trash were used to identify each litter category.

	Large	Small
Far	4 Blue Beer Cans	4 Cardboard Pieces
Close	4 White Beer Cans	4 Gatorade Bottle Caps

Before participants began their trail evaluation, they were provided with an informed consent form (see Appendix C). The author served as the “head researcher” in all cases. The study was described as a trail evaluation and then participants were requested to "help" the Fishburn by picking up litter as they conducted the trail evaluation. These requests were tailored to the respective condition:

Phase 1 – Control Condition:

> “The litter program is voluntary and any help you provide is appreciated. I'll hand you a litterbag on your way out and, if you see any litter on the proposed trail, it would be helpful if you could pick it up. A research assistant will be at the end of the trail to collect your litterbag and give you the trail evaluation form. Thank you for your help.”

Phase 1 – Financial-Incentive Condition:

"The litter program pays volunteers a quarter ($0.25) for each item you pick up. It is voluntary and any help you provide is appreciated. I'll hand you a litterbag on your way out and, if you see any litter on the proposed trail, it would be helpful if you could pick it up. A research assistant will be at the end of the trail to collect your litterbag and give you the trail evaluation form. Thank you for your help."

Each participant walked the trail by themselves in approximately ten-minute intervals. This prevented group dynamics from influencing individual behavior and allowed individual behavior and effort to be measured. In between each participant, a research technician removed any non-planted litter from the trail and replenished any planted litter that had been collected by the participant. Replacing collected litter allowed each participant an equal opportunity to pick up 16 pieces of litter. This research technician carried a container (shown in Appendix D) to carry extra litter to plant. A larger stash of relevant litter was hidden in the woods to resupply the container.

After each participant completed the trail, a research technician collected the litterbag and recorded the participant's identification number. The research technician gave the participant the trail evaluation form to complete, payment for participation in the study and, for the treatment condition, payment for each item of trash removed.

One week later, the same participants returned to conduct the second trail evaluation. A one week delay was selected because it was short enough to minimize the potentially high attrition rates that may occur over extended periods of time. For the financial treatment condition, the prompt was altered to reflect the idea that the program was still in existence but the funds were no longer available to support a financial incentive. For Phase 2, participants in the Control group received the same prompt they received in Phase 1.

Phase 2 – Control (Same script as Phase 1)

Phase 2 – Financial Incentive

> "The litter program is voluntary and any help you provide is appreciated. Because we no longer have any funds, we cannot offer $0.25 per litter item like before. However, there are no longer any funds to pay people to collect trash. I'll hand you a litterbag on your way out and, if you see any litter on the proposed trail, it would be helpful if you could pick it up. A research assistant will be at the end of the trail to collect your litterbag and give you the trail evaluation form. Thank you for your help."

All participants were given a debriefing form to read and sign at the end of the experiment (Appendix E). All participants received a chance to ask any questions and were requested to not talk about the study to others.

Calculating Effort

The dependent variable was the effort participants expended in picking up litter between Phases 1 and 2. At the most basic level, effort can be calculated as the difference between the number of items collected in each phase. This measure, however, does not fully represent effort because the litter's size and placement affected detectability. Therefore, effort was calculated as a weighted function of the litter's size, placement, and the number of items collected.

The sixteen items of litter were evenly divided into four litter categories based on their distance from the trail and size (see Table 2). Because the two trails were not identical, weights for each litter category were calculated separately for each trail using the control group's data. This group's data were selected because participants were asked to pick up litter without an incentive; therefore, participants removed litter under baseline, natural conditions.

To calculate the weights used for each of the four litter categories, the following process was used. First, for each participant, the total number of litter items collected was divided by four, the number of possible items in the litter category. This value is the proportion of litter each participant collected in each litter category. Next, the control group's average proportion of litter collected was calculated for each litter category.

Then group's average proportion was inverted so higher values represent greater effort. This weighting system assumes that small litter items located further from the trail require more effort to detect and remove compared to large items close to the trail. These values were then standardized by setting the large/close value to one and dividing the other three categories by the original large/close value.

Lastly, the proportion of the standardized values was calculated by dividing each one by the sum of the four litter category's standardized value. This final calculation is the weight, or "effort value," used for each litter category (see Table 3).

To calculate a participant's effort, the number of littered items collected in each litter category were multiplied by the empirically-derived weight. Next, these values were added together to reflect a participant's total effort. These total effort values were used in the analysis.

Table 3

Empirically-determined weights used in calculation of total effort.

	Phase 1 Weights	Phase 2 Weights
Large Close	.155	.131
Large Far	.238	.111
Small Close	.202	.393
Small Far	.404	.365

Statistical Analysis

The hypotheses considered the immediate impact of payments on effort as well as change in effort when payments are no longer available. Thus, differences in the two group's (Control

and Incentive) mean effort in Phases 1 and 2 was examined. A repeated measures ANOVA was used for analysis because there was a within-subjects (Phases 1 and 2) and between-subjects (Control and Incentive) factor.

Effect Size

A p-value is limited in that it can only reveal if an effect exists; however, the effect size is a standardized way of quantifying the magnitude of the differences between the groups (Ellis, 2010). Because the data was normally distributed and the dependent variable is continuous, Cohen's d_{av} was used to calculate effect size for paired groups (Cumming, 2012; Lakens, 2013). Cohen's d_{av} is calculated by dividing the difference between the groups means by the standard deviation averaged across groups.

To further enhance interpretation of the effect size, the probability of superiority was calculated and reported, which reports the probability that a randomly selected participant in the Phase 1 will have a more favorable outcome compared to a randomly selected participant in the Phase 2 (Ellis 2010). This was calculated by transforming a group's difference between the two Phases into a probability by using a *z*-score table. Specifically, the probability of superiority was calculated using the mean difference between a group's Phases and dividing it by the standard deviation that's the square root of the sum of the variances to obtain a z value (z_{ps}). Next, the probability of superiority was determined by using the z_{ps} value in a z table.

Ellis (2010) proposed three methods to interpret effect size. First, compare the effect size to similar studies to determine if any significant contributions exist. Second, consider the context of the effect size. Specifically, small effects can lead to meaningful consequences in the right context. Finally, when the previous two assessments are difficult, Jacob Cohen's cutoffs for small (d=0.2), medium (d=0.5), and large effect (d=0.8) sizes can be used (Cohen, 1977).

Even though Cohen's cutoffs are widely used, the cutoffs were arbitrary selected (Cohen, 1977; Ellis, 2010). For this study, the last two methods were used to interpret the effect sizes since there are no studies for comparison.

IV. Results

Descriptive Statistics

A total of 44 undergraduate students participated in the study with 22 randomly assigned to each treatment (Control vs. Incentive). Examining only the number of littered items removed, the Control group collected 48% of the total litter in Phase 1 and 32% in Phase 2 (Table 4). Similarly, the Incentive group removed 51% of the total litter in Phase 1 and 39% in Phase 2.

Table 4
The total number of littered items collected by each group in both phases. Means and percentages are included.

		Phase 1	Phase 2
Control	Total	168	112
	% Collected	48%	32%
	Mean	7.6	5.1
Incentive	Total	178	137
	% Collected	51%	39%
	Mean	8.1	6.2

Effort and Litter Characteristics

For both groups in Phase 1, a chi square analysis revealed that there was no relationship between litter size and distance (X^2=2.003, p=0.157). A total of 64% and 36% of the big and small littered items were collected and 60% and 41% of the close and far items were removed, respectively (Table 5).

Table 5
The number of littered items collected by distance and size in Phase 1 (X^2=2.003, p=0.157)

	Big	Small	Total
Close	126 36.42%	80 23.12%	206 59.54%
Far	96 27.75%	44 12.72%	140 40.46%
Total	222 64.16%	124 35.84%	

For both groups in Phase 2, there was no relationship between size and distance (X^2=0.102, p=0.749) Overall 74% and 26% of the big and small littered items were collected and 49% and 51% of the close and far items were removed, respectively (Table 6).

Table 6
The number of littered items collected by distance and size in Phase 2 (X^2=0.102, p=0.749)

	Big	Small	Total
Close	92 36.95%	31 12.45%	123 49.40%
Far	92 36.95%	34 13.65%	126 50.60%
Total	222 73.90%	124 26.10%	

Combining the total littered collected in both Phases by both groups, there was again no relationship between size and distance (X^2=1.327, p=0.249). A total of 68% and 32% of the big and small littered items were collected and 55% and 51% of the close and far items were removed, respectively (Table 7).

Table 7
The number of littered items collected by distance and size for both Phases 1 and 2 (X^2=1.327, p=0.249)

	Big	Small	Total
Close	218 36.64%	111 18.66%	329 55.29%
Far	188 31.60%	78 13.11%	266 50.60%
Total	406 68.24%	189 31.76%	

Comparing Mean Effort between Conditions and Over Time

Including the empirically determined weights, the average effort exerted for Phases 1 and 2 by the Control group was 1.691 and 0.929 and the Incentive group was 1.781 and 1.201, respectively (see Table 8 and Figure 3).

Table 8
Mean effort exerted by each group phase

	Phase 1	Phase 2
Control	1.691	0.929
Incentive	1.781	1.201

The repeated-measures ANOVA (2 Groups X 2 Phases) examined differences in effort between the two conditions and over time (Table 9). The control and incentive group were expected to exert different levels of effort to remove litter. However, the analysis did not reveal a between-subjects main effect of groups ($F_{(1)} = 0.435$, $p = 0.513$). This means that, on average, the control and financial incentive group exerted the same effort to remove litter.

There was a within-subjects main effect for Phase ($F_{(1)} = 22.418$, $p < 0.001$). The decrease in the overall mean indicates that, when considering both the control and financial incentive group, participants exerted more effort to remove litter in Phase 1 than in Phase 2. Finally, there was no significant interaction between groups and phases ($F_{(1)} = 0.412$, $p = 0.525$).

This indicates the relationship between effort and phase did not differ as a function of the incentive/reward contingency.

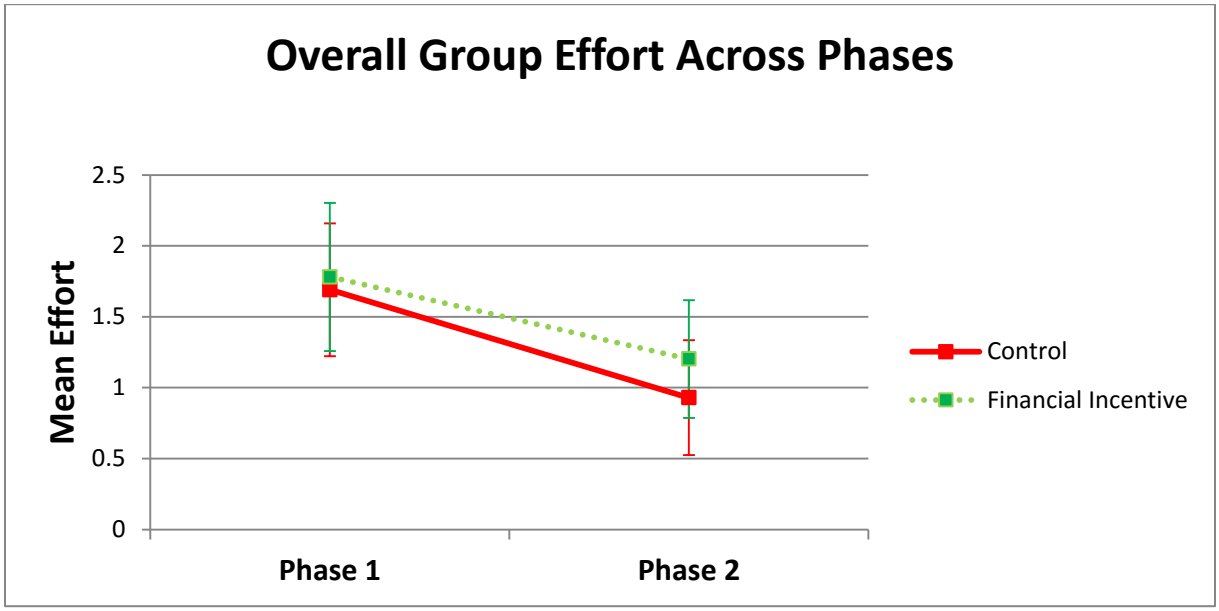

Figure 3. Means of the control and incentive groups across phases.

Table 9

Results of a repeated measures ANOVA. There was no significant difference between the two groups' effort to remove litter. However, there was a significant decrease in both groups overall mean effort from Phase 1 to Phase 2. Lastly, there was not a significant interaction effect between groups and phases.

	df	*F*	*p*-value
Groups (Between-Subjects Factor)	1	0.435	0.513
Phase (Within-Subjects Factor)	1	22.418	<0.001
Group and Phase Interaction	1	0.412	0.525

Changes in Effort by Phase

Because the ANOVA indicated that effort decreased between phases, two paired t-tests were conducted to examine the changes in means between phases for each group (Table 10). Although effort was expected to remain constant for the Control group and decrease for the Incentive group, the decrease in effort was statistically significant for both treatments. The Control group's effort decreased by an average of 0.762 (t = -3.258, p = 0.004, Cohen's d =

0.773). Overall there was a 71% chance that a randomly selected person in Phase 1 would exert more effort compared to a person randomly selected in Phase 2. The mean effort of the Incentive group also decreased by an average of 0.58 (t = -3.622, p = 0.001, Cohen's d = 0.545). For this group, there was a 65% chance that a person randomly selected in Phase 1 would exert more effort compared to a randomly selected person in Phase 2.

Table 10
Differences in group means across phases.

Group	n	Phase	Mean	SD	Lower CI	Upper CI	df	t	p	Cohen's d_{av}
Control	22	Phase 1	1.691	1.055	1.223	2.159	21	-3.258	0.004	0.773
		Phase 2	0.929	0.913	0.524	1.334				
Incentive	22	Phase 1	1.781	1.177	1.259	2.303	21	-3.622	0.001	0.545
		Phase 2	1.201	0.938	0.785	1.617				

V. Discussion

Using self-determination theory as this study's theoretical framework, the immediate and delayed impacts behavior-based financial incentives have on motivating adults to engage in a PEB (i.e., litter removal) to repair an environmental condition were examined. The presence of a behavior-based financial incentive was expected to increase litter removal effort over the effort of a control group receiving no financial incentive. Compared to the control group, the financial incentive had no significant effect on effort during Phase 1. When the financial incentive was no longer available in Phase 2, the financial incentive group's effort was expected to decrease below the level of the control group; however, there was no difference in Phase 2. The following section discusses possible reasons for these findings along with implications.

First, it was assumed the Control group would exert the same amount of effort in both phases; however, their effort decreased in the second phase. Greenwald (1976) proposed three reasons why changes like this may be observed during a repeated measures experiment. First, performance may improve simply as a result of their ability to "practice" the behavior. Although, it is possible litter removal could improve as participants develop a "search image" for the litter, this did not occur. Second, one intervention may have a lasting effect that influences the results of future treatments. This was not an issue in this study because the control group did not receive any inducement. Third, participants may behave according their own hypotheses about the purpose of the study. To prevent this, the study's true purpose was disguised with the trail evaluation cover story. Had participants developed their own hypotheses and behaved accordingly, greater variance in effort on their second visit would have been likely because their hypotheses would be different. That is, some participants might have exerted less effort while others exerted more. Furthermore, participants in the Control condition were not informed about the Incentive condition. For these reasons, participants in the control group should have exerted the same effort between phases. However, the effort of the Control group decreased in Phase 2.

One possible reason for the control group's decrease in effort is that they felt a lack of control in cleaning the Fishburn Forest. Specifically, participants could perceive that, because others did not seem to be removing litter, their efforts would not make a signification impact on cleaning up the Fishburn Forest. Previous research has shown people are influenced by what they perceive as appropriate/inappropriate behaviors and by what others are doing or not doing (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). In this study, participants were aware that others previously walked the trail. Furthermore, most participants knowingly walked

the littered area after someone else. Perceiving that others had not made an effort to remove all of the litter can decrease one's effort.

Second, because the forest was naturally littered (i.e., the access road, parking lot, the path to the experimental trails, and the trails themselves), participants might have exerted less effort because they may have perceived their efforts as futile (Seligman, 1972). In sum, control group participants might have exerted less effort in Phase 2 because they perceived others not removing litter and their efforts were perceived as making no difference in cleaning the forest.

Litter removal effort was expected to be significantly higher in the Incentive group than the Control group in Phase 1; however, there was no difference. One possible explanation is that the price paid for litter removal was not high enough to increase behavior, but not low enough to undermine effort in Phase 1. Previous research has shown that when the financial incentive is too low, people tend to exhibit less effort compared to a control group (Gneezy & Rustichini, 2000; Heyman & Ariely, 2004). When the financial incentive is high enough, people exhibit increased effort compared to a control.

Based on this line of research, Figure 4 provides a conceptual depiction of the relationship between the amount of a financial incentive and behavior. The dashed line represents the effort of a Control group and the dots indicate payment amounts that may lead to effort that is similar to the Control group. Based on this, there is potentially one level of payment ("D" in Figure 4) where payment may not lead to differences in effort when compared to a Control group. Because the payment level was generally considered low ($0.25 per item) and the task as not complex, it is possible the payment for litter pick-up matched the control

group's effort at dot "D." This relationship of the payment level to effort is intriguing and worthy of further investigation.

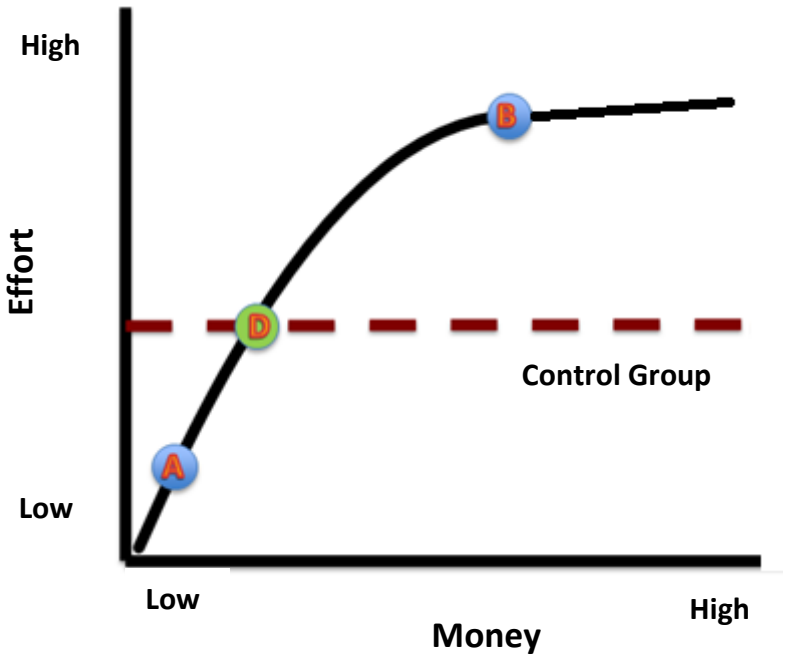

Figure 4. The relationship between payment amount and effort. A: Effort decreases below the control groups when payment is low. B: Increased payments raise effort. D: A payment amount that match control group's effort.

Another possible explanation as to why the financial incentive did not increase effort was because removing litter is an easy task. Camerer and Hogarth (1999) conducted a review of 74 pay-for-performance studies and found that the modal effect financial incentives have on behavior was no effect. They argue that this occurs in contexts where the incentivized behavior is easily performed. Further, easy tasks, such are removing litter, may not be intrinsically motivating because they are not challenging and could be considered tedious (Gagne & Deci,

2005). Thus, satisfaction for task accomplishment is low because one's sense of competency is not enhanced.

Compared to the Control group in Phase 2, the Incentive group was expected to exert less effort than the Control group because of the crowding out effect of the financial incentive. The inability to find a difference in Phase 2 is not surprising considering the financial incentive did not increase litter removal effort in Phase 1. Because the financial incentive did not affect behavior in Phase 1, the conditions for crowding-out in Phase 2 did not exist. Crowding-out occurs when a financial incentive is responsible for the behavior change, individuals feel their behavior is being controlled and this subsequently impairs their self-esteem (Frey, 1997). In this study, there was no indication that behavior was affected by the incentive. Further, the task request encouraged self-directed behavior by explicitly telling participants that removing litter was voluntary and any help was appreciated (Deci & Flaste, 1995).

In this study, money had no effect on effort. Yet, litter removal occurred. It is possible that participants picked up litter because they were complying to the researcher's request (Cialdini & Goldstein, 2004; Milgram, 1963), seeking social approval or avoiding disapproval (Cialdini & Goldstein, 2004), and because their actions were not private (Ariely, Bracha, & Meier, 2009). However, these factors were held constant across both groups and phases, and the author is unaware of research that investigated the conditions under which these factors may override the effects of a financial incentive.

Given my confidence in the design and execution of this experiment, my findings suggest that financial incentives might not be an efficient strategy to motivate PEB under all conditions. This study examined the immediate and delay effects a behavior-based financial incentive have

at motivating adults to repair a damaged environmental condition. Because the task was easy and the financial incentive was low, litter removal effort was not increased. Under this study's conditions, a verbal request was as effective as the low financial incentive to motivate litter removal.

Limitations

There were a few limitations to this study. First, as is true in other experimental social psychology research conducted in the field, there is potential for information to get out about the true nature of the study. However, every effort was made to discourage participants from discussing the study. For example, participants were repeatedly asked to not discuss this study with peers and all research assistants were instructed to monitor conversations. If participants discussed the study, research assistants diverted the conversation to another topic. Even if discussion occurred, its likely participants did not accurately detect this study's true purpose. Second, this study was limited by its sample size. Differences for large effects would have been detected, but a larger sample size is needed to detect medium to small effects.

Future Research

Additional research is needed to tease apart the conditions under which behavior-based financial incentives can motivate immediate and long-term PEB. Future research could evaluate the effects of different levels of financial incentives, vary the gap in time between providing and removing the financial incentive, incentivize different PEBs that vary in difficulty, and investigate nonfinancial incentives. In this study, participants might have removed trash to look like a "good" person to the researchers and other participants. If this is the case, future research

should explore other socially motivated behavior-based incentives strategies (e.g., public recognition or nonfinancial rewards) to motivate PEB.

Conclusions

Concerns about the sustainability of natural resources can be reduced if people engage in PEBs on a large scale. This study examined the immediate and delayed impact of behavior-based financial incentives on motivating a PEB, and found that a financial incentive and a verbal request had the same impact on litter removal effort over time.

To motivate a PEB that repairs a damaged environmental condition, practitioners should consider whether a behavior-based financial incentive is an appropriate strategy. If it is appropriate, the level of compensation should match the PEB. If the financial incentive is too low, effort may be lower than a verbal request. If the financial incentive is too high, Crowding Out effects are still a concern.

Lastly, practitioners should consider the difficulty of the task as financial incentives may have no effect when the task is too easy or too difficult. In sum, more research is needed to understand the impact of behavior-based incentives on motivating PEB to repair a damaged environmental condition.

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Appendix A

The cover story given to all participants:

> “Thank you for participating in this study. The Fishburn Forest is Virginia Tech's research forest where we conduct research and harvest timber. For this study, we are trying to understand perceptions of trails in a working landscape. Your participation in this study will help Virginia Tech as they plan to install public use trails in the Fishburn.
>
> You will evaluate one trail for us today. When you come back next week you may walk this trail again, you may walk a modified version of this trail, or you may walk a different trail.
>
> As you go through the trail, we want you to take your time and enjoy the view and the nature around you. Spend some time listening to nature and to the other sounds you hear. Look around and observe what's happening. Even pay attention to the path itself.
>
> Because we are interested in your individual opinion, we want you to walk the trail by yourself. The trail has not been constructed yet, but it has flags to help you find your way. We also have a volunteer roaming out there to make sure everyone stays on the trail.
>
> Please enjoy yourself and pay particular attention to what you like and what you don’t like. When you get to the end of the trail, a research assistant will give you a short survey to fill out.”
>
> <Deliver the condition’s trash collection prompt>
>
> “Although we're happy to help with this program as Virginia Tech builds support for the Forest, we want to remind you this is a trail study. So, pay attention to the trail—what you like, don't like, what's memorable about it, etc.
>
> Does anyone have any questions?”

Appendix B

Trash placement box guides for each trail. A pictorial and written description was used to easily identify which item goes into which compartment. Items on the left and right columns were placed on the left and right side of the trail. The numbers indicate the order of the trash placement.

Front of Box

Place on Left side of Trail	Place on Right side of Trail
Cap 1 Close	Blue Can 2 Far
Box Tear 3 Far	White Can 4 Close
Blue Can 5 Far	White Can 6 Close
Cap 7 Close	Box Tear 8 Far
White Can 9 Close	Box Tear 10 Far
Blue Can 11 Far	Cap 12 Close
Box Tear 13 Far	Cap 14 Close
White Can 15 Close	Blue Can 16 Far

Front of Box

Place on Left side of Trail	Place on Right side of Trail
Blue Can 1 Close	Cap 2 Far
White Can Far	Box Tear 4 Close
White Can 5 Far	Blue Can 6 Close
Box Tear 7 Close	Cap 8 Far
Box Tear 9 Close	White Can 10 Far
Cap 11 Far	Blue Can 12 Close
Cap 13 Far	Box Tear 14 Close
Blue Can 15 Close	White Can 16 Far

Appendix C

The information sheet all participants read and signed before the study procedures began.

PURPOSE OF THE STUDY – To obtain feedback on the design of potential trails to be constructed in the Fishburn Forest. We would request that you help us with an initial evaluation of two trails. This requires you to visit the Fishburn Forest twice.

PROCEDURES TO BE FOLLOWED IN THE STUDY – This study will take place on two separate weekend days. The first visit to the Fishburn Forest will take place on **XXXX** and you will be shuttled to the Fishburn Forest (12 miles from Virginia Tech's campus). We will meet in the parking lot next to Virginia Tech's Cheatham Hall. At the forest you will walk the trail and complete a short evaluation form after walking the trail. After the trail evaluation is complete, all volunteers will be shuttled back to the parking lot next to Cheatham Hall. We will leave at **XXXX** and return at **XXXX**.

The second visit to the Fishburn Forest will take place on **XXXX**. Except for taking an additional survey, the procedures will remain the same. After the trail evaluation and survey is complete, all volunteers will be shuttled back to the parking lot next to Cheatham Hall. We will leave at **XXXX** and return at XXXX.

ANONYMITY OF SUBJECTS – Data collected for this study will be treated confidentially. The researchers conducting the research will know who is participating but will not release that information to anyone. Each person will be assigned a unique ID. Individual records in the database will be identified by numeric codes only.

DISCOMFORTS AND RISKS FROM PARTICIPATING IN THE STUDY – To minimize risks associated with transportation, please wear your seatbelts. Also because you will be outside, make sure to wear clothing appropriate for the outdoors and weather conditions. Bring insect repellent and/or sunblock if necessary. Be cautious of hazards caused by wildlife, insects, plants (e.g., poison ivy) and/or weather conditions. Please bring any supplies you may need (e.g., epipen for allergies). Expenses associated with seeking or receiving medical treatment will be your responsibility and not that of the research project, research team, or Virginia Tech.

EXPECTED BENEFITS – Benefits of participation are related to providing input and improving trails for the Department of Forest Resources at Virginia Tech.

COMPENSATION – Students participating will earn up to $30 -- $10 for the first session and $20 for the second session.

FREEDOM TO WITHDRAW – You are free to withdraw your consent and terminate your participation at any time. You are also free to decline to answer any items on the evaluation form and survey.

USE OF RESEARCH DATA – The information from this research may be used for scientific or educational purposes. It may be presented at meetings and/or published and reproduced in professional journals or books, or used for any other purposes that Virginia Tech's Department of Forest Resources and Environmental Conservation considers

proper in the interest of education and research. You will not be identified in any presentation of the collected information.

APPROVAL OF RESEARCH – This research project has been approved by the Human Subjects Committee of the Department of Forest Resources and Environmental Conservation and by the Institutional Review Board of Virginia Tech.

SUBJECT PERMISSION –
I have read the above description.
I have had an opportunity to ask questions and have them all answered.
I hereby acknowledge the above and give my voluntary consent for participation in this study.
I further understand that if I participate I may withdraw at any time without penalty.
I understand that, should I have any questions regarding this research and its conduct, I should contact any of the person's named below.

Principal Investigators:	Michael Sorice, PhD	msorice@vt.edu
Co-Investigator:	Cory Furrow	Coryf87@vt.edu
Institutional Review Board Chair:	David Moore, DVM	moored@vt.edu

SUBJECT'S SIGNATURE: _____ DATE:_____

SUBJECT'S ID#: _____

EXPERIMENTER SIGNATURE: _____ DATE:_____

Appendix D

A picture of the 2 X 8 compartment used by the trasher to systematically place litter on the trail.

Appendix E

At the conclusion of the experiment, all participants were handed this debriefing form and were allowed ample time to ask questions.

Trail Evaluation Debriefing

Thank you for your participation in the study. The goal of this study is to look at helping behavior in people and how people respond to incentives to help. Specifically, we were interested in how helping behavior such as picking up litter changes as the result of receiving a reward for doing it. Although the trail evaluation task was just a way to engage you without being aware of the intended purpose of this study, we are actually interested in your evaluations. Dr. Michael G. Sorice and the Department of Forest Resources is creating a visitor use plan for the Fishburn, and your feedback is considered valuable.

We adopted this approach so that you would not be distracted with trying to figure out the hypothesis or feel compelled to behave a non-truthful way. Our purpose was not to "trick" you, but to allow you to respond naturally. So, although there are some misleading aspects to this study, we hope that you understand that they were included for an important reason.

This study is important because it allows us to better understand how to create programs that are more effective in encouraging sustainable behaviors for the environment.

All of the information that was collected will be kept in complete confidentiality and there will be no way of identifying your responses with your identity. We are not interested in any one participant's responses by themselves. Rather, we are interested in the general responses of all participants when they are combined together.

If you are uncomfortable in any way as a result of answering any of the questionnaire items, then please let me know.

Finally, we ask that you do not discuss this research with anyone else, at least until the end of the semester, because it could ruin the study for other participants. If you have any questions or concerns regarding your participation in this study please contact Dr. Michael G. Sorice at msorice@vt.edu.

Please sign below to indicate you have been debriefed and you would like your data to be used in the analysis.

_____ _____

Signature Date

_____

Print Name