COMPARING THE INFLUENCE OF INTERPRETIVE AND SANCTION SIGNS ON VISITOR'S ATTENTION, KNOWLEDGE, ATTITUDES AND BEHAVIORAL INTENTIONS

by

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ABSTRACT

This study examines the impact of interpretive and sanction signs in recreation settings. A quasi-field experiment was designed to compare the effectiveness of two types of signs at a county beach in Northern California. Questionnaires were presented to a total of 240 people, randomly assigned to one of three treatments (sanction, interpretation or control). Both sign treatments included messages about keeping dogs under voice control and proper disposal of litter. The control (or no treatment) group did not view a sign. Observations and survey data were collected regarding visitor's on-site experiences and impact of the signs. Subjects in the three groups filled out questionnaires pertaining to their knowledge, attitudes and behavioral intentions towards keeping dogs under voice control and littering. Questionnaires used a combination of multiple choice and Likert-scale questions to elicit responses. Quantitative analysis revealed that the interpretive sign was more effective than the sanction sign at capturing attention and imparting knowledge than the sanction sign. In five of the six measures used to assess attitudes, there was no difference between groups. In the sixth measure, the interpretive group was the superior intervention. Although there was no significant difference between the three groups in their stated behavioral intentions, members of the interpretation group were more likely to say that their sign would be effective at getting *other* beach-goers to stop littering.

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INTRODUCTION

Human impact in natural resource settings is an issue of critical importance to public lands management agencies. While a single person's carelessness may have a small impact on the environment in which he/she is recreating, the carelessness or deliberate misbehavior of ten, a hundred, or a thousand people can have drastic repercussions in the same setting. Undesirable visitor behavior has major impacts on our country's natural resources, including soil, vegetation, water and air quality, and wildlife (Hammit and Cole, 1998). Additionally, misbehaved visitors can adversely impact the experiences of other recreationists (Roggenbuck, 1992). In a 1994 survey of National Park Service units, managers reported that visitor non-compliance had caused a backlog of over $80,000,000 in damages with an additional $18,000,000 in recurring annual clean-up costs (Johnson, Vande Kamp, and Swearingen, 1994).

Agencies have tended to use one of two types of methods in combating undesirable behavior: "heavy-handed" and "light-handed" approaches. Heavy-handed interventions typically involve placing restrictions on visitors' perceived sense of freedom, including increased surveillance, added rules and regulations, and verbal and monetary sanctions. In contrast, light-handed approaches attempt to change people's behavior without overt coercion and include "proactive" interventions such as seeking public assistance in rule formation, changes to the physical environment such as architectural and landscape modifications, and public education (Christensen, 1981). The use of education, via interpretation, as a management tool has gained in acceptance and

has coincided with a number of studies demonstrating its effectiveness in changing people's attitudes and behavior (Hooper and Weiss, 1991). There have been few studies, however, comparing interpretation to other behavior change strategies (Widner and Roggenbuck, 2000). Additionally, results of these studies have differed as to the relative effectiveness of the various persuasion techniques.

Because public signage is one of the most commonly used "light-handed" behavior change strategies, and because the design and fabrication of signage can often be quite expensive, it behooves public land managers to know which type of sign is most effective. The objective of this study, was to compare the effectiveness of interpretative versus regulatory signage in influencing the antecedents to overt behavior change, including capturing visitors' attention, imparting knowledge, changing attitudes and altering behavioral intentions.

Background

"Through interpretation, understanding. Through understanding, appreciation. Through appreciation, protection." (From U.S. Park Service Administrative Manual, 1953, as quoted by Freeman Tilden (1957)).

Though the father of modern interpretation, Freeman Tilden, said these words close to 50 years ago, interpretation was not widely used to influence people's behavior until recently. Traditionally, public and private agencies viewed interpretation as useful in the context of education and recreation, leaving the protection of resources up to regulation and law enforcement (Field and Machlis,1985). It was not until the

publication of Sharpe and Gensler (1978), that interpretation for behavior change began to be used regularly by land-use managers (Hooper and Weiss, 1991).

By the 1990's, interpretation had become a leading approach to combating non-compliant visitor behavior. Of the 191 respondents to a survey sent to interpreters, Hooper and Weiss (1991) found 82.2 % using interpretation as a management tool. A review of the literature conducted by Vande Kamp, et al. (1994) found interpretation widely used by public agencies to combat minor acts of non-compliance.

There are several reasons that interpretation is now used extensively in protecting natural resources and in reducing conflicts among recreationists. Of prime importance to many land-use managers is interpretation's ability to persuade without diminishing the public's sense of freedom and enjoyment (Lucas, 1982, 1983; Roggenbuck, 1992). Interpretation can be a cost-effective means of protecting natural resources and public facilities and minimizing user conflicts (Lucas, 1983). Interpretation can make a difference by educating visitors about the value of specific resources, behaviors that degrade resources and actions that can be taken to protect resources (Dame, 1985). Visitors generally prefer interpretive appeals to regulatory interventions and don't experience the same level of negativity toward managing agencies with interpretation as they do with more traditional regulatory approaches (Martin, 1992; Moore, 1995). Finally, interpretation presented effectively can improve visitor experiences (Lime and Lucas, 1977).

Despite the recent proliferation of interpretive interventions in recreation settings, park managers have continued to utilize regulatory approaches where there are safety

issues such as protection of visitors and natural resources and in order to reduce user conflicts (Lucas, 1982; Roggenbuck, 1992). Many park managers believe that a deterrence approach is effective in combating a wide array of depreciative behaviors (Johnson, et al., 1994). Regulatory signs are sometimes viewed as more credible than interpretive signs that feature graphic or written explanations for the stated injunctions (Wirsching, 2001). Research has also shown that regulations can aid visitors in their appreciation of the resource when those regulations are linked to management goals that are popular with visitors (Frost and McCool, 1988). Several authors believe that regulatory approaches should be used as backup strategies where interpretative interventions have been attempted but failed (Hendee, Stankey, & Lucas, 1990; Lucas, 1982; Wallace, 1990). Conversely, others have argued that a coercive approach should be the primary defense in the protection of public resources because it has a strong track record in changing people's behavior, and because interpretation's ability to change behavior over a long period is largely unproven (McAvoy and Dustin, 1983).

Although regulatory approaches to behavior modification have been shown to be effective under certain circumstances, there are those who think this approach is undesirable because it does not explain the underlying reasons behind regulations that could positively influence visitor's perceptions of managing agencies and their policies (Ham, 1992; Moore, 1995). Others have stated that visitor enjoyment should be the most important factor in determining message type (Martin, 1992) and that sanctions often run counter to the philosophy and goals of recreation agencies where fostering a sense of freedom is a high priority (Duncan and Martin, 2002; Hendee, Stankey & Lucas, 1990;

Lucas, 1983). Additionally, sanctions may not be effective in changing knowledge, attitudes and behaviors in the long-term (Manning, 2003; Roggenbuck, 1992). In spite of these reservations, natural resource agencies have traditionally relied on regulations to modify visitor behavior. A 1981 study of the National Wilderness Preservation System found that agencies used regulation more often than indirect approaches such as interpretation in curbing undesirable behavior (Fish and Bury, 1981). The study's authors also reported that managers believed regulations were more effective than education in reducing problems with noncompliance (Bury and Fish, 1980). The trend away from regulation however towards light-handed techniques like interpretation, has steadily increased since the early 1980's (Hooper and Weiss, 1991; Vander Stoep, 1995).

Competing theories in persuasion

Because depreciative behaviors arise out of varied underlying drives, resultant interventions must be grounded in persuasion theories best suited to those particular motivations. Managers traditionally employ techniques that can be grouped into three conceptual categories: Applied Behavior Analysis (ABA), the central route to persuasion, and the peripheral route to persuasion (Roggenbuck, 1992).

ABA attempts to change people's behavior without trying to change behavioral antecedents such as thoughts, attitudes, and beliefs (Geller, 1987). It maximizes desirable behavior while minimizing undesirable behavior through the use of behavioral prompts, changes to the physical environment, rewards for good behavior, and punishments for poor behavior. By focusing specifically on overt behavior, ABA may not shift the

underlying values, attitudes, and beliefs thought to be required for long-term behavior change (Roggenbuck, 1992).

Because of its reliance on punishments and rewards for overt behavior, ABA is often most effective at changing behavior among recreationists who are chiefly motivated by their personal welfare. According to Laurence Kohlberg's Theory of Moral Development (1976), people progress through stages of ethical maturity in which their receptivity to reward/punishment messages is largely based on their moral framework. Kohlberg believed that many people never advance beyond the first stage of development, in which fear of punishment and desire for social acceptance outweigh other concerns.

Land use managers often attempt to change peoples' behavior by helping them "shift" to higher stages of moral development in which principles of justice and fairness are emphasized. This "shift" is accomplished through techniques associated with the second theoretical approach to persuasion, called the central route (Petty and Cacioppo, 1986) or systematic processing (Chaiken and Stangor, 1987). This approach to persuasion is one of the underlying principles of interpretive interventions, in which individuals gain insight into and think critically about management decisions.

Although attitudes may be changed through this deliberative, central route to persuasion, research has shown that there is, at best, a weak link between attitudes and behavioral outcomes (Armitage and Christian, 2003; LaPierre, 1934; Wicker, 1969). One of the biggest factors complicating the attitude-behavior link is the intervening effect of social norms. According to the Theory of Planned Behavior (Ajzen,1988), the best

predictor of a person's behavior is their "behavioral intention", which is formulated through a combination of attitudes, normative influences, and the perceived ability to perform the given behavior. The purpose of persuasive communication is to sway the salient beliefs that underlie attitudes, social norms and perceived control.

According to Cialdini (1996), persuasive communication must not only attempt to influence relevant norms, but must align competing norms that could otherwise be at odds. The competing norms include descriptive norms in which people do what they see others do and injunctive norms in which people do what they think is "right".

The final theoretical underpinning of many behavior change interventions is the peripheral route to persuasion. This approach is characterized by a minimum of attention and evaluation to the content of the message and by little integration of issue-relevant arguments into the recipient's belief system (Chaiken and Stangor, 1987; Petty and Cacioppo, 1986). In this model, communicators recognize that recipients often use "rules of thumb" in making decisions, and they attempt to shape recipients' behavior choices by activating these mental shortcuts. This route to persuasion is employed in both regulatory and interpretive interventions and often determines the extent to which behavioral appeals are seen as credible.

Interpretative versus regulatory interventions

Although there have been calls by many to use interpretation in solving management problems (Lucas, 1982, 1983; Sharpe and Gensler 1978; Wallace, 1990), there have been comparatively few empirical research studies evaluating the effectiveness of interpretation (Hooper and Weiss, 1991; Roggenbuck, Hammitt, and Berrier, 1982).

Compounding the problem is the variety of behaviors that have been measured, including crowding (Krumpe and Brown, 1982; Lime & Lucas, 1977; Roggenbuck, et al., 1982), vandalism (Jacobi, 2003; Oliver, Roggenbuck, and Watson, 1985; Vander Stoep and Gramann, 1987), littering (Clark, Hendee, and Burgess, 1972; Oliver, et al., 1985), stealing (Martin, 1992; Widner and Roggenbuck, 2000), and feeding animals (Schwartzkopf, 1984). Additionally, many types of interpretive interventions have been studied in those evaluations, including uniformed rangers (Oliver et al., 1985; Roggenbuck, Hammitt and Berrier, 1982; Widner and Roggenbuck, 2000), signs (Hockett, 2000; Jacobi, 2003), brochures (Lime and Lucas, 1977; Martin, 1992), and other media (Fazio, 1979b, Duncan, 2002). Studies have often produced conflicting results due to the different techniques tested under site-specific conditions (Widner and Roggenbuck, 2000).

Like interpretation, investigations into the uses of regulation have found it to be a persuasive deterrent. Studies have looked at the use of uniformed rangers to deter theft (Widner and Roggenbuck, 2000), and signs to deter off-trail hiking (Johnson and Swearingen, 1992), littering (Heberlein, 1971), theft (Martin, 1992), parking in handicap spaces (White, Jones, Ulicny, and Powell, 1988) and feeding wildlife (Schwartzkopf, 1984). Several of those studies have shown that regulations combined with sanction messages were more effective than regulatory messages alone (Johnson and Swearingen, 1992; White, et al., 1988). Threatened monetary sanctions are often used in recreation settings (Vande Kamp et al., 1994), perhaps because of their acceptability to visitors over other sanctions (Taylor and Winter, 1995). Although sanction messages can be effective

in many situations, they are less effective when visitors doubt the follow-through on the part of managing agency (Grasmick and Green, 1981).

Although both regulatory/ sanction methods and interpretive approaches have been found to be effective in controlling depreciative behavior, few empirical studies have been undertaken to compare the two approaches (Hendee, Stankey and Lucas, 1990). Of these studies, results are mixed as to their relative effectiveness. Martin (1992) compared three injunctive signs and an interpretive brochure in controlling the removal of pumice by visitors at Mount St. Helens National Volcanic Monument. Each of the three signs contained short statements using different persuasive messages. The interpretive brochure contained information about the area and problems associated with the removal of pumice. All three signs and the brochure were effective in reducing the rate of pumice removal, however the sign that included a sanction message was found to be significantly more effective than the other methods (Martin, 1992).

Schwartzkopf (1984) studied several signs, some with interpretive elements, designed to discourage visitors from feeding squirrels at Crater Lake National Park. It was found that a sign describing the risk of contracting diseases from the squirrels was roughly twice as effective in preventing visitors from feeding them as a message describing the negative effects of human food on the squirrels. Although the sanction in this study was not imposed by the managing agency, the underlying threat of a consequence to personal welfare acts in much the same way (Heywood, 2002).

In a laboratory experiment, Duncan and Martin (2002) tested the influence of interpretive and sanction messages on behavioral intentions among college students.

Students viewed a series of slides of a hypothetical wilderness outing. The series of slides contained sanction messages, interpretive messages, or no messages (control). Participants were then asked to respond to four different scenarios. Analysis revealed that in all four scenarios, both sanction and interpretive messages significantly reduced negative behavioral intentions over the control. In one of the scenarios, the interpretive message was more effective than the sanction message.

In a study conducted among park rangers in eight wilderness/ backcountry areas, Wallace (1990) evaluated his Authority of the Resource Technique (ART) for combating depreciative behavior. ART was developed to increase visitor compliance with regulations by explaining how certain behaviors can impact resources. Wallace found that in instances where rangers used ART without additional law enforcement, visitors had a much higher rate of compliance than in situations where a traditional regulatory approach was added. Rangers were told to use whichever method seemed most appropriate at the time, and comparisons were only made between ART and ART plus regulation, not with regulation alone.

Purpose of the study

As described previously, it has been demonstrated that both interpretive and regulatory interventions in natural resource settings are effective in many situations. The two approaches are grounded in different psychological theories and utilize different persuasion techniques to change behavior. Few studies have been done comparing the two techniques and of these studies results have been mixed. The purpose of this study

was to compare the effectiveness of an interpretive and regulatory approach in order to contribute to, and perhaps help clarify, the literature on these two persuasion techniques.

This study investigated the effectiveness of interpretive and regulatory signage at Moonstone Beach, a popular county park located in northern California. The location was picked because of the strong desire by local officials to change the behavior of Moonstone Beach visitors in regards to out of control dogs and littering. Both behaviors have been shown to adversely impact threatened Western Snowy Plovers. In addition to a dramatic decline in population numbers, their nesting locations have declined by 80% in the last thirty years (Colwell, 2003). Additionally, a recent survey of visitors to Moonstone Beach (Martin, 2003) found that litter and uncontrolled dogs were two of the most frequently mentioned behaviors impacting visitors' enjoyment.

Though both the interpretive and regulatory interventions attempted to change visitor behavior, this study measured the interventions' influence on the antecedents to overt behavior change. In this case, the indicators included attention, knowledge, attitude, and behavioral intention.

Research questions

Is a regulatory or interpretive intervention more effective at capturing people's attention?

Is a regulatory or interpretive intervention more effective in imparting knowledge?

Is a regulatory or interpretive intervention more effective at changing participant's attitudes?

Is a regulatory or interpretive intervention more effective at changing participant's behavioral intentions?

Humboldt State University's Committee for the Protection of Human Subjects in Research approved this research proposal on August 6, 2004. The approval number is 04-06.

METHODS

Study Site and Population

A quasi-field experiment was conducted at Moonstone Beach, located thirteen miles north of Arcata, California, off Highway 101. The location was chosen in part due to the large number of visitors who frequent the beach and the relatively restricted access point by which all visitors must pass from the parking lot to the beach. The study included a sample of visitors (n = 240) to Moonstone Beach during the height of the recreation season in September.

Study Design

The dependent variable was effectiveness of two types of sign messages designed to influence visitor behavior. "Effectiveness" was measured using four components: attention, knowledge, attitudes and behavioral intentions. These were measured through the use of behavioral observations and questionnaires. The independent variables were the treatment (described below) and demographics associated with the sample population including: gender, dog ownership, and frequency of participant visitation to the beach. The sample consisted of a sanction treatment (80 subjects), an interpretive treatment (80 subjects), and a control or no-treatment (80 subjects).

Visitors entering Moonstone Beach either encountered a message board displaying one of the two treatments, or passed by a blank message board (control). In

the treatment periods, the board either displayed a simple regulatory sign describing sanctions for breaking Humboldt County park rules or an interpretive sign that gave the reasons behind the rules but did not mention sanctions. Messages on the board were set up and removed each day of the study period.

Data collection took place over the course of four and a half weeks in September and October 2004. Each data collection period lasted 3 hours during the morning, afternoon or evening. Each of the treatments and the control were tested during morning, afternoon and evening blocks, as well as blocks on weekends and weekdays. The total number of data collection periods per treatment type differed due to the rapidity with which a sub-sample of 80 subjects was collected for each group. On days when there was more than one data collection period (i.e. morning and afternoon) only one type of treatment was given. There were 23 data collection periods, during which each treatment type was tested at each time-period more than once. There were a total of eight interpretation sampling blocks, nine regulation sampling blocks, and 6 control sampling blocks.

Both the sanction and the interpretive sign were of equal size, roughly two and a half by three feet, and were constructed out of a durable, weather resistant polymer. Defining characteristics of both signs are described in Table 1, with photos in Figure 1 and Figure 2.

Table 1: Characteristics of sanction and interpretive signs

Components of the Sign	Sanction (Appendix B)	Interpretation (Appendix C)
Design	Emulated existing Humboldt county signs	Followed "best practices" of interpretive design
Text	Listed the county's regulations pertaining to littering and keeping a dog under voice control, with corresponding penalty for an infraction	"Sold" the idea that disposing of litter in waste receptacles and keeping dogs under voice control protected the rights of other beach users and the threatened Western Snowy Plover
Graphics	Brown background with white lettering	Included a large "broken heart" set against the backdrop of a beach, pictures of snowy plovers and visitors with their dogs
Goal	Influence visitor's knowledge, attitudes and behavior towards dogs and litter	Influence visitor's knowledge, attitudes and behavior towards dogs and litter

Figure 1: Interpretive sign

Figure 2: Regulatory sign

Data Collection

Two procedures were used to collect data, including both an observational check sheet and a self-report questionnaire. The check sheet was used to keep track of visitors' behavior as they approached one of the two signs (if they were in one of the treatment groups). The questionnaire required visitors' participation after they had passed the treatments or control and were exiting the beach. In the first procedure, visitors were

discreetly monitored as they left the parking lot and approached the sign. Unobtrusive observations included dressing casually and making observations from an inconspicuous vantage point, such as behind a large boulder. The purpose of the observations was to assess visitor behavior as they approached the signs. Observers carried a check list (Appendix A) that included behavioral categories including whether or not visitors stopped, length of stay (measured with a stop watch), and number of people in the group. Additionally, physical characteristics of the observed visitors (as well as an assigned number) were recorded in order to identify them later as they were leaving the beach.

The second procedure involved giving previously observed visitors a questionnaire as they returned to their cars after recreating. Placing the observation number on each corresponding questionnaire correlated visitor observations and questionnaire responses. The purpose of the questionnaire (Appendix B) was to assess visitors' knowledge and attitudes of regulations on dogs and litter, as well as their behavioral intentions towards those regulations. The questionnaire used a mixture of multiple choice and Likert-scale questions to measure dependent variables from several perspectives. In addition to questions about knowledge, attitudes, behavioral intentions, and demographics, the questionnaire also asked participants whether they had seen one of the treatment signs on a previous occasion in order to screen for repeated measures bias. Respondents who indicated that they had seen one of the two signs previously were not counted among the total sample.

On sampling days, all visitors entering the beach along the path of the sign base had an equal chance of being observed and asked to participate in the study. Participants

were chosen by selecting a member to observe from each group who approached one of the treatments. In groups that consisted of more than one person, the visitor who was "picked" alternated between the first and second person at the front of the group. The observation process continued through the entire 3 hour treatment period. The survey component began once observed visitors returned to the parking lot. As visitors approached their cars, researchers asked visitors to participate in the survey. Visitors who were observed but who did not wish to participate in the questionnaire were tracked as non-respondents. There was a 91% response rate on the questionnaires. Both the observational check sheet and several questionnaire designs were pre- tested in classes at Humboldt State University in order to assess the clarity of instructions as well as the response to scales used for scoring.

RESULTS

Visitor Characteristics

Of 240 participants, 112 were male (47%) and 128 were female (53%). There was no statistical difference in the ratio of men to women among the three groups, χ^2 (2) = 1.136, p =0.567 (table 2).

Participants were asked about the frequency of their visits to Moonstone Beach. Somewhat less than half (43%) said they visit the beach at least once a week, 34% visit at least once a month, 14 % visit at least once a year, and 9% said it was their first visit. In spite of my attempts to minimize external variables through apportioning equivalent sample times and days of the week to each group, a chi-square test found that the regulatory treatment group had a higher percentage of frequent (at least once a week) visitors than did the interpretive group (χ^2 (1) = 7.510, p =0.006) (table 3).

Table 2: Ratio of men to women in each treatment group.

Group	Men	Women
Interpretation	42	58
Regulation	48	52
Control	50	50

Table 3: Percentage of frequent (at least once a week) visitors in each group.

Group	% Frequent Visitors
Interpretation	33
Regulation	55
Control	41

In order to answer the question "were differences in results due to treatment type or frequency of beach visitation?," a subsample of participants was selected for special analysis. This subsample, by consisting of exactly 50% frequent and 50% infrequent visitors in each treatment group, reduced the influence of frequency of beach visitation as an intervening variable. A balanced subsample was achieved by using a random selection process to bring the ratio of frequent to infrequent visitors to 50/50. Analyses were then conducted on this subsample, replicating analyses conducted on the complete sample. Because the majority of findings from the selected subsample did not significantly differ from those of the complete sample, results throughout the remainder of this section are given for the complete sample. In the few circumstances where frequency of beach visitation did seem to influence visitors' responses, results from both the balanced and unbalanced sample sets are given.

Because sign treatments were attempting, in part, to influence owners' behaviors towards dogs, a question was asked to find the percentage of dog owners in the total sample. Roughly half the participants (54%) own dogs (table 4), and there was no significant difference in the percentage of owners to non-owners among the treatments, (χ^2 (2) = .115, p =0.944).

Table 4: Percentage of dog owners and non-dog owners in each treatment group.

Group	Dog owner	Non-dog owner
Interpretation	55	45
Regulation	52	48
Control	54	46

Attention

Using a chi-square non-parametric test for statistical significance, I found that a greater percentage of visitors stopped at the interpretive sign for at least one second (81%) than at the regulatory sign (68%), (χ^2 (1) = 3.968, p = 0.046). Using a log of the data due to problems associated with skewness and kurtosis (time interval data that does not have a normal curve can often be corrected by taking a log of the data), I found that of the visitors who did stop, the average viewing time was much longer for the interpretive group (42 seconds) than for the regulatory group (9 seconds), (F (1) = 30.493, p < 0.001) (table 5).

Knowledge

In order to test visitors' knowledge of beach regulations (as well as their attitudes and behavioral intentions towards those regulations), only visitors who stopped at a sign for at least one second were counted in the sample pool for the interpretation and regulation groups. All visitors in the control group were counted in the sample pool. The sample size (and statistical power) of the interpretation and regulation groups was therefore smaller than that for the control group on all survey questions.

Table 5: The length of stay of those who stopped.

Group	Time it takes to read sign (seconds)	Average reading Time (seconds)	Range (seconds)
Interpretation	57	42	0-169
Regulation	19	9	0-39

Visitor knowledge was assessed through responses to several multiple choice questions on the survey. The first question asked, "How much freedom are dogs allowed at Moonstone Beach?" Answers included, 1) kept on a leash at all times, 2) under voice control or on a leash at all times, 3) not allowed on Moonstone Beach, 4) under voice control in the parking lot but allowed to run on the beach, 5) allowed to run in both the parking lot and beach, and 6) don't know. Using the chi square test, both the interpretive group (χ^2 (1) = 28.308, $p < 0.001$) and regulatory group (χ^2 (1) = 36.302, $p < 0.001$) had a higher percentage of correct responses (under voice control or leashed at all times) than the control group (table 6).

The second question asked, "According to Moonstone Beach regulations, what should you do with your trash when leaving the beach?" The question was left open ended in order to elicit a range of responses. Because attitudes against littering are deeply crystallized social norms in the United States (Heywood, 2002), I did not attempt to measure whether or not participants knew the general beach rules regarding littering. Instead, the open-ended question was meant to find out whether participants remembered the specific injunction contained in both signs to "put litter in a designated trash can." Participant's responses included such directives as, "throw it away," "take it

Table 6: Rate of correct responses to question, "How much freedom are dogs allowed?"

Group (N)	Correct Response: under voice control or leashed at all times
Interpretation (64)	61
Regulation (53)	69
Control (79)	18

with you," "recycle it," "don't bring it in the first place," and "bury it." Somewhat less than 50% of respondents in all three groups said to "throw trash away," although a larger portion of participants in the interpretive and regulatory groups gave this response. A chi-square test however, found no difference between the groups (χ^2 (2) = 2.081, p = 0.721). A majority in all three groups (>90%) said to either "throw it away" or "take it with you" (table 7).

The final multiple-choice question in this section sought to find out whether visitors knew the managing agency of Moonstone Beach. Because Humboldt County's parks logo was placed on both signs, a high percentage of correct responses within either of the treatments would indicate the medium's communication effectiveness. In response to the question "Who manages Moonstone Beach?", possible answers included 1) Bureau of Land Management, 2) Humboldt County Parks Department, 3) California State Fish and Game, 4) National Parks Service, 5) California Coastal Commission, 6) United States Fish and Wildlife Service, and 7) Don't know. Using a chi-square test it was found that the interpretation group had a significantly higher correct response rate than the control group (χ^2 (1) = 8.021, p = 0.005) (table 8). When an analysis was done of the 50/50 data set (equal numbers of frequent to infrequent in each group), the interpretive group

Table 7: Frequencies of responses to the question, "What should you do with your trash when leaving the beach?"

Group (N)	Correct Response: Put in the trash	Take it with you	Other
Interpretation (65)	45	51	4
Regulation (53)	45	51	4
Control (72)	36	56	8

had a higher correct response rate than the control group (χ^2 (1) = 10.014, p = 0.002), and a higher correct response rate than the regulatory group (χ^2 (1) = 5.776, p = 0.016) (table 9). Correcting for an inflated alpha using the Bonferroni procedure (α / number of tests), it was found that results still met statistical significance at the p =.017 threshold.

In addition to the multiple-choice questions, two open-ended "knowledge" questions were put to members of the interpretive and regulatory groups. The first question was, "What was the purpose of the sign?" (table 10). Members of the interpretative group were more likely than the regulatory group to describe their sign as informational/ educational (χ^2 (1) = 11.938, p = 0.001). Additionally, the interpretative group more often described their sign as a tool for protecting the environment, χ^2 (1) = 16.477, p <0.001, as opposed to the regulatory group which more often described their sign as simply "about rules", (χ^2 (1) = 21.520, p <0.001).

Table 8: Rate of correct responses to question, "Who manages Moonstone Beach?" among total sample pool.

Group (N)	Correct Response: Humboldt County Parks
Interpretation (65)	52
Regulation (53)	40
Control (79)	29

Table 9: Rate of correct responses to question, "Who manages Moonstone Beach?" among groups with equal ratios of frequent to infrequent visitors.

Group (N)	Correct Response: Humboldt County Parks
Interpretation (44)	61
Regulation (47)	36
Control (65)	30

The second question asked participants to state what they remembered about the sign. The interpretive group had a higher percentage of participants who could recall at least one graphic or written component of the sign as compared to the regulatory group, (χ^2 (1) = 4.652, p = 0.031) (table 11).

Attitudes

In order to measure visitor attitudes toward Moonstone Beach regulations, participants were asked to rate their level of agreement or disagreement with a series of statements. Because of the ordinal nature of responses (1. strongly agree, 2. somewhat agree, 3. somewhat disagree, 4. strongly disagree), the Kruskal-Wallis test for non-parametric data was used to assess differences among groups. The first statement attempted to measure whether the regulatory treatment elicited a higher level of "psychological reactance" toward the managing agency than either the interpretive or control treatments. The theory of psychological reactance proposes that attempts to

Table 10. Frequencies of responses to, "What was the purpose of the sign?"

Comment	Interpretation (n = 65)	Regulation (n = 54)
Information	(1) 40%	13%
Stop poor behavior/ promote good behavior	12%	0%
Protect enviro.-general	(3) 17%	0%
Protect enviro.- plover	11%	0%
Rules- general	3%	(2) 28%
Reduce littering	6%	0%
Reduce dog problems	8%	(3) 17%
Dogs *and* litter	15%	13%
Other	8%	4%
Don't know	(2) 31%	(1) 35%

restrict an individual's freedom often produce a "boomerang effect", in which an individual will increase in the restricted behavior and (or) exhibit negative attitudes towards those placing restrictions (Brehm and Brehm, 1981). All three groups tended to disagree with the statement, "The managing agency is too strict in enforcing regulations at Moonstone Beach." There was no significant difference between groups (χ^2 (2) = 0.574, p = 0.751) (table 12). In a related statement, all three groups generally agreed with "The managing agency does a good job in providing for visitor enjoyment at Moonstone Beach." Again, there was no significant difference among groups (χ^2 (2) = 0.008, p = 0.996) (table 13). Responses to both questions indicatedthat neither sign elicited a high level of psychological reactance.

Table 11. Frequency of responses to, "What do you remember about the sign?"

Comment	Interpretation (n = 65)	Regulation (n = 54)
Aspects of sign general	6%	2%
Brown	0%	6%
Red Heart	(1) 23%	0%
People	5%	0%
Plovers/ Wildlife	12%	2%
Dogs-general	11%	(3) 15%
Dogs- voice control	(3) 15%	(2) 19%
Litter	13%	11%
Rules	2%	(2) 19%
Education	2%	0%
Liked it	9%	0%
Didn't like it	3%	4%
Other	6%	0%
Don't know	(2) 22%	(1) 35%
Could recall at least one graphic or written component of sign	**68%**	**48%**

Two statements measured attitudes toward litter. The first stated "As long as it's biodegradable, litter is not going to hurt anyone." It was found that the interpretation group was more likely to disagree with this statement than the regulation group (χ^2 (1) = 4.968, p = 0.026) (table 14). The difference between the interpretation and control group did not meet statistical significance (χ^2 (1) = 1.086, p = 0.297).

The second related statement read, "Litter is a major area of concern on Moonstone Beach." All three groups tended to agree with this statement and there was no significant difference among the groups (χ^2 (2) = 1.204, p = 0.548) (table 15)

Table 12: Mean ranking (on scale 1-4, from strongly agree to strongly disagree), "The managing agency is too strict in enforcing regulations at Moonstone Beach."

Group (N)	Mean	SD
Interpretation (65)	3.16	.627
Regulation (54)	3.00	.907
Control (80)	3.04	.801

Table 13: Mean ranking (on scale of 1-4, from strongly agree to strongly disagree), "The managing agency does a good job in providing for visitor enjoyment at Moonstone Beach."

Group (N)	Mean	SD
Interpretation (65)	1.97	.677
Regulation (54)	1.98	.769
Control (80)	2.00	.822

Table 14: Mean ranking (on a scale of 1-4, from strongly agree to strongly disagree), "As long as its "biodegradable", litter is not going to hurt anyone".

Group (N)	Mean	SD
Interpretation (65)	3.65	.648
Regulation (54)	3.35	.805
Control (80)	3.46	.871

Finally two statements elicited attitudes toward off-leash dogs. Although members of the interpretative group appeared more likely to agree with the statement "Out-of-control dogs frequently interrupt visitor's enjoyment" than members of the control group, the results did not meet statistical significance (χ^2 (1) = 2.729, p = 0.099 (table 16).

In response to the statement "Moonstone Beach is a good place for dogs to run freely," all three groups generally agreed and there was no statistical difference between groups (χ^2 (2) = 2.503, p = 0.286) (see table 17). Dog-owners, regardless of treatment, were more likely to believe that dogs should be allowed to run freely than non-dog owners (χ^2 (1) = 11.283, p = 0.001). Additionally, frequent beach visitors, regardless of treatment, were more likely to believe that Moonstone Beach is a good place for dogs to run freely than infrequent beach visitors (χ^2 (1) = 7.560, p = 0.006). In spite of this, analysis of the 50/50 data set found that the frequency of beach visitation did not impact the overall differences among groups (χ^2 (2) = 2.572, p = 0.276 (table 18).

Table 15: Mean ranking (on a scale of 1-4, from strongly agree to strongly disagree), "Litter is a major area of concern on Moonstone Beach.."

Group (N)	Mean	SD
Interpretation (65)	1.94	.916
Regulation (54)	1.98	.858
Control (80)	2.06	.843

Table 16: Mean ranking (on a scale of 1-4, from strongly agree to strongly disagree), "Out-of control dogs frequently interrupt visitor's enjoyment."

Group (N)	Mean	SD
Interpretation (65)	2.22	1.111
Regulation (54)	2.28	1.133
Control (80)	2.51	1.066

Table 17: Mean ranking (on a scale of 1-4, from strongly agree to strongly disagree), "Moonstone Beach is a good place for dogs to run freely."

Group (N)	Mean	SD
Interpretation (65)	2.17	1.084
Regulation (54)	2.24	1.181
Control (80)	1.96	1.096

Behavioral Intentions

In order to ascertain what visitors might actually do upon reading one of the signs, participants were asked to rate the likelihood that they would take specific actions described in the survey. Participants ranked the likelihood of taking those actions on a scale from 0-100%; 0% being very unlikely and 100% being very likely. The first action read, "I will bury garbage away from heavily used areas." Using analysis of variance, it was found that most visitors, regardless of treatment, were unlikely to bury garbage and

there was no statistical difference among groups (F (2) = 1.426, p = 0.243) (table 19). Because the standard deviations in this analysis were on the order of 2-4 times the size of their corresponding means, an analysis was conducted in which outlier responses (90-100% likelihood of burying garbage) were taken out of the sample. This analysis confirmed that there was no statistical difference between groups (F (2) = 1.241, p = 0.292).

A related question measured responses to the action explicitly described in both signs, "I will dispose of garbage in a trash can." This time subjects in all three groups said they were very likely to do so and again there was no difference among groups (F (2) = .101, p = .904) (table 20).

Table 18: Mean ranking (on scale of 1-4, from strongly agree to strongly disagree), "Moonstone Beach is a good place for dogs to run freely," among groups with equal ratios of frequent to infrequent visitors.

Group (N)	Mean	SD
Interpretation (44)	2.16	1.055
Regulation (48)	2.25	1.176
Control (56)	1.95	1.115

Table 19: Likelihood (0-100%) that visitors would "Bury garbage away from heavily used areas."

Group (N)	Mean	SD
Interpretation (65)	4.97	20.002
Regulation (53)	12.26	29.784
Control (76)	6.84	22.640

In a final question dealing with personal behavior towards litter, visitors were asked to rate their responses to the statement "I will not bring garbage to the beach." All visitors, regardless of treatment, said they were unlikely to bring garbage, and once again there was no statistical difference between the groups ($F(2) = 0.066$, $p = 0.936$) (table 21)

Although neither of the sign treatments influenced participants' intended actions towards litter, there was a significant difference in which sign they thought would influence other people to stop littering. Though a minority of participants within both sign treatments thought their sign would get people to stop littering, a larger percentage of the interpretive group thought their sign would be effective than did the regulatory group ($\chi^2(1) = 7.148$, $p = 0.008$) (table 22).

Table 20: Likelihood (0-100%) that visitors would "Dispose of garbage in a trash bin."

Group (N)	Mean	SD
Interpretation (65)	96.00	13.555
Regulation (54)	96.67	11.655
Control (76)	95.57	15.338

Table 21: Likelihood (0-100%) that visitors would "Not bring garbage to the beach."

Group (N)	Mean	SD
Interpretation (65)	66.41	33.823
Regulation (52)	66.92	37.810
Control (76)	67.40	37.584

When asked why the sign would or would not be effective in stopping people from littering, participants gave a range of responses that were later analyzed using content analysis. Although a minority of participants in both treatments thought the sign would be effective, a larger percentage of the interpretation group had favorable responses than did the regulatory group (approaching statistical significance χ^2 (1) = 3.495, p = 0.062) (table 23). Additionally, a larger percentage of the regulatory group had negative responses than did the interpretive group (χ^2 (1) = 4.316, p = 0.038) (table 23).

The next series of questions asked participants about their behavioral intentions toward their dogs. Because the questions were geared to dog owners, only participants who said that they own dogs were counted in the sample pool. It should be noted that due to the relatively small number of dog owners, the statistical power was also reduced.

The first question asked participants to rate the likelihood (from 0-100%) that "The next time that I bring my dog to Moonstone Beach, I will let him/her run unhindered in the parking lot and beach." All dog owners, regardless of treatment, said they were unlikely to do this. Although the interpretation and regulation groups appeared less likely to agree with the statement than the control group, the difference was not statistically significant (F (2) = 0.743, p = 0.478) (table 24).

Table 22: Visitors who thought the sign they read would "Get people to stop littering."

Group (N)	Percentage
Interpretation (57)	43
Regulation (47)	19

Table 23: Frequencies of responses to "Why would/wouldn't the sign stop people from littering?"

Comment	Interpretation (n = 65)	Regulation (n = 54)
Yes- good Reminder	14%	4%
Yes- ff people read it they'll stop littering	2%	4%
Yes- it will raise awareness	12%	2%
Yes- it will help somewhat	11%	2%
Yes- gives consequences	0%	2%
Total who gave at least one favorable response	29%	15%
No- no consequences	5%	2%
No- people won't read it	11%	16%
No- those who litter will do it anyway	31%	41%
No- preaching to the choir	3%	3%
No- too nice	2%	0%
No- too bureaucratic	0%	2%
No- didn't like look of sign	2%	2%
No- doesn't talk about litter	0%	4%
Total who gave at least one unfavorable response	48%	67%
Don't remember much about sign	3%	2%
Don't know	0%	4%

The next question asked participants to rate the likelihood that "I will keep my dog under voice control at all times." All dog owners, regardless of treatment, said they were likely to do this and there was no statistical difference among groups ($F(2) = 0.894$, $p = 0.412$) (table 25).

A final question dealing with intended behavior towards dogs asked participants to rate the likelihood that "I will keep my dog on a leash at all times." A minority of dog owners said they would do this, and there was no statistical difference among groups ($F(2) = 0.266$, $p = 0.767$) (table 26).

Another question related to dogs asked participants (dog owners and non-dog owners alike) whether the sign they saw would "deter out-of-control dogs." Although it appeared that members of the interpretive group were more likely to say their sign would be effective in changing other dog-owners' habits than members of the regulatory group, results did not meet statistical significance (χ^2 (1) = 1.954, p = 0.162) (table 27).

In a follow up question, participants gave a wide range of responses to the open-ended question, "Will the sign get people to keep their dogs under voice control: why or why not?" Although it appeared that the interpretive group had more favorable responses than the regulatory group, the difference between groups did not meet statistical significance (χ^2 (1) = 2.461, p = 0.117) (table 28). Additionally, although it appeared that members of the regulatory group were more likely to have negative opinions of their sign than members of the interpretive group, the difference did not meet statistical significance (χ^2 (1) = 1.194, p = 0.275 (table 28).

Table 24: Likelihood (0-100%) that visitors would "Let my dog run unhindered at the beach."

Group (N)	Mean	SD
Interpretation (35)	38.00	38.866
Regulation (27)	36.67	37.826
Control (42)	47.38	44.779

Table 25: Likelihood (0-100%) that visitors would "Keep my dog under voice control at all times."

Group (N)	Mean	SD
Interpretation (35)	85.43	29.139
Regulation (25)	90.00	22.913
Control (42)	80.00	34.571

Table 26: Likelihood (0-100%) that visitors would "Keep my dog on a leash at all times."

Group (N)	Mean	SD
Interpretation (34)	27.06	32.986
Regulation (25)	31.20	37.229
Control (41)	33.17	38.629

Table 27: Visitors who thought the sign they read "Would get people to keep their dogs under voice control."

Group (N)	Percentage
Interpretation (57)	53
Regulation (47)	39

Table 28: Frequencies of responses to, "Do you think the sign will get people to keep their dogs under voice control: why or why not?"

Comment	Interpretation (n = 65)	Regulation (n = 54)
Yes-general	8%	15%
Yes- if dog is well trained	3%	0%
Yes- if owner is well trained	5%	7%
Yes- it will bring awareness	14%	2%
Yes- because it makes you feel guilty	9%	2%
Yes- enforcement	2%	6%
Total who gave at least one favorable response	35%	22%
No-general	2%	0%
No- surfers let their dogs run	3%	0%
No- people won't listen	11%	22%
No-dogs are too wild	9%	7%
No- no enforcement	2%	2%
No- preaching to the choir	2%	11%
No- people won't read sign	8%	11%
Total who gave at least one unfavorable response	40%	50%
Don't know	5%	2%
Other	5%	0%

DISCUSSION

There were several primary findings of this study. The interpretive sign was more effective in capturing attention, and in keeping attention longer, than the regulatory sign. The interpretive sign was better at imparting knowledge than the regulatory sign. Of five of the six measures used to assess attitudes, the interpretive, regulatory and control groups had equally high pro-social responses. The sixth measure used to asses attitudes found members of the interpretive group had higher levels of pro-social responses than the regulatory group. Finally, it appeared that although there was no difference between the groups in their behavioral intentions, the interpretive group was more likely than the regulatory group to believe their sign would persuade other people from littering.

Had there been no differences between the two sign treatments in their ability to influence visitor knowledge, attitudes or behavioral intentions, the interpretive sign still would have been the superior intervention by virtue of more people stopping at the sign (13% more than the regulatory treatment), and reading it (an average of 33 seconds longer). The fact that a greater percentage of visitors received some form of communication meant that a larger pool of people were at least superficially aware of beach regulations and were able to exert influence on social norms. This result concurs with research by others showing that interpretive media incorporating novel and vibrant colors (Arndt, Screven, Benusa, & Bishop, 1992), pictures (Korenic, 1991), and provocative headings (Kanel and Tamir, 1991) are more effective at capturing attention than traditional media.

As can be seen from the results of the other dependent variables, not only was the interpretive sign superior to the regulatory sign in capturing people's attention, but it was better at transmitting information. These findings were tempered by demographic characteristics of the sample population that in some instances reduced the significance of the main findings. Although gender and dog ownership influenced how respondents answered a number of questions, the ratio of men to women and dog owners to non-dog owners was fairly constant across treatment groups, and therefore did not influence the overall results. This was not the case with frequent versus infrequent beach visitors. The ratio of frequent visitors (at least one visit per week) was much higher among members of the regulatory group (55%) than among members of the interpretative (33%) or control (41%) groups.

People who repeatedly visit specific recreation areas often have strong "place attachment," in which they identify with and rely on those places for a fairly constant range of experiences (Moore and Graefe, 1994). According to Williams and Stewart (1998), strong place attachment is often associated with crystallized attitudes about the uses, norms and regulations pertaining to that place, and is not amenable to persuasion. Additionally, Moscardo (1999) points out that any type of repetitive activity, such as frequent visitation to the same beach, can give rise to a state of "mindlessness" in which new stimuli are ignored or evaluated only superficially. In spite of this, roughly equal numbers of frequent and non-frequent visitors stopped at the sign in both the regulatory and interpretive groups, demonstrating that the signs were novel enough to pique curiosity, regardless of visitation frequency. Though "place attachment" did not seem to

influence attention, there were differences in how frequent and non-frequent visitors responded to a number of questions pertaining to attitudes and behavioral intentions. Where those differences impacted the overall findings, they are explored later in this section.

On three of the five measures used to assess knowledge acquisition, members of the interpretive group correctly answered questions about the content and design of their sign better than members of the regulatory or control groups. Of the questions that did not find the interpretive sign the superior treatment, one found both treatments equally effective and the other found no difference between the three groups. The fact that the interpretive intervention was found superior in a majority of situations concurs with several studies on knowledge acquisition and retention, which show that effective communication often includes elements that are personally relevant to the individual (Koran, Morrison, Lehman, Koran and Gandara, 1984), salient to the situation (Falk, Phillips, & Boxer, 1992), and thematic (Tarlton, 2004).

There was no significant difference between groups when asked, "What should you do with your trash when leaving the beach?" The fact that over 90% of the individuals within each group said to either "take it with you" or "throw it away" demonstrates the strength of social norms associated with littering.

The findings for attitudes showed that neither sign was effective in five of the six measures used. This is likely due to the difficulty in changing attitudes, in which the persuader must overcome the subject's personal beliefs as well as prevailing social norms. In response to a statement attempting to measure psychological arousal,

participants may have disagreed that "the managing agency is too strict in enforcing regulations" precisely because there is little direct management or enforcement of regulations at Moonstone Beach. In a related statement, a majority of participants may have agreed that "the managing agency does a good job of providing for visitor enjoyment" because of a perception that minimal regulation equates with visitor satisfaction.

In a statement pertaining to littering, participants across groups may have agreed that "litter is a major area of concern on Moonstone Beach," because anti-littering opinions are strongly crystallized social norms in the United States (Heywood, 2002). Additionally, there is conspicuous debris at Moonstone Beach during periods of peak visitation.

When it came to attitudes towards off-leash dogs, the statement "out-of-control dogs frequently interrupt visitor enjoyment" elicited general agreement among all three groups and differences between groups were not statistically significant. This finding contrasts with visitors' agreement that "Moonstone Beach is a good place for dogs to run freely." The fact that participants believed dogs were a problem, and concurrently thought they should be left to run wild, may be due to the effect of bifurcated social norms arising from "self serving bias" (Campbell and Sedikides, 1999). People may have felt that other people's dogs negatively impacted their enjoyment yet thought their own dogs should be left unhindered. The fact that both signs failed to elicit higher levels of pro-social responses demonstrates the power of both social norms ("collective" versus "individual" norms) in limiting the persuasiveness of the interventions.

Although there was no statistical difference between the regulatory and interpretive groups in their opinions of off-leash dogs, dog owners were far more likely to believe that dogs should run freely than non-dog owners. Once again, this is likely due to self-serving bias in which people ascribe positive motives, personal virtue and social acceptability to their actions (Campbell and Sedikides, 1999). In addition to the difference between dog-owners and non dog-owners, frequent beach visitors were more likely to believe that they should let their dogs run freely than infrequent visitors. This is likely due to the influence of "place attachment" in which those who are repeat visitors get used to and subscribe to prevailing social norms; in this case lack of enforcement and presence of many off-leash dogs.

In the one instance where a treatment elicited a higher rate of pro-social response, members of the interpretive group were more likely to disagree with the statement, "biodegradable litter is not going to hurt anyone," than members of the regulatory group. This was likely due to the overall effectiveness of the interpretive sign, which incorporated best practices such as appeals to different levels of moral development (Kohlberg, 1976) and central and peripheral routes to persuasion (Petty and Cacioppo, 1986). Additionally, the interpretive intervention may have been persuasive due to the specificity of the message that described how litter attracts predators that harm snowy plovers. The fact that a higher percentage of the interpretive group agreed with the statement is a measure not only of the sign's ability to change attitudes, but also of its ability to convey a specific message.

Among questions pertaining to behavioral intentions, there was no difference between groups in how they said they would act with respect to litter or keeping dogs under voice control. Behavioral intentions regarding litter were likely unchanged because strongly preexisting social norms were already in place. Likewise, it may have been difficult to change behavioral intentions towards dogs because participants were uniformly dog-owners who had a vested interest in maintaining their established behavior. It may be that participants evaluated the pros and cons of changing their habits and decided that the benefits of continuing habitual patterns outweighed the benefits of changing them.

Although neither sign was effective at changing personal behavioral intentions, members of the interpretive group were more likely than members of the regulatory group to believe their sign would be effective in combating littering behavior. Typical positive comments from the interpretive group included, "It's a good reminder," and "Shows you how litter can harm kids and wildlife." The fact that personal behavioral intentions were unchanged by either sign, while the interpretive group thought other people's behavior could be changed, demonstrates the superiority of the interpretive intervention in spite of prevailing social norms. The disparity between what members of the interpretive group said they would do versus what others would do when it came to littering likely results from self-serving bias where individuals assumed their actions were blameless and needed no revision. Although this pattern would seem to reduce expectations of the sign's ability to influence individual behavior, the interpretive group's

positive view of their sign's influence on others demonstrates the potential for it to shape normative standards and potentially shape behavior.

Infrequent visitors and females were more likely to say their sign would be effective in getting people to keep their dogs under voice control than frequent visitors and males, regardless of sign treatment. Infrequent visitors likely ascribed powers of persuasion to their sign due to their own openness to persuasion, brought on by a lack of place attachment and habitual behavior. Female visitors were more likely to believe that the sign would influence other people's behavior. This is likely due to females' tendency to value social cohesion and stability (in this case following the rules) over taking risks (Byrnes, Miller, & Shafer, 1999). Although the difference between women and men differed in their response to the effectiveness of the sign on others' behavior, the ratio of men to women did not differ across groups and therefore did not alter the ultimate findings.

In conclusion, the findings show that the interpretive sign was superior in capturing attention and imparting knowledge and in one case changing attitudes. When it came to changing behavioral intentions neither sign was effective, however the interpretive sign was deemed more persuasive than the regulatory sign when it came to impacting other people's littering behavior. The fact that it became harder to influence people as one moved from capturing attention to changing behavioral intentions demonstrates the difficulty in overcoming social norms. As Cialdini (1996) has pointed out, when people are trying to sort out competing normative influences, it is often descriptive norms (doing what others do) that win out over injunctive norms (doing what

is right). In this case, even though people in the interpretive group were likely to know the regulations and were even likely to have pro-social attitudes, their behavioral intentions were unchanged due to prevailing descriptive norms. Where hardened social norms prevent people from acting in accordance with management goals, there are few options to successfully gain visitors' compliance. One alternative is to circumvent attitudes altogether by increasing law enforcement; the other possibility is to cultivate a critical mass of visitors with pro-social attitudes. This later approach to changing visitor culture may only be effective after weeks, months or years of sustained public interpretation.

Management Implications

There are several management implications from this study. Management can expect that a larger percentage of visitors will read and learn from interpretive signage than from traditional regulatory signage. This is due not only to the use of novel design elements contained in many interpretive media, but also to carefully crafted messages that appeal to a wide variety of learning styles and levels of development. This has important implications not only for signs, brochures and exhibits designed to influence behavior, but for media meant purely for educational purposes as well. At a time when managing agencies are looking for new and creative ways to communicate with an expanding number of visitors, crafting signage and other interpretive materials that incorporate best practices is vitally important.

Management can also expect that attitudes, one of the main antecedents to overt behavior change, are likely to be influenced by interpretive signage more so than regulatory signage. Although the findings on this dependant variable were more ambiguous than that for attention and knowledge, the interpretive sign was better than the regulatory sign in the only measure that recorded a difference between groups. Among open-ended responses on the survey, visitors were more likely to remember something about the interpretive sign, have a positive view of it, and believe it would be effective in changing behavior. This agrees with other research showing that visitors generally prefer interpretation to regulation (Martin, 1992; Moore, 1995). The power of interpretation to impact attitudes has enormous implications for land-use managers. Because molding attitudes are essential to changing social norms, the use of interpretive signs that incorporate the central route to persuasion can be key components in changing public opinion.

The fact that neither intervention elicited "psychological reactance" may be due to visitors believing that the signs carried no real threat to their perceived freedom. It should be noted however that the regulatory sign's failure to elicit higher levels of negative reaction over that for the interpretive sign, in spite of a message containing a $500 fine, shows that there may be circumstances where regulations are appropriate.

Management can absorb several lessons from the conclusion that neither sign was effective at changing behavioral intentions. In the case of this study, one might have expected the regulatory group to have a greater degree of changed attitudes and behavioral intentions due to their single exposure to the sign. A one-time encounter

might favor a more direct approach to behavior change in which a premium is placed on changing overt behavior rather than changing underlying beliefs and attitudes. The fact that members of the interpretive group often scored better on attitudes and equally on behavioral intentions as their regulatory counterparts, and were more likely to ascribe powers of persuasion to their sign, points to the effectiveness of this intervention.

The failure of the interpretive sign to elicit even more pro-social responses can be largely attributed to the difficulty in changing behavior (and behavioral intentions). Intervening variables such as normative influences and perceived control can dissuade someone from performing a behavior even when their personal attitudes are in alignment with that behavior. Because persuasion is impacted by social norms, interpretive interventions must seek to change not only personal attitudes, but must attempt to shift the normative "culture" of the visiting population. A one-time encounter with an interpretive sign is unlikely to change behavior without first having laid a positive groundwork of social norms. Changing the underlying beliefs of a critical mass of visitors is likely to occur only after time and sustained effort on the part of the agency. As has been demonstrated by this study, interpretive interventions can help to cultivate this "critical mass" simply by reaching and influencing more people than regulatory interventions do.

People bring with them a wide range of learning styles and levels of cognitive, emotional, and moral maturity that can impact how they react to signage and what they learn and do as a result. While one person may give more credibility to an "official" looking regulatory sign, the personal narrative of an interpretive sign may move another

person. Examples of two contrasting perspectives on a single sign are members of the interpretive group who said, "It's important to tell people how their actions impact the environment," and "It won't be effective because it's too nice." That neither treatment was successful in changing behavioral intentions may be due in part to the narrow scope of moral development that each sign targeted. A more effective intervention may have used a persuasion strategy to appeal to a wide range of moral development. An effective sign could have included both an ethical appeal to keep dogs under voice control and refrain from littering, and a sanction for not complying with regulations.

Finally, neither sign may have been effective in changing visitors' behavioral intentions because of characteristics of the population. As has been noted previously, almost half the participants (43%) in the total sample visit the beach once a week. That Moonstone beach is a "locals" beach agrees with a study by Martin (2003) of Moonstone visitors, which found that 85% of the sample population was comprised of repeat visitors and a plurality of those came weekly. Not only was it more difficult to influence attitudes and behavioral intentions among frequent visitors (at least in some instances), but it was harder to persuade males and dog owners as well. This demonstrates the importance of "knowing your visitors" and tailoring management strategies to specific populations. This may include using single interventions with messages tailored to a multitude of groups, or separate strategies directed toward populations with different demographic characteristics.

Although neither sign was effective in changing behavioral intentions, it should not be construed that the methods would necessarily fail in the field. Learning and

attitude formation are processes that take time and sometimes need repeated exposure to change. What impact would the signs have had on visitors seeing them repeatedly in different locations, or in the same location but multiple times? What impact would the signs have had on visitors who had "soft" (as opposed to "highly crystallized") social norms resulting from a sustained educational campaign?

Further Research

This study suggested several questions for further research. First, what effect would multiple exposures to the same sign have on visitors? In a real world situation, visitors entering a park are likely to walk or drive past the same sign many times over the course of their stay. Often the same or similar signs will be encountered in various locations on the same site, especially in the case of signs emphasizing resource management. Although repeat exposure to the same sign may help visitors remember more, increased "memorization" does not always equate with increased "understanding" (Martin, Wen, & Wong, 2005). Similarly, Moscardo (1999) noted that novelty is a key component of persuasive communication, from capturing attention to impacting attitudes. Would visitors be as likely to stop and read an interpretive or regulatory sign after passing it for the second or third time? If they did read it, would their knowledge, attitudes and behavioral intentions be increased significantly over those who read the sign only once?

A second topic for research could involve comparing the effectiveness of an interpretive and regulatory sign (as were used in this study), plus the addition of a sign

that blends components of the two strategies. As has been discussed previously, people are at different levels of cognitive and moral development and may be affected by different types of persuasion. How effective would a sign be that includes a heading such as "Love is in the Air!" and a byline mentioning a "$500 fine for infraction"?

Another question worth investigating is whether the interventions owed their successes and failures to the overarching conceptual models used in developing the signs (interpretive versus regulatory), or were the results related more to individual characteristics associated with the signs themselves (too many/ too few words, the right/ wrong color, etc.). A study could be designed in which several interpretive and regulatory signs were developed, tested, and the results averaged for each group. This might give a better picture of the effectiveness of the theoretical underpinnings of the two treatment types and reduce the influence of atypical signs.

Similarly, did the signs owe their successes and failures more to their unique messages or were they due to differences in their design and layout? A study could be conducted in which the two signs' messages were teased apart from other design elements. Such a study might look similar to the one conducted by Duncan and Martin (2002) in which interpretive and regulatory signs, without graphic components, were tested for impacts on behavioral intentions. In this case however, the study would be conducted in the field instead of in a classroom.

As has been demonstrated in this study by the contrasting responses among frequent and infrequent visitors, men and women, and dog owners versus non-dog owners, a compelling investigation could be to test signs that target specific demographic

characteristics. As an example, signs targeting frequent visitors could emphasize the need to "save the beach from negative change", versus signs targeting newcomers which could emphasize "making the beach a better place."

Finally, although many of the antecedents to overt behavior change were measured in this study, behavior change itself was left out as a dependant variable. This was largely due to the difficulty in measuring behavior. In the case of litter in the study, the percentage of people who actually leave trash behind at Moonstone Beach is very small. Actually seeing someone litter is probably rarer still. Likewise, once dogs have been left off of a leash at Moonstone Beach, it is often difficult to match dogs with owners. Compounding this problem is the near impossibility of measuring "voice control" which is a subjective term that cannot be quantified. A study on regulatory versus interpretive signage could be conducted that measures easily observable behavior, such as picking up trash that had been left by the researcher or keeping a dog on a leash. An investigation such as this would add to the small but growing number of studies that have measured signs' impacts on behavior.

Limitations

Because the questionnaire portion of the study was attempting to gather information about several antecedents to behavior change (knowledge, attitudes, and behavioral intentions), only a limited number of questions (thirty four) could be asked without making the length of the survey unduly burdensome to participants. Because of this limitation, it was sometimes difficult to draw conclusions about the effectiveness of

the treatments on dependant variables (knowledge, attitudes and behavioral intentions). A better determination of the influence of the treatments on overarching dependant variables could have been made by increasing the number of questions in each category. Additionally, a broader understanding of the influence of the treatments on the dependant variables could have been made by either limiting the number of dependant variables under investigation, or randomly distributing questionnaires that focus solely on knowledge, attitudes or behavioral intentions. In the later case, it would have been essential to dramatically increase the number of participants in the total sample pool.

Another reason for increasing the total sample size would have been to increase statistical power. Among several results, the alpha value was slightly above the standard 0.05 level for statistical significance. A larger total sample (say 400 participants) could have given clarity to subtle differences in the various treatments' effectiveness. Additionally, the number of participants who answered questions about their behavioral intentions towards dogs was especially small due to the restriction on non-dog owners from participating. Statistical power could have been increased by asking all participants, regardless of dog ownership, to answer the questions, then separating out the responses of dog owners where needed.

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APPENDIX A

Observation Form

Appendix A (continued)

Visitor #	# people in group	1st/ 2nd person in group (if applicable)	Description	Length time stop	What was said/ other observations	Disqualify
1						
2						
3						
4						
5						
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APPENDIX B

Moonstone Beach Visitors Survey

Moonstone Beach Visitor Survey

2004

Principle Researcher, Marnin Robbins
Humboldt State University

Appendix B (continued)

Thank you for taking a few minutes to respond to this survey. You are participating in research that will lead to the proper management of Moonstone Beach. Because your answers are valuable and are being kept anonymous, please do not write your name anywhere on this survey. Additionally, if you are 18 years of age or younger, please do not participate in this survey. If you wish to stop participating in this survey, you may do so at anytime with no questions asked.

As you progress through this survey, please **do not** revise your answers once you have finished a question.

The following questions ask you about your current **knowledge** of official guidelines at Moonstone Beach. Please place a check mark in only one box after each question.

1) Moonstone Beach regulations state that off-road vehicles are restricted to:

- □ driving on the waves slope (wet sand)
- □ driving above the wave slope (dry sand)
- □ driving south of the Little River
- □ driving between sunrise and sunset
- □ not allowed on Moonstone Beach
- □ don't know

2) According to Moonstone guidelines, how much freedom are dogs allowed:

- □ kept on a leash at all times
- □ under voice control or leashed at all times
- □ not allowed on Moonstone Beach
- □ under voice control in parking lot but allowed to run on beach
- □ allowed to run in both parking lot and beach
- □ don't know

3) Moonstone Beach is open to the public:

- □ 5 am - midnight
- □ 6 am – 9 pm
- □ sunrise-sunset
- □ 24 hours/ day
- □ 6 am - sunset
- □ don't know

Appendix B (continued)

4) According to Moonstone Beach regulations, litter should be (answer in a word or two):

5) Who manages Moonstone Beach?

- □ Bureau of Land Management
- □ Humboldt County Parks Department
- □ California State Fish and Game
- □ National Park Service
- □ California Coastal Commission
- □ United States Fish and Wildlife Service
- □ don't know

Indicate how strongly you **agree** or **disagree** with the following statements by checking the appropriate box.

6) The managing agency is too strict in enforcing regulations at Moonstone Beach.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

7) As long as its "biodegradable", litter is not going to hurt anyone.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

8) Horses should continue to be allowed at Moonstone Beach.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

Appendix B (continued)

9) Out-of-control dogs frequently interrupt visitor's enjoyment.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

10) Off-road vehicles are a great way to explore Moonstone Beach..

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

11) Litter is a major area of concern at Moonstone Beach.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

12) Moonstone Beach is a good place for dogs to scamper and play.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

13) The hours of operation are too restrictive at Moonstone Beach.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

14) The managing agency does a good job in providing for visitor enjoyment at Moonstone Beach.

Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
□	□	□	□

Appendix B (continued)

The following questions ask you about what you **intend to do** while you are at Moonstone Beach.

15) I will bury litter away from heavily used areas.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100 %

16) I will dispose of litter in a trash bin.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100 %

17) I will not bring litter to the beach.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100 %

18) What impacts, if any, does litter have on Moonstone Beach? (Please answer in a word or two):

19) Do you own a dog?

□ yes
□ no (skip to question 26)

20) The next time that I bring my dog to Moonstone Beach, I will let my dog run unhindered in the parking lot and beach.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100 %

Appendix B (continued)

21) The next time that I bring my dog to Moonstone Beach, I will keep my dog under strict voice control in the parking lot and beach.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□ □ □ □ □ □ □ □ □ □ □
0 10 20 30 40 50 60 70 80 90 100 %

22) The next time that I bring my dog to Moonstone Beach, I will keep my dog on a leash at all times.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□ □ □ □ □ □ □ □ □ □ □
0 10 20 30 40 50 60 70 80 90 100 %

23) What impacts, if any, do out-of-control dogs have on Moonstone beach? (Please answer in a word or two):

24) Do you own an off-road vehicle (ORV)?

□ yes
□ no (skip to question 30)

25) The next time that I bring my ORV to Moonstone Beach, I will only drive on the wave slope (wet sand).

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□ □ □ □ □ □ □ □ □ □ □
0 10 20 30 40 50 60 70 80 90 100 %

26) The next time that I bring my ORV to Moonstone Beach, I will only drive above the wave slope (dry sand).

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□ □ □ □ □ □ □ □ □ □ □
0 10 20 30 40 50 60 70 80 90 100 %

Appendix B (continued)

27) I will not bring my ORV to Moonstone Beach.

On a scale from 0% - 100%, what is the chance that you would do this? Please mark an x above the percent:

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100 %

The next questions refer to the sign placed in the sand below the parking lot.

28) What was the purpose of the sign? (please answer in a sentence or two):

29) What do you remember about the sign?

30) Do you think the sign will stop people from littering?

Yes □ No □

Why or why not?

What do you think it would take to stop someone from littering?

31) Do you think the sign will get people to keep their dogs under voice control?

Yes □ No □

Why or why not?

What do you think it would take to get someone to keep their dog under voice control?

Appendix B (continued)

32) Are you male or female?

- □ male
- □ female

33) How often do you come to Moonstone Beach?

- □ 1-2 times per week
- □ 1-2 times per month
- □ 1-2 times per year
- □ this is my first visit

34) Within the past month (excluding today), have you seen a sign posted in the sand just below the Moonstone Beach parking lot?

- □ yes
- □ no