THE EFFECT OF A VERBAL INTERPRETIVE MESSAGE ON DAY USER IMPACTS AT MOUNT RAINIER NATIONAL PARK

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The behaviors of 434 hikers visiting the heavily used Bench Lake/Snow Lake Trail at Mount Rainier National Park were observed to assess the effect of a verbal interpretive message on compliance with minimum impact hiking recommendations. Significant relationships were found between compliance and message exposure, and a variety of situational and demographic variables.

Introduction

Off-trail hiking at Mount Rainier National Park is of increasing concern. Many of the trails accessible to the day use visitor are located within fragile subalpine meadows. Off-trail hiking within these areas creates a variety of undesirable impacts including trampled vegetation, bare ground areas, soil erosion, and a network of unsightly social trails. Encouraging minimum impact hiking is important not only for minimizing impacts on the resource, but also for enhancing the park visitors' experience. The effects of the quality of the natural environment on visitor experiences have been well documented (Brown, Richards, Daniel and King 1990; Daniel, Brown, King, Richards and Stewart 1989; Vaske, Graefe, and Dempster 1982).

Mount Rainier's day user service area includes the growing communities of Seattle and Tacoma, Washington, which are within a two to three hour drive of Mount Rainier. Day use visitation from these areas is projected to increase as the population within the Puget Sound area of Washington state continues to grow. From 1980 to 1990 the three county area, Pierce, King, and Snohomish, on the eastern shore of the Puget Sound, experienced a 22.3% population increase to 2.5 million people, rising by 465,879 (U.S. Department of Commerce 1980; 1990). It has been documented that most of the off-trail hikers in the Paradise area of the park were in-state residents, thus exacerbating this management problem (Johnson and Swearingen 1988).

Because of the high levels of use and fragile habitats, the park's wilderness management plan includes regulations which prohibit off-trail hiking in the Sunrise and Paradise day use areas. Although it is not illegal, off-trail hiking is discouraged in the fragile meadows outside of these restricted areas. The existing park management policies are based on those methods that are the most effective in deterring off-trail hiking, yet least offensive to the visitor (Samora 1991).

The intent of this study was to investigate possible management strategies to discourage off-trail hiking. Specifically the indirect management approach of presenting a verbal interpretive message was tested for its effectiveness on increasing hiker compliance with minimum impact hiking recommendations.

Previous studies suggest that attitudes and behaviors of hikers at Mount Rainier were most influenced by interpretive messages emphasizing that the visitor's behavior has a direct impact on the vegetation (Johnson and Swearingen 1988). Anderson and Manfredo (1985) suggest that land managers need to communicate clearly to visitors the reasons for a proposed action. Mercer (1984) recommends that education and information programs include not only minimum impact skills and techniques to avoid impacts, but also information about wilderness philosophies, values, history and policy, management techniques, and information about the ecosystem itself. Further, interpretive programs must be designed to reach people at all six levels of Kohlberg's moral development (Christensen and Dustin 1989). Messages should be designed to create some conflict or dissonance to encourage people to advance to the next stage of moral reasoning. The recommendations provided by these previous studies were incorporated into the message design tested during this study. Stage one of Kohlberg's moral development was eliminated from the message, since no formal sanction for off-trail hiking is enforced in the study area.

Methods

Subjects

The subjects involved in this experiment were day visitors to the Bench Lake/Snow Lake Trail at Mount Rainier National Park, Ashford, Washington. The Bench Lake/Snow Lake Trail receives intense use during the summer months. Between 90 and 120 visitors hike the trail on an average summer weekend day. The trail is 1.3 miles long and of moderate difficulty. It leads to one of the most scenic areas of the park. Subjects included day hikers on Fridays through Mondays during the second half of July, and the entire month of August, 1992.

Data Collection

Hiking parties approaching the trailhead were systematically assigned to the experimental or control group. On-site personal interviews were conducted at the trailhead prior to hike initiation. While subjects were completing the survey, the interviewer recorded the assigned group and individual numbers of the hikers, hiker descriptions, time of the interview, and experimental or control group status.

Following the interview, the interviewer, wearing a Student Conservation Association uniform, informally delivered the verbal interpretive message to hiking parties assigned to the experimental group. The opportunity for conversational interaction (comments and questions) between the hikers and interviewer existed. The message was as follows:

"On your hike today, please stay on designated trails. If you go to the lakeshores or beyond the waterfall, be sure to walk on the rocks, because the meadows and forests you are about to enter are unique and fragile. They are easily damaged by trampling. As few as 15 people walking off the trail in the same location can cause noticeable damage to the soils and vegetation. Revegetation efforts funded by tax dollars are only successful if people stay on the trails. If you enjoy the area from the trails, future generations will be able to enjoy its beauty as well."

Following the interview and message delivery, the interviewer communicated the assigned group number, the individual subject numbers, and hiker descriptions to the observers via a hand radio transceiver. This was done once the hikers were on the trail and out of sight and hearing range. Once the hikers approached the lake, hidden observers, dressed in casual clothing, observed and recorded the behaviors of the hikers and whether the hikers complied with the message. The observers utilized binoculars to observe the hikers at a distance whenever possible, in order to be unobtrusive. Hikers were observed for thirty minutes or until the hiking party was out of site, whichever occurred first.

Pilot Study
A pilot study of the procedures was conducted during the first two weekends of July, 1992. The boundaries of the study area and the length of the observation time were determined during the pilot study. Also, inter-rater reliability was established for the two observers employed in this study. The two observers independently recorded observations on 13 hiking parties to ascertain the consistency of their ratings. The observers came to the same conclusion regarding compliance levels ninety-two percent (92%) of the time. Thus, their findings were judged to be comparable and were used for further statistical calculations.

In addition, a manipulation check was performed to confirm that the experimental group and control groups perceived a difference in their treatments. This step was important in ascertaining the effectiveness of the verbal interpretive message. As subjects returned from their hikes, they were asked whether they had received a message on minimizing hiking impacts prior to their hike. The subjects' answers were recorded on the master sheet next to their previously logged information. For the twenty-three cases checked, the participants' perceptions were in complete (100%) agreement with their assigned treatment groups; experimental groups members perceived receiving a message, control group members had not. The manipulation check therefore confirmed the use of control and experimental groups.

Independent Variables
The independent variable pertaining to the main research question was exposure to a verbal interpretive message on minimum impact hiking techniques. Other independent variables measured during the interview were age, gender, education level, ethnicity, location of the subject's permanent residence, occupation, group make-up, hiking experience of the individual, membership in environmental organizations, visitation at visitor information centers, and exposure to park educational information sources. Other independent variables recorded through observations were the size of the hiking party, the number of other people present at the study area excluding other party members, and the number of non-compliant hikers present excluding other party members.

Membership in environmental organizations was used as an indicator of environmental concern. This measure was part of a reliable and valid environmental concern instrument developed by Schahn and Holzer (1990). Environmental action such as conservation organization membership is a stronger measure of environmental concern than positive environmental attitudes or verbal commitment to the environment (Van Liere and Dunlap 1981). Higher correlations existed between independent variables and responsible environmental behavior when the subjects had ties to an environmental organization (Hines 1984).

Dependent Variables
Level of compliance with the recommendation to stay on the trail or walk on rocks while off-trail was the dependent variable measured through observations of hiker behavior. Visitors were considered to be compliant with the minimum impact hiking recommendations if they stayed on the trails, or walked on rocks to avoid vegetation while traveling off-trail. Visitors were considered to be non-compliant if they intentionally stepped off the trail for a short distance to stand, sit or photograph; walked off-trail for longer distances or durations without walking on rocks; or created environmental impacts in addition to off-trail hiking such as littering, harassing wildlife, washing in the lake, picking flowers, cutting or carving vegetation, building a campfire, and disturbing or removing natural features.

Results

Description of the Sample
Eight hundred eighty-four individuals were included in this study. Four hundred nine were exposed to the verbal message, four hundred seventy-five were not exposed to the message, and four hundred thirty-four of these individuals were observed. Overall, the majority of hikers (54%) were non-compliant with the verbal message.

The average Bench Lake/Snow Lake Trail hiker ...

- was Caucasian
- was a college graduate
- was employed in a managerial or professional occupation
- resided in the Seattle-Tacoma area of Washington
- was aged thirty-one to forty years
- hiked in a family group of three to five persons
- had no children in their hiking party
- started their hike during mid-day between 11 a.m. and 1 p.m.
- hiked one to five times during the previous year including trips to Mount Rainier
- was not a member of an environmental organization
- sought an easy trail with scenic beauty
- sought participation in wildflower viewing, photography, and wildlife viewing
- hiked for two to three hours.

Relationships between Independent Variables and Compliance
Exposure to message. Based on the results of a chi-square analysis, a significant relationship was found between exposure to a verbal interpretive appeal for minimum impact hiking and compliance [C^2 (1,4) = 44.87, p = .00000]. The majority of the individuals who did not receive the message (64%) were non-compliers, compared to forty-two percent (42%) of the individuals who did receive the message. The majority of message recipients (58%) were compliant.

Age. Based on the results of a chi-square analysis, a significant relationship was found between age group and compliance [C^2 (4,4) = 47.99, p = .0001]. The majority of hikers aged sixteen to twenty (69%), thirty-one to forty (53%), and forty-one to sixty-five (67%) were compliant with the minimum impact hiking recommendations. Ironically, all of the hikers who created environmental impacts in addition to hiking (e.g, harassing wildlife, littering) were aged sixteen to twenty. The majority of hikers aged twenty-one to thirty (57%) and over sixty-five (67%) were non-compliant.

Level of education. Based on the results of a chi-square analysis, no significant relationship was found between level of education and compliance [C^2 (6,4) = 17.50, p = .6803].

Gender. Based on the results of a chi-square analysis, no significant relationship was found between gender and compliance [C^2 (1,4) = 4.741, p = .31492].

Ethnicity. Based on the results of a chi-square analysis, a significant relationship was found between ethnicity and compliance [C^2 (5,4) = 114.45, p = .00000]. The majority of African Americans/Blacks (73%) were compliant. The majority of Asian Americans/Orientals (78%) were non-compliant. Caucasians/Whites and "other" ethnic groups were equally split between compliers and non-compliers. Only one Hispanic and no Native Americans were observed.

Location of residence. Based on the results of a chi-square analysis, a significant relationship was found between location of residence and compliance [C^2 (61,4) = 267.61, p = .00001]. The majority of hikers residing within King and Pierce Counties of Washington State (Seattle-Tacoma area) (59%) were non-compliers. The majority of hikers residing in other counties within Washington State (52%), residing out of state (60%), and in foreign countries (56%) were compliant with the minimum impact hiking recommendations. Only King and Pierce County residents were observed creating environmental impacts in addition to those from off-trail hiking.

Occupation. Based on the results of a chi-square analysis, no significant relationship was found between occupation and compliance [C^2 (9,4) = 28.412, p = .3899].

Group make-up. Based on the results of a chi-square analysis, a significant relationship was found between group make-up and compliance [C^2 (7,4) = 106.465, p = .00000]. The majority of hiking parties comprised of individuals (76%), and family groups (56%) were compliant. These family groups did not necessarily contain children. Many were married couples and other combinations of adults. The majority of groups comprised of family and friends (51%), friends (53%), and organized group tours (94%) were non-compliant. Specifically, organized group tours comprised of church groups (100%) and foreign travelers (100%) were non-compliers, while an organized group tour comprised of a hiking club (100%) complied.

Hiking party size. Based on the results of a one-way analysis of variance, a significant difference was found between compliers and non-compliers with regard to hiking party size [F = 4.27, p = .002]. Specifically, there were larger party sizes ($\bar{x}$ = 4.10) with those who traveled off-trail without walking on rocks, compared to the party sizes ($\bar{x}$ = 3.58) with those who either stayed on the trail or walked on rocks while off-trail. As hiking party size increased, compliance decreased.

Number of other people present. Based on the results of a one-way analysis of variance, a significant difference was found between compliers and non-compliers with regard to the number of others present (excluding other party members) [F = 5.66, p = .000]. Specifically, there was a greater number of others present ($\bar{x}$ = 1.34) with those who traveled off-trail without walking on rocks, compared to the number of others present ($\bar{x}$ =.60) with those who stayed on the trail. As the number of other people present at the site increased, compliance decreased. Individuals who created environmental impacts in addition to off-trail hiking were the exception. The few individuals observed throwing rocks at wildlife had no other people present.

Number of non-compliant hikers present. Based on the results of a one-way analysis of variance, a significant difference was found between compliers and non-compliers with regard to the number of non-compliant hikers [F = 4.30, p = .002]. Specifically, there were more non-compliant hikers present ($\bar{x}$ = .68) with those who traveled off-trail without walking on rocks, than with those ($\bar{x}$ = .18) who stayed on the trail. As the number of non-compliant hikers present at the site increased, compliance decreased. Individuals who created environmental impacts in addition to off-trail hiking were the exception. The few individuals observed throwing rocks at wildlife had no other people present.

Level of hiking experience. Based on the results of a one-way analysis of variance, no significant difference was found between compliers and non-compliers with regard to the level of hiking experience at Mount Rainier [F = .27, p = .847].

Degree of environmental concern. Degree of environmental concern was measured as the number of memberships in environmental organizations. Based on the results of a chi-square analysis, no significant relationship was found between the degree of environmental concern and compliance [C^2 (5,4) = 26.304, p = .1560].

Visitor center visitation. Based on the results of a chi-square analysis, a significant relationship was found between visitation at visitor information centers and compliance [C^2 (1,4) = 17.623, p = .0015]. The majority of both visitor center visitors (53%) and non-visitors (58%) were non-compliant. Further analyses show that visitation at some visitor centers exhibited a significant relationship with compliance, while others did not. Visitation at the Longmire Museum and the Paradise Visitor Center was related to minimum impact compliance. The relationship between visitation at the Longmire Hiker Information Center and compliance approaches statistical significance. Significant relationships were not found between visitation at other visitor information centers and compliance. It is uncertain what factors associated with these visitor information centers influenced compliance. Visitor center visitors could have been exposed to a ranger, indoor exhibits, or a variety of other interpretive media.

Park educational information sources. Based on the results of a chi-square analysis, no significant relationship was found between overall exposure to educational information sources prior to the hike and compliance [C^2 (1,4) = 2.3116, p = .5103]. Through further analyses, it was apparent that some educational information sources influenced level of compliance, while others did not.

There was a significant relationship between exposure to naturalist's walks/talks and compliance [C^2 (1,4) = 15.3905, p = .0015]. The majority of individuals who were exposed to a naturalist's walk or talk (70%) were compliant with the minimum impact hiking recommendations. The majority of hikers who were not exposed to naturalist's programs (52%) were non-compliant. Naturalist's walks/talks were the most powerful educational information source in influencing compliance in this study.

Based on the results of a chi-square analysis, a significant relationship was found between exposure to indoor exhibits and compliance [C^2 (1,4) = 7.7248 p = .0521]. The majority of individuals who were exposed to indoor exhibits (59%) were compliant with the minimum impact hiking recommendations. The majority of individuals who were not exposed to indoor exhibits (54%) were non-compliant.

There was a significant relationship between exposure to personal contact with a park ranger and compliance [C^2 (1,4) = 8.3912, p = .0386]. The majority of individuals who were exposed to personal contact with a park ranger (60%) were compliant with the minimum impact hiking recommendations. The majority of individuals who were not exposed to contact with a ranger (53%) were non-compliant.

Presence of children. Based on the results of a chi-square analysis, a significant relationship was found between the presence of children in the hiking party and compliance [C^2 (1,4) = 27.0396, p = .00002]. The majority of both individuals hiking with children (59%) and without children (51%) were non-compliant. Fewer individuals with children complied by walking on rocks while off-trail, compared to individuals without children. Further, there was a significant relationship between the ages of the children in the hiking party and compliance [C^2 (1,4) = 12.9952, p = .04311]. Although the majority of hiking parties with children of any age were non-compliant, a larger proportion of individuals with children aged five to then (72%) were non-compliant than those with children aged eleven to fifteen (60%) or under five (56%).

In summary, individuals who complied with the minimum impact hiking recommendations can be described as follows. The majority of the following groups *complied* (all relationships shown were statistically significant):

❀ message recipients		(58%)
❀ persons aged	16 - 20	(69%)
	31 - 40	(60%)
	41 - 65	(60%)
❀ African Americans	(73%)	
❀ residents of	Washington State (excluding King and Pierce Counties)	(52%)
	other states	(60%)
	foreign countries	(56%)
❀ those hiking	alone	(76%)
	with family	(56%)
❀ those who had fewer other people present ($\bar{x}$ =.60)		
❀ those who had fewer non-compliant people present ($\bar{x}$ =.18)		
❀ those with smaller party sizes ($\bar{x}$ =3.58)		
❀ those who visited the	Longmire Museum	(66%)
	Paradise Visitor Center	(59%)
❀ those exposed to	naturalist's programs	(70%)
	contact with a park ranger	(60%)
	indoor exhibits	(59%)

Individuals who did not comply with the minimum impact hiking recommendations can be described as follows. The majority of the following groups were *non-compliers* (all relationships shown were statistically significant):

❀ message non-recipients		(64%)
❀ persons aged	21 - 30	(57%)
	65+	(67%)
❀ Asian Americans		(78%)
❀ residents of King and Pierce Counties, Washington		(59%)
❀ those hiking with	family and friends	(51%)
	friends	(53%)
	organized group tours	(94%)
❀ those who had more other people present ($\bar{x}$ = 1.34)		
❀ those who had more non-compliant people present ($\bar{x}$ = .68)		
❀ those with larger party sizes ($\bar{x}$ = 4.10)		
❀ hiking parties with children	aged five to ten	(72%)
	aged eleven to fifteen	(60%)
	aged under five	(56%)

Conclusions and Implications

Management Implications

The intent of this study was to test the effectiveness of a verbal interpretive message in deterring off-trail hiking at Mount Rainier National Park. The most important implication of this study is that a verbal interpretive message about minimizing hiking impacts, designed to challenge individuals at various stages of moral development, is related to hiker behavior. The results of this study confirm findings of previous research that personal contact with the message deliverer is the most effective interpretive method to induce behavioral changes (Wagstaff and Wilson 1988).

Interpretation can be successfully employed to reduce off-trail hiking impacts at Snow lake. Practical interpretive methods that affect hiker behavior need to be developed and implemented. Ideally, a ranger or volunteer would be stationed at the most heavily used trailheads to provide a message similar to the one used in this study. The appeal of personal contact and the temporal proximity of the message delivery and hike initiation should produce substantive effects on behavior.

A substitute for trailhead interpretation is the delivery of minimum impact appeals by interpreters in the visitor centers. The findings of this study show that personal contact with a park ranger influenced hikers to be more compliant. Findings suggest that visitors to some visitor centers are more likely than the entire population to be compliant. Although the exact media to which visitor center visitors were exposed is unknown, it is possible that messages provided by interpretive rangers at information desks persuaded hikers to stay on the trails. The personal contact provided by rangers delivering messages to visitors who request trail information should be effective in deterring off-trail hiking.

Other interpretive techniques, although not tested for their effectiveness during this study, should be implemented to reach those visitors who do not go to visitor centers. One such option would be to inform visitors through trailhead bulletin boards. The bulletin boards would serve as a reinforcement for individuals who received the verbal message, and the boards could provide site specific information. Trailhead bulletin boards should be visually attractive and interpretive, not mere lists of rules and regulations. The temporal proximity of this message exposure technique to hike initiation should prove to be successful. Not all hikers however will read bulletin boards, especially those who have familiarity with or have previously visited the area. Methods by which to reach local residents presents a concern.

Interpretation using brochures is another method by which to deliver minimum impact appeals. Brochures can be used to reach visitors who request trail information by mail. Communication via mail may be the only means of direct correspondence for some visitors who do not visit visitor centers. Fazio and Ratcliffe (1989) emphasize that responses to mail inquiries from the public are not being fully utilized for dissemination of resource protection information. Exposure to brochures was not related to compliance in this study. This finding is not surprising, because most visitors receive the official park map/brochure upon entering the park. The park map/brochure does not contain minimum impact hiking information. In addition, no other brochures were being utilized for minimum impact hiking information dissemination. Lucas (1981) warns that brochures may fail if the focus is too narrow, if they do not contain information about enjoying the park, or if the readers are already familiar with the topic. He also explains that visitors may not read the brochure before embarking on their hike, if the brochures are distributed at the park. Stolarz (1984) has found that brochures are less effective than other interpretive methods in some situations in encouraging desired behavior changes.

Compliance with minimum impact messages may be increased through several other strategies. Christensen and Clark (1983) explain that single solutions are rarely effective in producing minor rule compliance. Comments made by several hikers suggest that improved trail design may increase compliance. Several hikers suggested that off-trail hiking would be reduced if trails were built to good photography spots, lakeshores, overlooks, and points of interest where visitors are tempted to go. Places for hikers to stop and rest should also be incorporated into trail design. Others suggested providing a designated trail around the lake and placing boardwalks over sensitive areas. Perhaps some of the social trails could be upgraded and designated as official trails.

Additionally, improving trail markings and camouflaging social trails should encourage compliance. The existing social trail network is extensive, and creates a confusing scenario for hikers who intend to comply with minimum impact hiking recommendations. Many of these trails access the lakeshore or are trail links encircling the lake. Some social trails lead to nowhere, while others are intermittent. Hikers may experience difficulty in distinguishing between developing social trails, well established social trails, and National Park Service designated trails. A well intentioned hiker may easily be lead off-trail by following a social trail. A standardized system for designated trail marking could prevent this problem, if undesirable social trails are blocked off or masked.

Existing trail signage is problematic. A sign exists along the National park Service designated trail which reads "END OF THE MAINTAINED TRAIL - Travel Safely Causing Minimum Impact Beyond Here." The trail continues unchanged for quite a distance beyond the sign before fading. These directions are confusing to the hikers. Individuals instructed to walk on rocks when they leave the trail may believe that they should commence these minimum impact hiking practices immediately after passing the sign. This sign placement may have confused some hikers and consequently lowered compliance rates. Perhaps this sign should be moved to the actual end of the trail, and the text should remind hikers to disperse their impacts, walk on rocks, and avoid trampling vegetation.

Recommendations for Further Research

It is desirable that the effects of interpretive messages are lasting. Further research should be conducted to determine if hikers retain minimum impact knowledge after their visit and whether the effect of the interpretive message on hiker behavior continues during other hiking trips at the park.

This study needs to be replicated in distinctly different areas of Mount Rainier National Park. Since Mount Rainier is a relatively large park, different park areas are considerably isolated from each other and may draw visitors from separate local populations. Other highly impacted day use sites deserve further investigation. The findings of this study are site specific and can not be generalized to all locations, conditions, behaviors or situations.

In addition to replicating this study at a variety of hiking sites, the study should be replicated using a variety of interpretive media. Various interpretive media need to be tested for their relative effectiveness in influencing minimum impact hiking behavior. The results of this study indicate that verbal messages are in some way related to hiker behavior; however, for logistical reasons interpreters are unlikely to be stationed at each trailhead to deliver minimum impact messages. Practical interpretive methods such as trail signage, trailhead bulletin boards, brochures informing visitors of conforming trail behavior, messages provided by hiker information center rangers, automated slide programs, indoor exhibits, and naturalist's programs should be evaluated separately and in combination to identify useful strategies to minimize recreational impacts.

Finally, naturalist's programs were identified as interpretive media which have a powerful influence on hiker behavior. It would be beneficial to evaluate why certain visitors choose to attend naturalist's programs while others do not. Park managers can learn ways of adapting current programs to better meet the needs of park visitors. Such information would be useful in marketing park programs to attract greater attendance. Increased attendance can only produce a greater proportion of informed constituents who are likely to become resource stewards -- advocates of park protection. Park naturalist's programs need to sensitively address important threats to the park's environmental quality, while providing positive solutions and practical means for the visitor to make a difference.

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