

THE EFFECT OF IN-GROUP AND OUT-GROUP PERSUASIVE
COMMUNICATIONS ABOUT CLIMATE CHANGE ON THE
ENVIRONMENTAL BELIEFS AND BEHAVIORAL
INTENTIONS OF WINTER RECREATIONISTS

by

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ABSTRACT

Climate change has become a ubiquitous topic in society. The majority of the scientific community has concluded that climate change is occurring and that humans are primarily responsible. However, there is less agreement among the general public. Within the winter recreation industry, inconsistent precipitation and higher global surface temperatures associated with climate change have the potential to be problematic. There is a need to effectively influence beliefs about climate change and the behavioral intentions of individuals for those who have an interest in preserving climatic conditions favorable for winter recreation. Persuasive messaging has the potential to leverage an individual's involvement in and social identity with winter recreation activities. This study examined the impact of socially relevant persuasive message sources on the environmental beliefs and behavioral intentions of winter recreationists. This research is presented in a three article dissertation format.

The first article addresses a preliminary pilot study developed to test persuasive messages about climate change using criteria outlined in the Elaboration Likelihood Model (ELM). This study tested strong and weak messages to determine the ELM's effectiveness using the real-world issue of climate change. The messages did not meet the established criteria, confirming the difficulties previously identified with applying the ELM to issues in an applied, nonlaboratory setting.

The purpose of the second article was to determine the most effective communicator of climate change messages in order to elicit changes in environmental belief and behavioral intention. This study assessed participant environmental beliefs and behavioral intentions in three message treatment groups (in-ski resort source, ski equipment manufacturer source, climate scientist source) and a control group (no message) while accounting for leisure involvement and social identity. An analysis of variance yielded no significant main or interaction effects. Manipulation checks yielded higher cognitive processing and source credibility for the climate science message source.

The third article was a practical application on current climatic conditions, perceptions of the general public and winter recreationists, and implications of climate change for winter recreation. In addition, this article proposes actions for the winter recreation industry in order to help mitigate the effects of climate change.

The culminating discussion is a reflection on the findings of all three articles. Recommendations include development of more comprehensive messaging strategies surrounding climate change and a more thorough evaluation of the ELM when applied in nonlaboratory settings.

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CHAPTER I

INTRODUCTION

The issue of climate change has become a ubiquitous topic in society today. The Intergovernmental Panel on Climate Change (IPCC) concluded that “warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level” (IPCC, 2007, p. 30). Paleoclimate data indicate that the current levels of carbon dioxide, the primary gas responsible for climate change, is at historically high levels, causing deleterious effects on the planet (Hansen et al., 2008).

In order to avert further environmental degradation, there is a need to both influence beliefs regarding climate change and to determine how to better influence environmental behaviors related to this issue. A belief is “the subjective probability of a relation between the object of the belief and some other object, value, concept, or attribute” (Fishbein & Ajzen, 1975, p. 131). In sum, an environmental belief is the subjective probability of a relationship between an aspect of the environment and some other object, value, concept, or attribute. In drawing from the Theory of Reasoned Action, beliefs form the foundation for attitudes and influencing environmental beliefs has the potential to be a starting point that can change environmental attitudes, behavioral intentions, and subsequent environmental behaviors (Fishbein & Ajzen, 1975).

The environmental behaviors of the general public indicate an overall lack of concern for the influence they may be having on climate change as worldwide emissions of carbon dioxide have continued to rise despite scientific consensus (Tans, 2010). Environmental problems, including climate change, are considered to be the result of collective human behaviors and “it is only by changing social behavior that imminent threats to humanity and its environment can be controlled” (Stern & Oskamp, 1987, p. 1076). In order to begin mitigating the effects of climate change, it is necessary to address the behaviors, and the behavioral antecedents, that have led to such drastic changes in climatic conditions. These changes in environmental behaviors are partially dependent upon changes in individuals’ intentions to engage in those behaviors (Ajzen, 1987; Ajzen & Fishbein 1977).

However, the public debate regarding the existence of climate change and its cause has been contentious and many citizens continue to be unconvinced that there is a correlation between human behavior and climate change. The foundations of climate change science date back to the early 19th century (Weart, 2008) and have developed into a contemporary scientific consensus as to the existence and causes of climate change (Anderegg, Prall, Harold, & Schneider, 2010). There is far less consensus among the general public regarding this issue (Gardner, 2011; Leseiowitz et al., 2011; Newport, 2010). “The *gap between* public perception and scientific reality is now enormous” (Hansen, 2009, p. 171) and it is critical to determine how to best bridge this gap. Recently, some researchers have identified a need for scientists to become more proficient and vociferous in the communication of scientific concepts (Hassol, 2008;

Miller et al., 2009). Despite this movement, climate scientists may not be the best messengers for spreading the word about climate change.

There are numerous aspects of persuasive messages, as identified in the Elaboration Likelihood Model (ELM), that can be altered to positively influence changes in belief and behavioral intention. One of the most critical aspects of a compelling message is its personal relevance (Petty & Cacioppo, 1986a). Personal relevance is referred to as the intrinsic importance (Sherif & Hovland, 1961) that a persuasive message has for the viewer. In assessing a persuasive message, and the personal relevance of that message, the viewer may put forth varying amounts of cognitive effort to consider the main tenets contained in the message, which will lead to differing levels of change in belief or behavioral intention (Petty & Cacioppo, 1986a). According to the ELM, a persuasive message will be attended to in one of two ways. For example, if there is a high level of personal relevance for the viewer, then he or she is more likely to cognitively process the arguments contained in the message (Petty & Cacioppo, 1986a). If those arguments are cogent (strong), then the message should elicit an attitude change or maintain the attitude of the viewer consistent with the intended purpose of the message. In the presence of specious (weak) arguments, a highly involved viewer will dismiss the arguments through cognitive processing and no attitude change will occur. If there is a low level of personal relevance, regardless of the strength of the arguments, the viewer will defer to cues outside of the arguments. These peripheral cues may include factors such as affect, source credibility, number of arguments present in the message, or attractiveness of the communicator (Petty & Cacioppo, 1986a). If the peripheral cue is

salient to the viewer, there is greater potential that he or she will retain the proposed belief or engage in the proposed behaviors.

In evaluating the message arguments, cognitive processing is more desirous because it leads to greater persistence of change, resistance to counter-persuasion, and predictive capacity of subsequent beliefs and behaviors (Petty & Cacioppo, 1986a). Those viewers with a high level of personal relevance, or involvement in, the persuasive message have a high likelihood of cognitive processing and change consistent with the intention of the message (Petty & Cacioppo, 1986a). Ideally, effective persuasive messages will elicit changes that exhibit greater persistence, resistance to counter-persuasion, and predictive capacity of subsequent behavior (Petty & Cacioppo, 1986a). However, there is a need to determine how to better influence belief and behavioral intention change in those message viewers with low levels of personal relevance.

The concepts of personal relevance and involvement have often been considered to be synonymous. "Involvement refers to the strength or extent of the cognitive linkage between the self and stimulus object" (Kyle et al., 2007, p. 399) and has been conceptualized as personal relevance (Kyle et al., 2007). There is strong overlap regarding these concepts as personal involvement, personal relevance, and issue involvement have all been used interchangeably and presented as a critical aspect of the Elaboration Likelihood Model, which explains an individual's connection with the issue presented in a persuasive message (Petty & Cacioppo, 1986a). Engagement in leisure activity has been associated with a high level of personal choice (Gunter & Gunter, 1980), which should be associated with personal relevance. For example, an individual's choice of leisure activity should make a persuasive message about that activity more

personally relevant. As a result, varying levels of leisure involvement will most likely influence how an individual attends to activity-relevant persuasive messages. Ultimately, the aforementioned effects of climate change should be significant to those individuals whose leisure activity choice is reliant upon specific climatic conditions (i.e., skiers, snowboarders).

In addition, the social identity of the viewer and how this interacts with the source of a persuasive message has the potential to become a peripheral cue that motivates cognitive processing (Mackie, Gastardo-Conaco, & Skelly, 1992; Mackie, Worth, & Asuncion, 1990). Social identity is developed as a result of an individual's knowledge about the social groups to which he or she belongs and the value and emotional significance attached to their membership in those groups (Tajfel, 1978). Engagement in a leisure activity, in particular, has been found to affirm identity (Dimanche & Samdahl, 1994). Depending on context, certain social identities may increase in importance, making the associated norms and attitudes of certain groups more or less prominent (Hogg & Abrams, 1988). Through social identification and comparison of their groups with other groups, individuals come to identify similar others as in-group and dissimilar others as out-group (Stets & Burke, 2000). It is postulated that in-group references have a greater level of perceived credibility because of their group standing and an increased potential for eliciting changes through the persuasive process (Clark & Maass, 1988), whereas messages from out-group sources have been found to be less influential (Mackie, Worth, & Asuncion, 1990; Van Knippenberg, Lossie, & Willke, 1994; Van Knippenberg & Wilke, 1992). A study of message sources found that an out-group source (university students from the US northeast), that should have a higher level

of credibility on the subject of a persuasive message (acid rain in the US northeast), was less influential than an in-group source with less credibility (university students from the US southwest) on the subject (Mackie, Worth, & Asuncion, 1990). This provides some evidence as to the extent that social identity can determine the success of persuasive messages.

In the context of this study, involvement in winter recreation should create some level of personal relevance with a persuasive message about climate change as climatic conditions influence a winter recreationist's capacity to engage in this leisure activity. However, differing levels of involvement in winter recreation activities should also create some level of variation regarding how they attend to a persuasive message about climate change. Those highly involved winter recreationists should attend to a climate change message through cognitive processing, thus eliciting a high level of change in environmental belief and behavioral intention.

There is a discernible need to determine how to best influence those winter recreationists with lower levels of involvement (see Figure 1). Winter recreationists with *low involvement* may not deem the issue of climate change to be substantial enough on its own to elicit cognitive processing and a subsequent, durable change in attitude. However, as a result of an individual's *social identity*, a persuasive message source that is important to this viewer may operate as a *peripheral cue* that motivates cognitive processing and a subsequent change in environmental belief and behavioral intention. Under these circumstances, a message source from within a socially identified group has a greater potential to elicit an attitude change than a message source from outside of a socially identified group. As a result, the climate science community, despite its higher level of

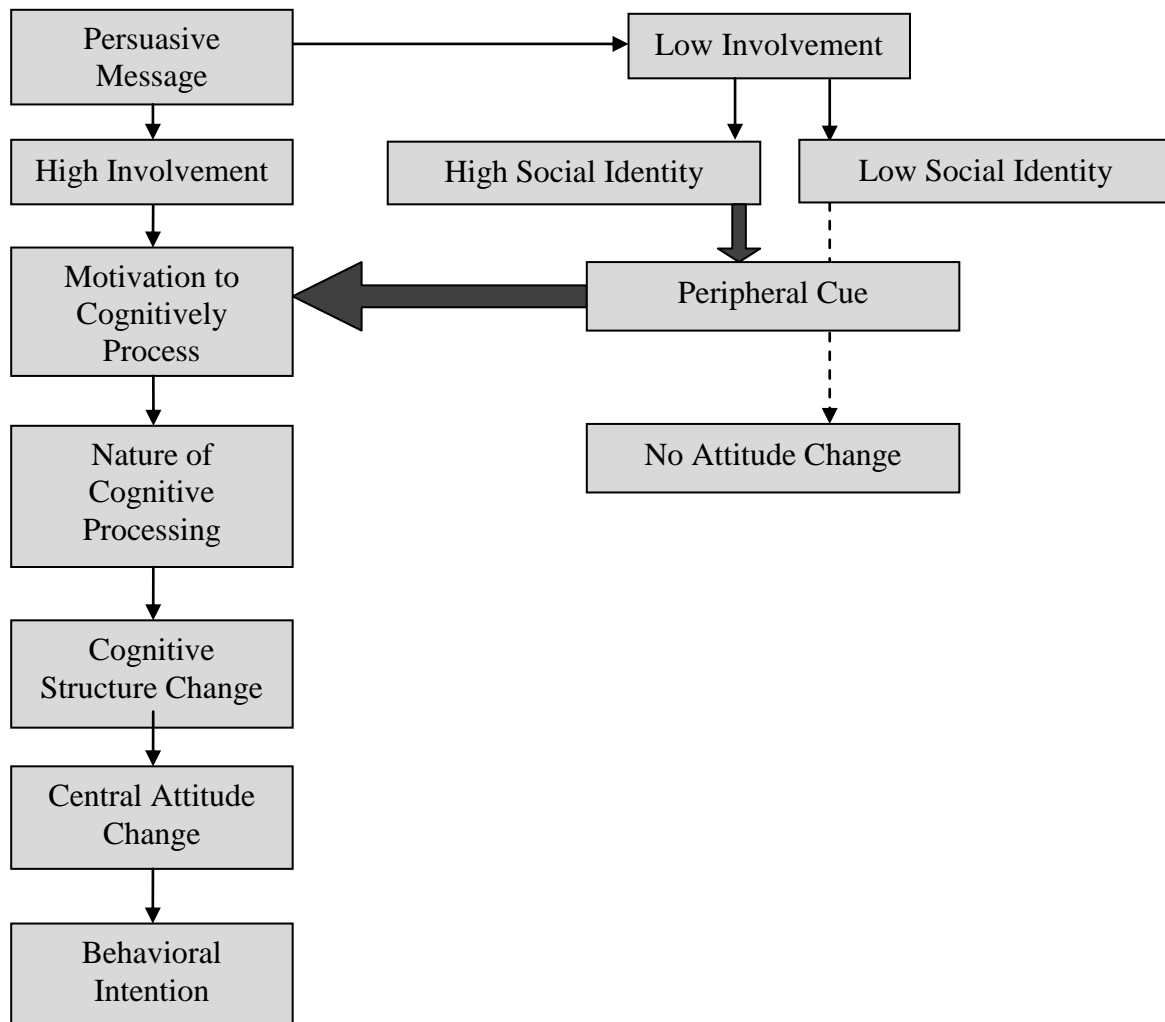


Figure 1: Proposed model of social identity peripheral cue influence on environmental belief and behavioral intention (Derived from Petty & Cacioppo, 1986b)

expertise, may or may not be the most influential message source from which to deliver a persuasive message about climate change and prompt a change in environmental belief and behavioral intention among winter recreationists. Therefore, this study will investigate the effect of winter recreation message sources on the environmental beliefs and behavioral intentions of skiers and snowboarders.

Statement of the Problem

Some minor inconsistencies have been acknowledged in the Elaboration Likelihood Model, which necessitates further investigation. Whereas the ELM differentiates the central and peripheral routes to persuasion, previous studies have found that there are peripheral cues that have the capacity to operate in a central route manner (Mackie, Gastardo-Conaco, & Skelly, 1992; Mackie, Worth, & Asuncion, 1990).

Persuasive messages communicated by a viewer's social group, in spite of having a less expertise, have been more influential than messages from more expert sources outside of the viewer's social group (Mackie, Worth, & Asuncion, 1990; Van Knippenberg, Lossie, & Willke, 1994; Van Knippenberg & Wilke, 1992). It is proposed that members of certain in-groups may be influenced by an in-group reference in one of two ways (Mackie, Gastardo-Conaco, & Skelly, 1992; Mackie, Worth, & Asuncion, 1990).

The first approach states that, consistent with the ELM, an in-group reference within a persuasive message may operate purely as a peripheral cue, which will not lead to cognitive processing, but may elicit some level of belief or intention change. The second approach proposes that the existence of an in-group reference may increase personal relevance, lead to cognitive processing, and elicit a higher level of belief or

intention change. It is also postulated that in-group references have a greater level of perceived credibility, which can facilitate a greater level of change (Clark & Maass, 1988). This research expanded upon the work of Mackie et al. (1990; 1992) by determining the effectiveness of social identity and a socially relevant message source in creating attitude change through persuasive messaging. Therefore, the purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit changes in environmental belief and behavioral intention among winter recreationists.

Significance of Research

The implications from this research extend far beyond both winter recreation and climate change. This study may help to more effectively guide environmental and scientific communication campaigns and has the potential to dispel the assumption that scientists, despite having a higher level of expertise, are the most effective messengers of scientific information. It would also add to the understanding of conditions under which individuals accept scientific information, in spite of its delivery from a source with a non-scientific background. In addition, this research has the potential to direct the utilization of social identity as a means of more effectively tailoring and applying persuasive messages.

Hypotheses

Research Question: What effect does a high level of leisure involvement have on environmental belief and behavioral intention when exposed to a persuasive message about climate change?

H1: If the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a message (control group).

H1a: Follow-up environmental belief scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

H2: If the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a message (control group).

H2a: Follow-up behavioral intention scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

Research Question: What effect does high social identity have on environmental beliefs and behavioral intention in individuals with low leisure involvement when they

are exposed to a persuasive message about climate change from different message sources?

H3: For those participants with a low level of involvement, if the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity groups who did not receive a message (control group).

H3a: For those participants with a low level of involvement, if the persuasive message is effective, those participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-group message source, low social identity treatment groups, and participants who did not receive a message (control group).

H4: For those participants with a low level of involvement, if the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity groups who did not receive a message (control group).

H4a: For those participants with a low level of involvement, if the persuasive message is effective, participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-

group message source, low social identity treatment groups, and participants who did not receive a message (control group).

Summary of Methods

This study utilized an experimental design to assess the effectiveness of in-group and out-group persuasive communications about climate change on the environmental beliefs and behavioral intentions of winter recreationists (Campbell & Stanley, 1963; Kerlinger, 1979). The researcher employed pretest, posttest and follow-up questionnaires to determine a change in environmental belief and behavioral intention resulting from the treatments (Babbie, 1973).

Participants in this study were randomly selected skiers and snowboarders utilizing both frontcountry (ski resort) and backcountry (nonski resort) settings in the greater Salt Lake City region during the winter of 2011-2012. Frontcountry users were recruited from the Salt Lake Area ski resorts of Snowbird and Alta, while backcountry users were recruited at access points located in Big and Little Cottonwood Canyons. Upon initial contact, measures of environmental belief and behavioral intention were obtained through a questionnaire, along with contact information. Subsequently, an e-mail survey provided a treatment condition and obtained measures of environmental beliefs, behavioral intention, cognitive processing, perceived credibility of the message source, the source's level of influence, and demographic information. A secondary e-mail survey, administered approximately 1 month after the treatment, obtained final measures of environmental belief and behavioral intention to determine the durability of any changes.

Delimitations

This study was delimited to skiers and snowboarders, 18 years of age or older engaging in winter recreation. In addition, this study was delimited to surveyed trailheads and ski resorts in Utah during the survey period from January 31, 2012 to March 21, 2012.

Limitations

The following are considered to be study limitations:

- (1) Sampling was carried out at backcountry and frontcountry sites in the state of Utah and in proximity of Salt Lake City. Consequentially, results may not be generalizable to the broader population of winter recreationists.
- (2) The use of e-mail surveys limited the sample population to only those who have internet access and e-mail accounts.

Definition of Terms

Environmental Belief- The subjective probability of a relationship between an aspect of the environment and some other object, value, concept, or attribute (Fishbein & Ajzen, 1975).

Behavioral Intention- A person's relative strength of intention to perform a behavior (Fishbein & Ajzen, 1975).

Leisure Involvement- Conceptualized as the personal relevance of a leisure activity (Kyle et al., 2007).

Social Identity- The result of an individual's knowledge about the social groups to which they belong and the value and emotional significance attached to their membership in those groups (Tajfel, 1978).

Winter Recreationist- An individual who participates in either alpine skiing or snowboarding.

Backcountry- Undeveloped winter recreation sites. Backcountry sites would be those where a winter recreationist must ascend under their own power in order to ski or snowboard back down.

Frontcountry- Developed winter recreation sites. Ski resorts, which contain ski lifts, would be considered a frontcountry site.

Structure of the Dissertation

This dissertation is broken down into several chapters. Following the introduction, Chapter 2 provides a review of literature addressing environmental belief, behavioral intention, climate change, the Elaboration Likelihood Model, involvement, and social identity. Chapter 3, Methods, provides an overview of the pilot study, measurement, procedures, and statistical tests that were employed in this study.

The subsequent three chapters (Chapters 4- 6) include three articles that cover the empirical research carried out during this study and the implications for practical application of findings. Chapter 4: The Development of Real-World Persuasive Messages About Climate Change Using the Elaboration Likelihood Model. This article determines the extent of the ELM's effectiveness in eliciting change in nonlaboratory

settings and will be submitted to an academic journal emphasizing environmental psychology.

Chapter 5: The Effect of In-Group and Out-Group Persuasive Communications about Climate Change on the Environmental Beliefs and Behavioral Intentions of Winter Recreationists, investigates the differential effects of persuasive message sources on environmental beliefs and behavioral intentions as influenced by the involvement and social identity of winter recreationists. The Elaboration Likelihood Model was employed to determine which type of message source (in-group, out-group) is most influential at delivering messages about climate change. This article will be submitted to an academic journal emphasizing environmental psychology.

Chapter 6: A Tenuous Future: The Ski Industry, Climate Change, and What Needs to be Done, provides a practical overview as to the influence that the ski industry might have in affecting public perceptions of climate change. In addition, it suggests communication strategies that may create a greater potential for changes in environmental beliefs and subsequent behaviors among their constituent winter recreationists. This article will be submitted to ski industry journals and ski industry magazines as there is a need for ski resorts, manufacturers, and winter recreationists to all be informed regarding these findings.

Chapter 7 summarizes the results of this dissertation. This chapter also includes concluding remarks, implications for future research, and implications for practical application.

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CHAPTER II

REVIEW OF LITERATURE

The purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit environmental belief and behavioral intention changes among winter recreationists. In this chapter, relevant literature pertaining to the following will lay the foundation for this study: (1) Climate Change; (2) Environmental Belief; (3) Behavioral Intention; (4) Elaboration Likelihood Model; (5) Involvement; and (6) Social Identity.

Climate Change

Climate change, also known as global warming, refers to the “enhanced greenhouse effect resulting from anthropogenic, or human-caused, emissions of greenhouse gases” (Leiserowitz, 2003, p. 2). The beginning of climate change research dates back to the mid-1800s when John Tyndall determined that carbon dioxide (CO₂) as an opaque gas could serve to block infrared radiation and operate in a manner similar to a greenhouse that might warm the earth (Weart, 2008). Since these early beginnings, a sizeable body of knowledge has been established in an attempt to both legitimize the science of climate change and point toward human behaviors as the major contributor to

these changes (Agenda 21, 1992; Brundtland, 1987; Intergovernmental Panel on Climate Change, 2007; IUCN/UNEP/WWF, 1991; United Nations, 1972). Studies have utilized paleoclimatology, which is the study of past climates, and contemporary observations to provide ample data to confirm that there are rapid and measurable changes occurring since the widespread usage fossil fuels began during the industrial revolution.

Paleoclimatic data, often obtained from air bubbles in arctic ice cores, provide a comprehensive picture of climatic conditions for the past 450,000 years based on the presence of carbon dioxide and how that might compare with present conditions. These data show that during the earth's history of warming and cooling cycles, the planet was ice free until atmospheric carbon dioxide levels dropped below 450 parts per million (ppm) \pm 100 ppm. This analysis points towards an earth that is on a trajectory towards a drastically altered climate scenario based on the earth's current CO₂ level of approximately 385 ppm. (Hansen et al., 2008). Numerous international research initiatives have both confirmed these findings and clarified other effects that might be realized.

One such international research study, the Stern Review (Stern, 2006), commissioned by the government of the United Kingdom, was an assessment of the global capacity to adapt to climate change and to continue to thrive economically. The summary of conclusions begins with a statement that is much more dire and does not even begin to consider the economic ramifications: "The scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response" (p. vi). Without any intervention, this report predicted a 2°C temperature

increase as early as 2035. There is a more than 50% chance that this increase will exceed 5°C.

The United Nations Intergovernmental Panel on Climate Change (IPCC; 2007) proposed one of the most recent and comprehensive perspectives on the global impacts of climate change. This panel concluded that “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level” (IPCC, 2007, p. 30). This panel outlined a number of warning signs that indicate mounting evidence of recent, human-induced climate change:

1. “Eleven of the last twelve years (1995-2006) rank among the twelve warmest years in the instrumental record of global surface temperature (since 1850)” (p. 30).
2. “Sea levels rose . . . at an average rate of about 3.1 mm per year from 1993-2003” (p. 30).
3. “The atmospheric concentrations of CO₂ and CH₄ [compounds believed to be responsible for climate change] in 2005 exceeded by far the natural range over the last 650,000 years” (p. 37).
4. “Increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers” (p. 31).
5. “Mountain glaciers and snow cover on average have declined in both hemispheres” (p. 30).

Regardless of natural planetary systems that may be influencing a minor level of change, there is substantial evidence in the IPCC report to implicate human behavior as the major contributing factor to the acceleration of the climate change process.

Perceptions of Climate Change

Numerous studies from international agencies and researchers have exhibited substantial concern regarding the widespread impacts of climate change as a global environmental threat (Brundtland Report, 1987; Hansen et al., 2008; IPCC, 2007; Stern Review, 2006). A study of scientific consensus regarding climate change found that 97-98% of climate scientists publishing in the field are proponents of the theory of anthropogenic climate change and those who are not supporters have much less scientific expertise and prominence in the field (Anderegg, Prall, Harold, & Schneider, 2010). In spite of the vast majority of reputable scientists and scientific bodies that have supported the existence of human-induced climate change, public opinion is still highly conflicted on this issue. "The *gap between* public perception and scientific reality is now enormous" (Hansen, 2009, p. 171).

In general, there is far less consensus among the general public in regards to this issue and climate change continues to place quite low on the list of general public concerns (Gardner, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Leiserowitz et al., 2011; Newport, 2010). Only recently has climate change become the top environmental concern for Americans, up from being the sixth most important concern in 2003 (Ansolabehere & Herzog, 2006). One public opinion poll found that 40% of Americans believe there is a lot of disagreement among scientists and 39% believe that most climate scientists think

climate change is happening (Leseirowitz et al., 2011). This same poll reported that only 15% of Americans knew that 81-100% of climate scientists believed that climate change is mostly caused by humans. Another poll of public opinion regarding the cause of climate change shows that only 50% of Americans believe climate change is caused by human activities as compared with 46% of the population that believe it is caused by natural systems (Newport, 2010). These numbers have been converging over the last decade, indicating inconsistencies among the general public despite broad scientific consensus. In addition, another public opinion poll found that approximately 83% of Americans believe that climate change is occurring. However, this poll came on the heels of a summer that saw record-breaking temperatures, regional droughts, widespread hurricanes, and increased prominence of the subject due to presidential debates (Gardner, 2011). Essentially, the public's perception of climate change is susceptible to both the presence of climate change-derived weather conditions and issues brought to prominence through social means.

In spite of a well-developed consensus that supports both climate change and its anthropogenic causes, there is still some level of disbelief among the general public, which compromises society's ability to make the changes necessary in order to avert further environmental damage. There is a critical need to accurately inform the public about the true causes and effects of climate change; however, this message has not been delivered in a manner that has drastically altered the public's opinion on the issue or their subsequent behaviors. In distributing this information, it is critical to be aware of the fact that there is no one approach that will be overwhelmingly effective for all of the

population. This realization necessitates that messages about climate change be tailored to specific segments of the population.

Climate Change and Winter Recreation

Inconsistent precipitation and higher global surface temperatures associated with climate change have the potential to create serious implications for the future of winter recreation. Past climate observations coupled with models of potential climate scenarios all point towards decreases that may seriously threaten winter recreation within the next century.

First and foremost, there is an overall downward trend in annual snow coverage. One study “ranks 2007 as having the third least extensive [snow] cover of record” (State of the Climate, 2007, p. S22). During that year, hemispheric snow coverage was below the long-term average in every month except for one. The fourth lowest snow cover on record was in 2008 (Peterson & Baringer, 2008). In 2010, there was a high level of northern hemisphere snow. However, rapid warming led to melting of snow from December to May that was the largest observed in more than 40 years (Blunden, Arndt, & Baringer, 2010).

In addition to losses of snow cover, dramatic glacial changes are being observed the world over. In the European Alps, glaciers lost approximately 35% of their surface areas from 1850 through the 1970s. This loss increased to nearly 50% by the year 2000 and these glaciers are currently on pace to lose 1% of their surface area annually (Zemp, Haeberli, Hoelzle, & Paul, 2006).

The loss of snow and glaciers are already beginning to negatively influence the winter recreation industry. In 2006, 47 ski resorts in the European Alps did not open because of nonexistent or unreliable snow conditions (Schendler, 2007). In spite of what has been observed all over the world, there are, potentially, even more negative implications for winter recreation on the horizon.

Numerous researchers have utilized climate models to determine what winter recreation areas might look like in a warming world. Climate models are simplified representations of natural processes that are occurring in the world and can serve as a basis for what may occur in the future. Despite significant advancements in climate modeling, the best that they can provide are scenarios for what might take place in future. In spite of this caveat, the results of these modeling efforts point towards consistently negative projections.

According to the experience acquired by Swiss ski resorts; a resort is snow-reliable if, “in 7 out of 10 winters, a sufficient snow covering of at least 20 cm (0.6 ft.) to 50 cm (1.6 ft.) is available for ski sport on at least 100 days between December 1 and April 15” (Burki, Elsasser, & Abegg, 2003, p. 3). “Under current climate conditions 85% of all Swiss ski areas are snow-reliable. This number would drop to 63% if temperatures were to rise by 2°C” (Koenig & Abegg, 1997, p. 56). This temperature increase would raise the reliable snow line from its 2001 level of 1,200 m (3,937 ft.) to 1,500 m (4,921 ft.; Elsasser & Messerli, 2001). This small increase in temperature is a legitimate threat to almost half of ski resorts in the Alps.

Ski resorts in Australia are predicted to have substantial decreases in snow cover based on climate change models. Under the best-case scenario, Mt. Baw Baw is predicted

to have “the frequency of years of more than 60 days decline to 15% by 2030 and 5% by 2070” (Whetton, Haylock, & Galloway, 1996, p. 477). Under the worst-case scenario, higher sites in Australia will have their simulated annual snow coverage cut in half by 2030 and approach zero by 2070 (Whetton et al., 1996). Utilizing only natural snow, this worst-case scenario would make only one Australian ski resort financially viable in 2030 and none viable in 2070 (Bicknell & McManus, 2006). In another Australian model, “the high impact scenario for 2020 leads to reductions of 30-40 days in average season lengths” (Hennessy et al., 2003).

Prospects for the future of skiing in Canada are equally precarious. A case study of Blue Mountain, the most vulnerable in Ontario, projects a reduction in the ski season of 18-30% in the 2020s, 30-52% in the 2050s, and 54-66% in the 2080s (Scott et al., 2001). Without advancements in snowmaking equipment, these predictions may be conservative estimates. Short-term and long-term estimates from other studies point to decreases in ski seasons, even with the usage of snowmaking equipment (Browne & Hunt, 2008). However, the increased usage of snowmaking equipment serves to use more energy and further deplete water resources.

There are also legitimate concerns regarding the future of winter recreation in the United States. Vermont and New Hampshire, which average 165-day ski seasons, are facing a seasonal loss of 10% with a 3.6°F temperature rise and a 20% loss if temperatures rise 7.2°F (Sinclair, 2001). A model by Scott, Dawson, and Jones (2006), found that increases in snowmaking capacity in the Northeast would create viability problems for 4 of 14 resorts in the period from 2010-2039. However, within this model,

only four resorts would be economically viable in the period 2070-2099 (Scott et al., 2006).

The future of skiing in the American west is also uncertain. The State of the Rockies Report Card (Zimmerman, O'Brady, & Hurlbutt, 2006) concludes that if carbon dioxide emissions continue at their current trajectory, then there will be an average of 50% loss in snowpack in the Rocky Mountain areas and more sporadic precipitation patterns. The model utilized predicts major snowpack loss from 1976 to 2085 at major resorts in this region. This model estimates a low-end loss of 43% at the Aspen resorts in Colorado and a high-end loss of 89% at Taos in New Mexico.

All of the models reviewed pointed towards a significant threat to winter recreation. However, these models are contingent upon current carbon dioxide emission trajectories and continuation of warming trends. The sole use of adaptation strategies (e.g., artificial snowmaking) will serve to extend resort-based winter recreation with only minimal effectiveness in the long term.

Delivering the Climate Change Message

The lack of broad belief and behavioral change may be due to the fact that many of the indicators and impacts of climate change (e.g., CO₂ levels, longitudinal temperature increases, spring snowmelt times, and rising ocean levels) are less perceptible to the public in their daily lives. Individuals may be too distant from the direct or dramatic influences of climate change leading to low personal relevance. Therefore, there is a need to determine how to make these impacts both proximal and relevant to individuals.

Recently, a need was identified for scientists to become more proficient and vociferous in the communication of scientific concepts as a means of bridging the gap between scientific knowledge and public understanding (Hassol, 2008; Miller et al., 2009). There has been debate that scientists should not be focusing on influencing policymakers and working with the media, but rather should be collaborating with organizations that have the capacity to develop more effective outreach campaigns (Cole & Watrous, 2007). Their knowledge regarding the underpinnings of climate change should position scientists to be the most obvious communicator about this issue. However, there are other aspects regarding the climate change message that may play a role in how effectively this message is conveyed to the public.

In spite of scientific understanding, scientific consensus, and numerous climate models, CO₂ concentrations have continued to rise annually since 1959 (Tans, 2010). There is a need to create compelling reasons for individuals to alter their beliefs about climate change and the behaviors that may help to mitigate the effects. However, the scientific community's lower level of relevance to the general public may diminish its standing as the most effective climate change messenger. As a result, it is necessary to create a connection between climate change and some type of personally relevant factor. Thus, the ramifications of climate change should be prominent for those individuals who choose to engage in winter recreation activities (Behringer, Buerki, & Fuhrer, 2000). As a result, it is necessary to address how to more effectively influence these beliefs and the behavioral intentions of individuals who should have a vested interest in preserving climatic conditions that are favorable for winter recreation activities.

Environmental Belief

A belief is “the subjective probability of a relation between the object of the belief and some other object, value, concept, or attribute” (Fishbein & Ajzen, 1975, p. 131).

Utilizing this definition, an environmental belief can be surmised to be the subjective probability of a relationship between an aspect of the environment and some other object, value, concept, or attribute. In drawing from the Theory of Reasoned Action, beliefs form the foundation for attitudes (Fishbein & Ajzen, 1975). Thus, influencing environmental beliefs has the potential to be a starting point that influences environmental attitudes, behavioral intentions, and subsequent environmental behaviors.

Much of the philosophical and social psychological conversation surrounding the concept of belief has indicated that there are two specific ways in which in which it can be defined (Fishbein & Ajzen, 1975; Sayre, 1997). The main differentiation is between the meanings of the phrase “believe in”. The first usage of *believe in* focuses directly on the existence of a particular idea or institution. The second usage of *believe in* can mean trust in a particular idea or institution such as philanthropy or capitalism. This usage of *believe in* posits more about an individual’s beliefs regarding the characteristics of the idea or institution (Sayre, 1997). This distinction has also been characterized as belief in an object and belief about an object (Fishbein & Ajzen, 1975). In this study, environmental belief is defined as the subjective probability of the existence (attribute) of climate change (object of the belief).

Schema

As an individual encounters different aspects of their surroundings, certain factors have the potential to constantly influence their beliefs. When information from the environment conflicts with existing beliefs, there is a need to either resolve these conflicts by reassessing currently held beliefs or by dismissing the cause of that conflict (Quine & Ullian, 1978). When beliefs are reassessed, there is increased potential for a change in the individual's personal belief structure, or schema (Petty & Cacioppo, 1986b).

A schema is a cognitive structure that “enable[s] the perceiver to identify stimuli quickly, ‘chunk’ an appropriate unit, fill in information missing from the stimulus configuration, and select a strategy for obtaining further information, solving a problem, or reaching a goal” (Taylor & Crocker, 1981, p. 93). A description of how the schema functions is as follows:

First, it tells us what to attend to. Like a scientific theory, it makes some attributes relevant, that is salient, while allowing others to be ignored. Second, a schema contains the network of associations that is believed to hold among the attributes of the stimulus and thereby provides rules for thinking about the stimulus. Thus, if information conveying some relevant attribute is unavailable from the stimulus itself or is ambiguous or is unavailable from memory, the schema allows for the “filling in” of such information with “default options”. (Tesser, 1978, p. 290)

An individual's schemata (plural) are an interrelated system that allows for handling of incoming information in a more efficient manner. The acquisition of new information has the potential to alter already existing schema and initiate the development of new schema (see Figure 2).

Much of the previously reviewed research on schema focuses on how the schema develops and how it is utilized; however, the most critical aspect of the schema, or

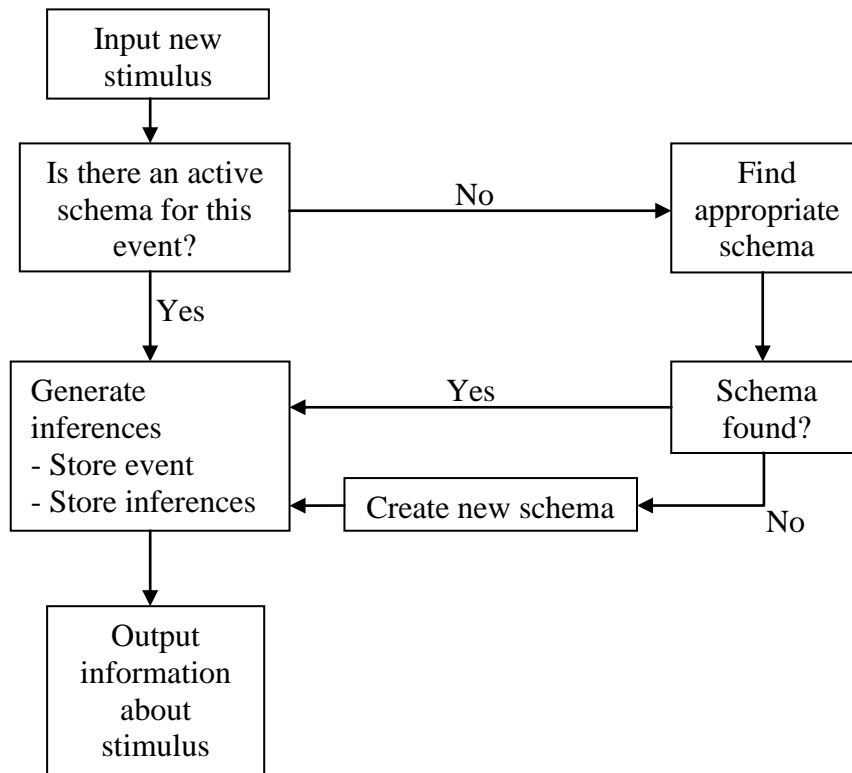


Figure 2: Flowchart showing the influence of new stimuli on schemata (Adapted from Hastie, 1981)

structure of beliefs, is its importance as a psychological construct. This belief structure has been identified as the foundation that has the capacity to influence change in attitudes, behavioral intention, and subsequent behaviors (Fishbein & Ajzen, 1975; Petty & Cacioppo, 1986a).

Outdoor Recreation and Environmental Beliefs

In assessing how to best influence environmental beliefs, it should seem likely that individuals who engage in outdoor recreation activities should have some connection to the natural environment that would influence their environmental beliefs. Numerous

studies have looked at outdoor recreation and its influence on environmental attitudes and concern, of which environmental belief is an antecedent (Dunlap & Heffernan, 1975; Geisler, Martinson, & Wilkening, 1977; Jackson, 1986; Pinhey & Grimes, 1979; Theodori, Luloff, & Willits, 1998; Van Liere & Noe, 1981). However, there are conflicting results that have the potential to be associated with the notion of specificity.

One of the primary studies of engagement in outdoor recreation as it relates to environmental concern found only a weak correlation between engagement in outdoor recreation and environmental concern (Dunlap & Heffernan, 1975). All of the successive studies that tested this hypothesis found similar results (e.g., Geisler, Martinson, & Wilkening, 1977; Jackson, 1986; Pinhey & Grimes, 1979; Theodori, Luloff, & Willits, 1998; Van Liere & Noe, 1981). However, Dunlap and Heffernan (1975) did find strong support for two other relevant hypotheses. There was a stronger association between appreciative outdoor recreation activities, such as hiking, and environmental concern in comparison to consumptive outdoor recreation activities, such as hunting and fishing. It has also been determined that strong affinity for an outdoor recreation activity can elicit a commitment to protect the resources necessary to engage in that activity (Dunlap & Heffernan, 1975; Gale, 1972). These findings have been expanded to include an understanding that the commitment does not extend to more general problems, such as air or water pollution. This information supports the importance of outdoor recreationists in engaging in resource- or area-specific preservation groups and organization (Tarrant & Green, 1999). Thus, engagement in a specific outdoor recreation activity has the potential to be associated with activity-specific, environmental beliefs.

Operationalization of Environmental Beliefs

The construct of environmental belief is important in regards to addressing the issue of climate change. Many of the causal variables of climate change are not visible; thus, some other entity must be relied upon in order to make this phenomenon tangible for the vast majority of the public. Climatic changes also take place over a longer period of time. Other environmental problems such as air and water pollution are potentially visible, which makes their existence apparent as compared with climate change where the evidence is somewhat more elusive. Therefore, there is some level of environmental belief that an individual must have regarding the existence in climate change.

The predominant usage of environmental belief in the reviewed literature emphasizes the perspective regarding human interaction with the natural environment rather than in regards to the existence of environmental phenomena (Bechtel et al., 2006; Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones, 2000; Hernandez et al., 2000; Johnson, Bowker, & Cordell, 2004). The most recent and widely utilized determination of environmental belief has been used to determine proenvironmental orientation or whether or not people are viewing the world from an ecological perspective (Dunlap, Van Liere, Mertig, & Jones, 2000). This perspective has been identified as ecocentric. This orientation is in contrast to the belief that humans are superior to the natural world (Bechtel et al., 2006). This perspective has been identified as a human exception paradigm or an anthropocentric view (Bechtel, et al., 2006; Dunlap, Van Liere, Mertig, & Jones, 2000). Most of the reviewed literature utilized the New Environmental Paradigm and its more current version the New Ecological Paradigm to gauge environmental belief (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones,

2000). However, despite the well-developed usage of the NEP, this scale does not adequately address belief in the existence of climate change as a natural or man-made phenomenon.

The measurement of belief regarding the existence of and causes of climate change have been most comprehensively addressed by the Yale Project on Climate Change Communication and the George Mason University Center for Climate Change Communication (Leseiowitz et al., 2011). This series of surveys addressed the public's beliefs regarding climate change and issues surrounding it. The most critical components of this survey asks participants: "Do you think global warming is happening?", "How sure are you that global warming is/is not happening?", and "Assuming global warming is happening, what do you think is causing it?". These three questions address their environmental beliefs about climate change by asking what they believe, how strong is that belief, and what they believe is causing this phenomenon. It is important to understand changes in belief as they have capacity to influence attitude, behavioral intention, and behavior (Ajzen, 1985; 1987; Fishbein & Ajzen, 1975; 1981).

Behavioral Intention

There are certain individual behaviors that can help to mitigate the effects of climate change. Behaviors can be measured through direct observation, indirect observation, and self-report of past behaviors or behavioral intention (Barry, 2000). However, certain types of measurement can be impractical given the nature of these behaviors. When behaviors are performed in the private sphere or have no indirect signal

that can be practically measured, it is far more effective to use behavioral intention as a measure as an indicator of behavior.

Behavioral intention is “a person's relative strength of intention to perform a behavior” (Fishbein & Ajzen, 1975). Behavioral intention has been identified as an important predictor of engagement in specific behaviors (Ajzen, 1985; 1987; Fishbein & Ajzen, 1975; 1981). This has been widely confirmed through the theories of reasoned action and planned behavior (Armitage & Connor, 2001; Hausenblas, Carron, & Mack, 1997).

Theories of Reasoned Action and Planned Behavior

The theory of reasoned action (TRA; Fishbein & Ajzen, 1975; 1981) and the theory of planned behavior (TPB; Ajzen, 1985; 1987) have long been utilized as the standard for understanding the factors that influence behavior. Within each of these theories, behavioral intention has been established and confirmed as one of the antecedents to engagement in that behavior. Therefore, it is necessary to provide a basic theoretical overview as to operation of behavioral intention within these theories and how it has been operationalized.

In general, it is asserted in the theory of reasoned action that behavior is directly influenced by an individual's intentions to engage in that behavior. Indirectly, behavior is influenced by an individual's attitude towards performing that behavior and the subjective norms regarding that behavior (see Figure 3; Ajzen & Fishbein, 1980). The theory of planned behavior expands upon the theory of reasoned action by addressing an individual's level of control regarding a behavior, also referred to as perceived behavioral

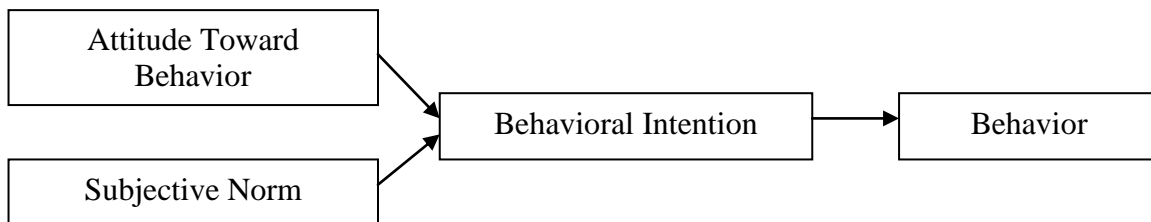


Figure 3: The Theory of Reasoned Action (Adapted from Fishbein & Ajzen, 1975; 1981)

control (see Figure 4). Prior to the development of these theories, it was considered that attitude was the direct antecedent to behavior. However, given these two theories, intention is a critical factor in predicting how likely an individual is to engage in a particular behavior. The theories of reasoned action and planned behavior have been empirically tested in a multitude of settings with notable success (Ajzen & Fishbein, 1980; Armitage & Connor, 2001; Sheppard, Hartwick, & Warshaw, 1988; Van den Putte, 1991).

Outdoor Recreation and Environmental Behavior

There is some amount of research that is supportive of engagement in outdoor recreation activities and environmental behavior (Thapa, Graefe, & Meyer, 2005; 2006). One study found that those engaged in recreational activities were likely to engage in green purchasing practices (Thapa, 2000). In addition, a study of scuba divers found that those participants who had a strong emotional connection to the activity had higher levels of self-reported environmental behaviors (Thapa, Graefe, & Meyer, 2005; 2006). In spite

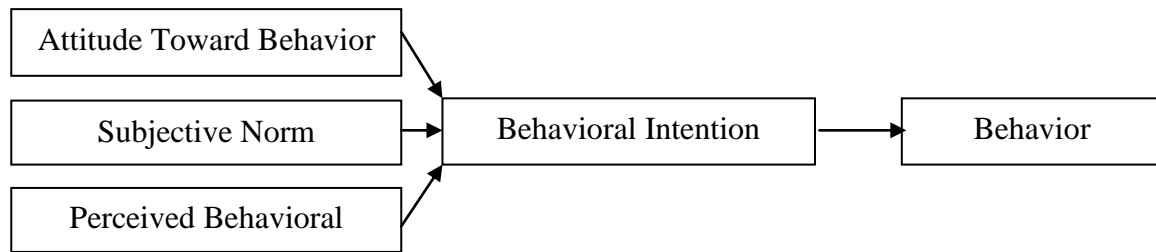


Figure 4: The Theory of Planned Behavior (Adapted from Ajzen, 1985; 1987)

of limited research in this area, these results provide some foundational basis that outdoor recreationists have some increased propensity to engage in environmental behaviors.

Operationalization of Behavioral Intention

Operationalizing behavioral intention must account for numerous aspects in order to develop an accurate measure of the likelihood that a participant may actually engage in the behavior being addressed. In order to more accurately predict a subsequent behavior, the factors of target, action, context, and time are important (Ajzen & Fishbein, 1980). Target refers to the person, issue, or object. Action refers to the behavior in relation to the person, issue, or object. Context refers to the circumstance in which the action takes place. Time refers to when the action would take place. Early on, it was proposed that behavior could only be predicted if there was a “high correspondence between at least the target and action elements of the measure” (Ajzen and Fishbein, 1977, p. 913). In assessing an individual’s intention to engage in a particular behavior, the more specific these four factors are, then the higher likelihood that they will be predictive of that behavior.

Clarifying the specifics of this behavior is important in relating behavioral intention to prediction of the subsequent behavior. Going back to the four factors that make up a behavior, questioning an individual about his or her behavioral intention towards driving (action) an electric vehicle (target) would be drastically different from ascertaining his or her behavioral intention about purchasing (action) an electric vehicle (target) within the next 6 months (time). Increasing the specificity of the behavioral intention is far more indicative of behavior. Thus, an individual's self-reported behavioral intention is deemed to be the best means of indirectly evaluating the potential for behavioral actualization.

The Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986a; 1986b; Petty, Cacioppo, & Goldman, 1981) provided a much needed structure in persuasive communications that has predicted more consistent findings than previous persuasive strategies (Petty & Wegener, 1998). The ELM brings together the four communication factors of source, message, recipient, and context, which have been consistently utilized in prior lines of research (Petty & Wegener, 1998). Through more finite interpretation of the influence of variables such as affect or source expertise, the ELM has made apparent many of the intricacies that created contradicting results among earlier theoretical research.

Through the development and combination of the central and peripheral route processes into one cohesive model, Petty, Cacioppo, and associates (1981; 1986a; 1986b) integrated what were previously treated as two single-route models of persuasion. Rather

than operating under the assumption that, for example, a credible source would increase personal change regardless, it was now postulated that there were variables, such as message involvement and argument quality, which may alter the effectiveness of a credible source. In general, the development of the ELM, despite being identified as a dual-process model, generated a more cohesive, interconnected, and generalizable model by which to construct and evaluate persuasive communications.

Operation of the Elaboration Likelihood Model

The Elaboration Likelihood Model was developed with the intended purpose of identifying which variables are influential in particular persuasive communications and, if variables are influential, when those will become salient within the change process (Petty & Cacioppo, 1986b). The change proposed in the ELM is accomplished through a dual-process strategy, which is made up of the central route and the peripheral route. The primary aspect that differentiates the central route from the peripheral route is the amount of elaboration, or cognitive processing, undertaken by the viewer. In spite of this model focusing on two routes to persuasion, it is important to note that it is feasible for aspects from both routes to influence a viewer towards a belief or behavioral intention change (Petty et al., 1987).

It is first necessary to outline the circumstances under which the viewer of a message will come to proceed through either the central or the peripheral route. A viewer may proceed through either route based upon an elaboration continuum (Petty & Wegener, 1998). Within this model, several terms are used to explain the relationships that occur, including elaboration, motivation, and ability. *Elaboration* is defined as “the

extent to which a person scrutinizes the issue-relevant arguments contained in the persuasive communication” (Petty & Cacioppo, 1986a, p. 7). The elaboration continuum consists of a viewer’s motivation and ability to attend to a persuasive message.

Motivation refers to the viewer’s “conscious intentions or goals” regarding the message such as its personal relevance to the viewer (Petty & Cacioppo, 1986a, p. 8). *Ability* refers to the understandability of the message and may be influenced by factors such as a viewer’s prior knowledge of the message content or the presence of a distraction. High motivation and ability to attend to a message will lead to a higher “elaboration likelihood” (Petty & Cacioppo, 1986a, p. 7). Consequently, a high level of elaboration likelihood is expected to lead a viewer through the central route, while a low level should lead the viewer through the peripheral route. Based upon varying levels of motivation and ability, the elaboration continuum can range from no elaboration to high elaboration (Petty & Cacioppo, 1986a).

Procession through the central route is characterized by a high level of cognitive effort. The viewer will typically attempt to elaborate upon the arguments or information contained within the message by scrutinizing the cogency of any assertions (Petty & Cacioppo, 1986b). As the viewer progresses through the central route, he or she is elaborating upon the message that is presented and how the arguments interact with his or her already existing attitudes. If the viewer determines that the arguments are cogent then a change takes place. This change may take place as the result of persuasive messages that are attempting to influence either positive or negative changes.

Procession through the peripheral route is characterized by a lower level of cognitive effort. Via this route, the viewer will defer to a peripheral cue. Peripheral cues

are stimuli external to any message argument or information and do not require excessive cognitive effort (Petty & Cacioppo, 1986a). Peripheral cues may include affect, source credibility, number of arguments present in the message, or attractiveness of the communicator. Rather than processing the arguments in the persuasive message, the viewer will determine, based on the peripheral cue, if the proposed belief is acquired. If the peripheral cue is salient to the viewer, there is greater potential that he or she will acquire the proposed belief (see Figure 5).

An early study by Petty, Cacioppo, and Goldman (1981) found support for the operation of the elaboration continuum, central route, and peripheral route in the manner previously outlined. Study participants were undergraduate students who listened to persuasive communications about the implementation of comprehensive exams at their university. The researchers manipulated motivation, argument strength, and peripheral cue. Motivation was manipulated by informing half of the sample that these exams would be implemented next year (high personal relevance), while the other sample was told the implementation would be in 6 years (low personal relevance). Argument strength was manipulated by providing either strong, well-formulated arguments or weak, specious arguments to the participants. The peripheral cue was also manipulated in that the persuasive message was prepared by either a university professor (high expertise) or local high school students (low expertise). Results indicated increased personal relevance motivated higher levels of elaboration and attitude change was elicited when a strong argument was presented. Low personal relevance prompted participants to defer to the peripheral cues, of which the more expert of the two sources facilitated greater attitude change.

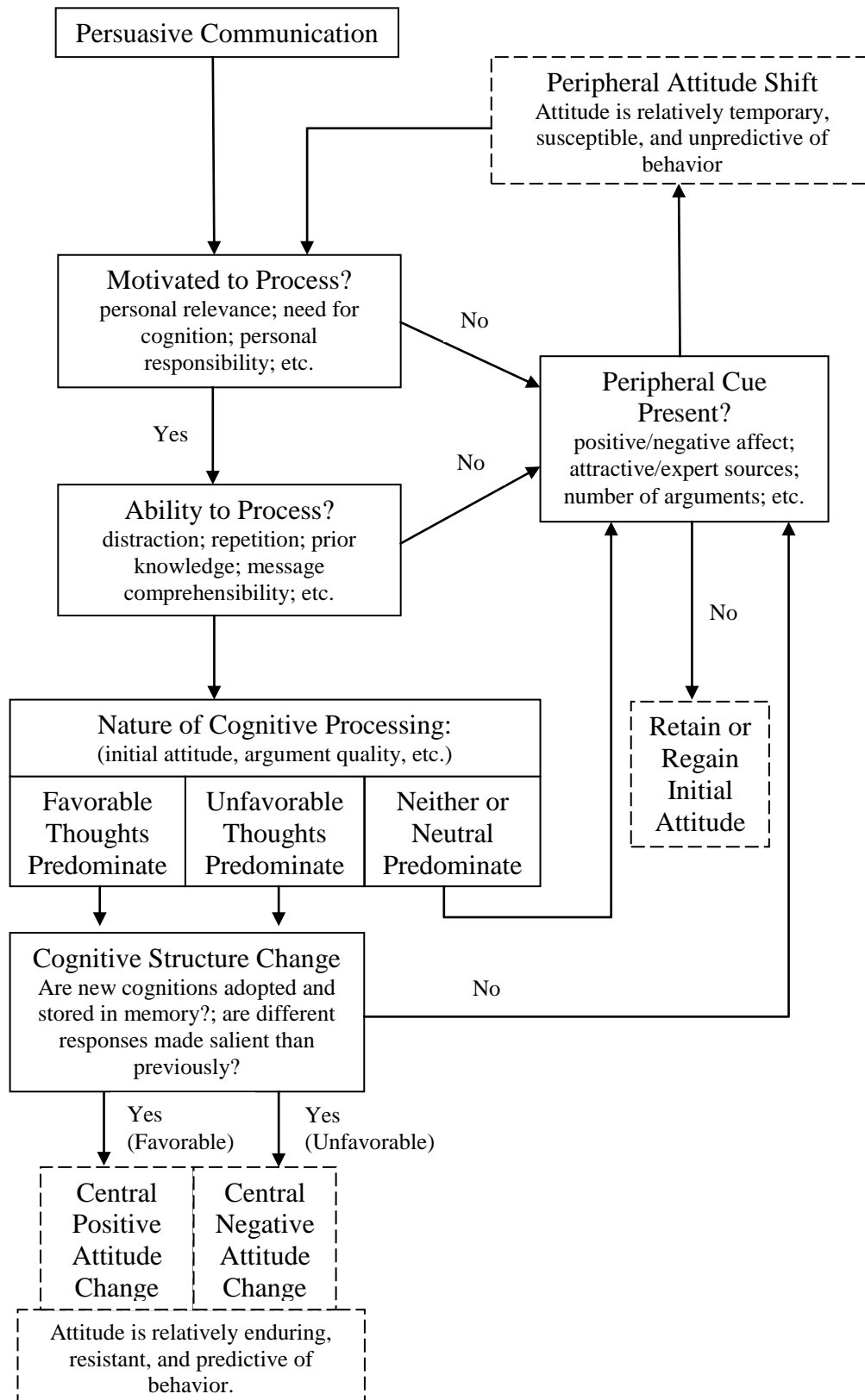


Figure 5: The Elaboration Likelihood Model (Petty & Cacioppo, 1986b)

Involvement

“Involvement refers to the strength or extent of the cognitive linkage between the self and stimulus object” (p. 399) and has been conceptualized as personal relevance (Kyle et al., 2007). Numerous terms have been used to clarify this concepts, such as “intrinsic importance” (Sherif & Hovland, 1961, p. 197) and “personal meaning” (Sherif et al., 1973, p. 311). Involvement has spanned numerous areas of research and led to somewhat consonant definitions of this construct. Early work on ego-involvement defined this concept as “a condition of total participation of the self” (Allport, 1943, p. 459). Another important investigation from social psychology characterized ego-involvement as “when any stimulus or situation is consciously or unconsciously related to them [an individual]” (Sherif & Cantril, 1947, p. 117) The principle of involvement is also evident in interpretation literature: “Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile” (Tilden, 2007, p. 36). In creating interpretive communications, it is the interpreter’s responsibility to develop some type of meaning for the individual. Research in consumer behavior and marketing indicated that one of the components of involvement is “The perceived importance of the product” as a measure of “its personal meaning” (Laurent & Kapferer, 1985, p. 43).

In spite of the numerous definitions and usages that refer to the personal characterizations of involvement, there is also an underlying social aspect that drives some measure of personal involvement (Sherif & Cantril, 1947). This original characterization of the social aspect of involvement has persisted to more recent work on involvement in the form of identity expression, which is an individual’s engagement in an

activity and how that engagement confirms the self to others (Kyle et al., 2007). It has been proposed that when these personal characteristics, such as self-identity or status, are threatened, then ego-involvement would become more apparent (Iverson & Reuder, 1956). It is under these circumstances that the content of a persuasive message may utilize involvement of an individual in order to elicit a change in belief or behavioral intention.

Involvement and the Elaboration Likelihood Model

Personal involvement, personal relevance, and issue involvement have all been used interchangeably and presented as a critical aspect of the Elaboration Likelihood Model, which explains an individual's connection with the issue presented in a persuasive message (Petty & Cacioppo, 1986a). As a result of viewing a persuasive message, an individual may deem that the consequences derived from that message may have varying levels of significance. A study that differentiated attention to the message and relevance of the message, determined that relevance was more influential regarding attitude and behavior (Roser, 1990).

The concept of personal relevance has also become important in other areas of communication. In interpretation literature, Tilden (2007) made this quite evident in his first principle when he wrote that "Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile" (p. 36). In creating interpretive communications, it is the interpreter's responsibility to develop some type of meaning for the individual. People have a tendency to be more egocentric than altruistic or ecocentric; thus, what is

conveyed to them must appeal to this “Me” mentality. The schema is a cognitive structure through which individuals organize, interpret, and act on information provided by others and the surrounding environment (Stephan & Stephan, 1990; Taylor & Crocker, 1981). When individuals are receiving new information, they are utilizing their schema to process the new content. Thus, it is completely rational for a person to be most influenced by those things about which they have a cognitive structure already somewhat developed.

Research utilizing involvement as part of the ELM has typically manipulated this variable in a laboratory setting (Petty & Cacioppo, 1986a; Petty, Cacioppo, & Goldberg, 1981). These scenarios provided hypothetical changes that may or may not directly influence the study participants, thus making involvement clearly delineated. Attempts to determine the influence of moderate levels of involvement have yielded somewhat mixed results and are in need of further investigation (Petty & Cacioppo, 1984; Puckett et al., 1983).

Leisure Involvement

The same theoretical backgrounds that have guided the usage of involvement in the ELM are also the foundation for the concept of leisure involvement. Involvement, as applied to leisure behavior, was buttressed by Gunter and Gunter (1980) as “the degree and type of the person’s investment in specific activity or situation” (p. 366). Gunter and Gunter’s notion of involvement incorporates three aspects: behavioral involvement (doing), cognitive involvement (knowing or understanding), and affectivity (feeling). Higher levels of the first two factors, coupled with positive affect, will lead to greater

engagement and a “psychological fusion” between the person and the activity (Gunter & Gunter, 1980, p. 366).

Selin and Howard (1988) defined ego involvement in relation to leisure as “the state of identification existing between an individual and a recreational activity” (p. 237) and pointed to centrality, importance, pleasure, interest, and self expression as the five areas that constitute involvement. Involvement has been divided into attraction, self-expression, and centrality (McIntyre and Pigram, 1992). The attraction component has been commonly characterized as a combination of importance and enjoyment (Kyle et al., 2007; McIntyre, 1989). Importance refers to the ability of the activity to meet the actor’s goals. Pleasure is the amount of pleasure derived from the activity (Kyle et al., 2007). Self-expression refers to minimization of role constraints and the ability of participants to be themselves. Centrality has been characterized as the “friends or other social interactions centered on the activity” and “the central role of the activity in the individual’s life” (McIntyre & Pigram, 1992, p. 7).

The Modified Involvement Scale (MIS) utilizes attraction, centrality, social bonding, identity affirmation, and identity expression as the characterizations of involvement (Kyle et al., 2007). The social aspects, which McIntyre and Pigram found in centrality, have been separated to create the social bonding dimension. This change is indicative of Kyle and Chick’s (2002; 2004) studies of fair attendance, which found that participants attended in order to engage family and friends socially. In addition, the self expression dimension was divided to create identity affirmation and identity expression. Identity affirmation refers to “the degree to which leisure provides opportunities to affirm the self to the self” and identity expression is “the extent to which leisure provides

opportunities to express the self to others” (Kyle et al., 2007, p. 405). The MIS is the latest effort to determine which antecedents comprise involvement.

Ego-involvement can range from “temporary moderate involvement. . . where our capacities or abilities are at stake, to complex social situations in which we feel involved because of some threat to, or enhancement of, our position as a member of some gang, group, or class we identify ourselves with” (Sherif and Cantril, 1947, p. 118). However, the two identity components and the social bonding component that exist within the MIS do not fully elucidate to what extent an individual’s level of involvement and subsequent involvement with a persuasive message are influenced by relevant social groups. Thus, social identity may serve to be an important factor in motivating cognitive processing through the ELM and eliciting more widespread changes in environmental belief and behavioral intention.

Social Identity

Social identity is knowledge about the social groups to which the individual belongs and the value and emotional significance attached to their membership in those groups (Tajfel, 1978). Social identity theory (SIT) was first postulated by Henri Tajfel and is most concerned with the categorizations that take place within society and how this categorization process leads to certain social groups and associated self-identities, as a result.

SIT is made up of many distinct social concepts, but it is first necessary to briefly elaborate on how social identity is developed and the influence social structure has on the identity formation process. “Society not only defines but creates psychological reality.

The individual realizes himself in society – that is, he recognizes his identity in socially defined terms and those definitions become reality as he lives in society” (Berger, 1966, p. 108). Essentially, our numerous places within society all maintain certain norms, attitudes, and standards of behavior. Most individuals belong to numerous groups as a result of social identification factors (e.g., sex or race) or social choices (e.g., political affiliation or leisure activity). It is this amalgam of groups and their group identities that constructs an individual’s self-identity (Breakwell, 1978).

It is also imperative to outline how these identities manifest within social circumstances. Individuals may belong to numerous social groups that create their social identity. However, depending on the context, certain identities may become more or less important to the individual (Hogg & Abrams, 1988). For example, under certain circumstances, it may be more important for an individual to identify as a woman as opposed to a Republican. Depending on the context, either one of these social identities may increase in importance, making the associated norms, attitudes, or behaviors of that group more prominent.

Social Categorization

Social identity develops through both categorization and social comparison. Social categorization is “the ordering of one’s social environment” through the collection of social stimuli, which may be objects or events, that are associated with their social identity and the associated beliefs and behaviors (Tajfel, 1978, p. 61; Tajfel, 1981). Through this ordering, an individual begins to form a structure that guides thoughts, attitudes, and behaviors based on the groups to which he or she belongs. He or she also

begins to differentiate these socially identified attributes from groups to which he or she does not belong.

As mentioned previously, much of an individual's existence is the result of his or her belonging to numerous social groups. It is through a process of social comparisons, an "us" versus "them" mentality, that much of society is constructed (Hogg & Abrams, 1988). Often, social categorization and the development of social identities are solidified through social comparison. Within society, groups exist in the presence of other groups and most groups obtain their meaning through comparison. This process of differentiation will be discussed later in more detail. As most of the concepts within SIT are highly interrelated, both social categorization and social comparison contribute, to some extent, to the process of self-categorization.

Self-Categorization

Under the umbrella of SIT, self-categorization theory was also developed, although many of the concepts run consonant (Turner, 1985; Turner et al., 1987). This theory proposes that under certain contexts, individuals regard themselves more as individuals and under other contexts, more as members of groups. These categorizations are hierarchical and can exist at the super-ordinate level (human identity), intermediate level (social identity), and subordinate level (personal identity; Hogg & McGarty, 1990). As a result of this hierarchical structure, the social identity will often operate with a higher level of importance as compared with an individual identity.

In addition, self-categorization focuses more heavily on the cognitive processes within social identity and begins to draw more clear distinctions between groups.

Essentially, individuals will engage in more thought about which attributes are characteristic of their own group and which are characteristic of other groups. As these categorizations become more focused, the intragroup differences will begin to be minimized and the intergroup differences are maximized (Hogg & McGarty, 1990). It is this process of differentiation that begins to more clearly delineate the differences between groups.

These differentiations can be neutral (e.g., Swedes are tall) or value loaded (e.g., Girls are bad at math or Catholics are righteous) and are typically applied to both an individual's own group in a positive manner and any other group to which a comparison is being made in a negative manner (Tajfel, 1981). There is a tendency to differentiate more strongly regarding social contexts that are high in personal relevance (Abrams & Hogg, 1990). Thus, those social identities to which people hold most strongly often see the greatest value judgments placed on both their own group and opposing groups. The strength of differentiation segues into the concept of accentuation.

Accentuation has been identified as a departure from objective reality and is an overestimation of the intragroup and intergroup characteristics (Tajfel, 1957). Essentially, group members tend to overemphasize the positive attributes of their own group, while at the same time exaggerating the differences that exist between their own group and other groups through overemphasis of their negative attributes. Other groups are distorted and judgments about their characteristics are altered, which have been considered starting points for intergroup bias, discrimination, and prejudice.

In-Groups and Out-Groups

Through the identification, categorization, and comparison processes, individuals come to identify similar others as in-group and dissimilar others as out-group (Stets & Burke, 2000). In-group individuals have a tendency to anchor their thoughts, attitudes, and behaviors via the fact that these characteristics are consistent with other members of the group, although these perceptions may not always be accurate due to the influence of accentuation (Festinger, 1950). However, the same type of social identification that led a person to this group in the first place can be used to change these characteristics, as individuals are typically influenced by those within their social group.

Contrary to that, and through social comparison, the thoughts, attitudes, and behaviors of out-groups are often marginalized by those within an in-group, through both differentiation and accentuation. Much of the in-group's information regarding the characteristics of the out-group is the result of perception and has the capacity to be inaccurate. This distortion decreases the likelihood of an individual responding to the thoughts, attitudes, and behaviors that are considered to be out-group in nature or endorsed by that social group.

Past research utilizing the constructs of in-groups and out-groups have tapped a variety of structures to operationalize these distinctions. Some of these have included race (Castano et al., 2002), university affiliation (Mackie, Worth, & Asuncion, 1990), and opinion on abortion (Clark & Maass, 1988). Among the research reviewed, there was consistent support for the social identity theory and the influence of in-groups to more effectively influence attitudinal changes. The dichotomy of in-groups and out-groups has the greatest potential to initiate change via persuasive communications.

Social Identity Theory and the Elaboration Likelihood Model

This concluding section will outline how these two theories are best integrated to most effectively influence individual's thoughts, attitudes, and behaviors through their group membership. Through this integration, it is proposed that an in-group message source will be an effective means of creating a cognitive response to a persuasive message. There are currently two competing processes regarding in-group sources and how message viewers with low involvement are influenced (Mackie, Gastardo-Conaco, & Skelly, 1992; Mackie, Worth, & Asuncion, 1990). The first theory proposes that, consistent with the ELM, an in-group reference within a persuasive communication may operate purely as a peripheral cue, which will not lead to cognitive processing, but may elicit some level of attitude change. The second theory proposes that the existence of an in-group reference may increase personal relevance, lead to cognitive processing, and elicit a higher level of attitude change.

The most key aspect of this second approach is that it is not possible for a message source to be directly processed cognitively. There must be some message argument that is to be cognitively evaluated. As stated previously, if a message recipient has high elaboration likelihood, then they will cognitively process the arguments and there is increased potential for an attitude change. Therefore, the most plausible means of integrating SIT is through a message source operating as a peripheral cue with a targeted attempt to elicit central route processing through additional message arguments. The utilization of concepts from SIT is an attempt to generate an increased measure of elaboration likelihood among those message recipients who are initially not processing the central arguments.

It is also necessary to consider the characteristics of context, source credibility, and accentuation/bias as they may influence the potential for cognitive processing. As noted previously, context has the potential to make a group more or less influential (Oakes, 1996). Within a context provided, an individual is most likely to rely on the group norms that most closely align with a relevant social categorization. As the personal relevance of a context increases then, there is a higher likelihood that a person will more strongly identify with one of their social in-groups that is pertinent to that situation. An individual's beliefs are often a function of the groups to which he or she belongs and the social context in which his or her groups are placed (Van Knippenberg, 1999). Thus, if the correct context is included in a persuasive message, via an in-group message source, then a message recipient is more likely to draw from a relevant social identity.

Regarding source credibility, it is postulated that in-group references have a greater level of perceived credibility and an increased potential for eliciting persuasive change (Clark & Maass, 1988). Messages from out-group sources have been less influential than messages from an in-group source, regardless of argument strength (Mackie, Worth, & Asuncion, 1990; Van Knippenberg, Lossie, & Willke, 1994; Van Knippenberg & Wilke, 1992). The relevance of an in-group message may be increased as a result of the message content and the potential for this content to influence the in-group structure. Regardless of the in-group's actual credibility regarding a subject, it is perceived to be high because of their in-group standing (Clark & Maass, 1988).

The concept of accentuation, or bias, is a departure from objective reality. Utilizing objective judgment, individuals should direct themselves toward either the most credible source, as credibility is often considered to be a grouping of both knowledge and

trustworthiness (Hovland, Janis, & Kelley, 1953). Thus, a higher credibility message source should lead to increased attention given to that respective message. The bias that is taking place through these circumstances is operating both from an intragroup and an intergroup perspective. However, the in-group is receiving positive biases while any out-groups are receiving negative biases. This effect is apparent in numerous studies, but is even more emphasized in the following study. The results from this study found that an in-group source was given priority over an out-group source, despite what should be higher credibility on a particular subject (Mackie, Worth, & Asuncion, 1990). In a study of message source at the University of California at Santa Barbara (UCSB), the participants were given messages of either high (continuing drilling off the coast of the southwest United States) or low (imposing controls to curb acid rain in the northeastern United States) relevance. These messages were provided by either an in-group (UCSB source) or out-group (University of New Hampshire source). Even when the message was of low relevance to the UCSB students, an in-group source was more influential, in spite of the increased potential for a source from the northeastern United States to have an increased level of credibility. This example makes clear the extent to which individuals alter their reality based on their group affiliation and social identity. These factors do provide some level of support for the increased likelihood of the peripheral-central route being legitimized. However, the numerous social identities that exist make it difficult to determine which social identity reference has the potential to be the most effective.

Since Newcomb's (1943) early study of college students, which found that there was increased liberalism among students consistent with their classmates, there has been a consistent desire to explain how social groups and social identity influence individuals.

There are conflicting viewpoints regarding how the usage of in-groups and out-groups influence the process of persuasion (Mackie, Worth, & Asuncion, 1990; Mackie, Gastardo-Conaco, & Skelly, 1992; Fleming & Petty, 2000). Within both SIT and the ELM, there are a multitude of nuances that may have an unaccounted for impact on persuasive messages and their outcomes. Regardless of exactly how this process is occurring, it is still necessary to determine if there are more effective approaches and what those might entail. Despite some concern over the demise of this area of persuasion research (Mackie & Queller, 2000), there still appears to be a large amount of unexplained variability, which requires an increased investment from the research community.

Summary of Reviewed Literature

The purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit changes in environmental belief and behavioral intention among winter recreationists. There is a clear need to identify how to influence environmental belief and behavioral intention in order to begin mitigating the effects of collective human behaviors. Climate change in particular has become one environmental issue that necessitates drastic action from the broader population in order to curtail its negative impacts. However, there is some difficulty in determining how to best influence environmental belief and behavioral intention.

The Elaboration Likelihood Model has been consistently proven to be reliable regarding the operation of the central and peripheral routes at influencing beliefs and behavioral intention. However, procession through these two routes is not mutually

exclusive. The elaboration continuum on which these changes are based does have some gray area as to how different factors may influence the cognitive processing of viewers.

The concept of involvement is one aspect that has been identified as a means of facilitating changes in belief and behavioral intention. When involvement is high, the message viewer will cognitively process the arguments in the message and there is a higher likelihood of a substantial attitude change. However, a low level of involvement necessitates some additional message aspect in order to facilitate a change.

In spite of a low level of involvement, a participant's social identity in the presence of a socially relevant message source may operate as a motivator to elicit cognitive processing, which has the potential to lead to a higher level of change. In order to test this assertion, this study utilized involvement and social identity characteristics evaluated against varying message communicators as a means of determining their influence on belief and behavioral intention change.

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CHAPTER III

METHODS

The purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit environmental belief and behavioral intention changes among winter recreationists. The information presented in this chapter addresses the methods and procedures proposed to accomplish this purpose. This chapter is divided into the following sections: (a) Pilot Study; (b) Population and Setting; (c) Sampling; (d) Measurement; (e) Materials; (f) Procedures; (g) Data Analysis; and (h) Threats to Validity.

Pilot Study

A pilot study was carried out during the summer and fall of 2011 to develop the strong and weak versions of the persuasive message necessary for proper application of the Elaboration Likelihood Model (ELM). The development of strong and weak messages was necessary in order to determine the differential effects of the message arguments and any peripheral cues.

All aspects of the pilot study were applied using previously outlined protocols (Petty & Cacioppo, 1986a). The pilot was divided into the following phases: (1)

Argument Development and Testing; (2) Message Development and Testing of Intended Outcomes; and (3) Testing of Message Parallelism.

Argument Development and Testing

During this segment of the pilot study, potential strong arguments regarding climate change were developed utilizing the evidence in the IPCC (2007) report. Seven strong arguments were developed that indicate the effects of human-caused climate change and seven parallel weak arguments were derived from the strong arguments (see Appendix A). These seven initial pairs of arguments were submitted for further testing to determine their usefulness for the broader study.

Following argument development, message testing was utilized. The pilot study questionnaires were administered to convenience samples of students at the University of Utah that were obtained through the general education course listing. Arguments were tested individually for strength. Survey respondents were asked “Does this message make a weak or strong case for the existence of climate change?” and were asked to rate each argument on a scale ranging from “Extremely Weak” to “Extremely Strong”. The criterion to differentiate strong versus weak arguments was determined as the significant difference in means around the scale midpoint. The first round of surveying received responses from 46 participants yielding 23 responses for the strong and weak arguments, respectively. The data were analyzed using an independent samples *t*-test, which yielded four argument pairs that differed significantly.

In order to provide a more extensive number of arguments for the broader study, argument revisions for the three argument pairs that were not significantly different were

instituted. The arguments were then reevaluated. After argument revisions, an additional sample of participants ($N = 66$) evaluated the strong and weak messages with groups of 33 for the strong and weak arguments, respectively. As a result of this survey, one additional argument pair differed significantly and was added to the pool of arguments that met the strength criterion (see Table 1).

Message Development and Testing of Intended Outcomes

After the strength criterion, the five arguments that differed significantly around the strong/weak midpoint were included as part of either the strong or weak message. These messages consisted of a brief introduction and closing outlining the critical nature

Table 1: Pilot Study - Argument Strength Scores

Argument	Strength	<i>N</i>	Mean	Standard Error	Sig (2-tailed)
Global Temperature Increases	Strong	23	4.78	.226	$p < .001$
	Weak	23	3.04	.311	
Melting Arctic Ice	Strong	23	4.91	.313	$p = .025$
	Weak	23	3.91	.294	
Rising Sea Levels	Strong	23	4.91	.287	$p = .007$
	Weak	23	3.61	.365	
More Variable Precipitation	Strong	23	4.87	.283	$p < .001$
	Weak	23	3.22	.295	
Loss of Alpine Glaciers	Strong	33	4.15	.199	$p = .002$
	Weak	33	3.29	.180	

and evidence of human-caused climate change, and included either all five strong arguments or all five weak arguments (see Appendix B).

The strong and weak messages were then tested for their intended outcome. Strong messages are intended to generate favorable thoughts while weak messages are intended to generate unfavorable thoughts (Petty & Cacioppo, 1986a). Previous thought listing exercises have utilized the coding specification of polarity, origin, and target (Cacioppo, Harkins, & Petty, 1981; Cacioppo & Petty, 1981).

After the strength criterion, the five arguments that differed significantly around the strong/weak midpoint were included as part of either the strong or weak message. These messages consisted of a brief introduction and closing outlining the critical nature and evidence of human-caused climate change, and included either all five strong arguments or all five weak arguments (see Appendix B).

The strong and weak messages were then tested for their intended outcome. Strong messages are intended to generate favorable thoughts while weak messages are intended to generate unfavorable thoughts (Petty & Cacioppo, 1986a). Previous thought listing exercises have utilized the coding specification of polarity, origin, and target (Cacioppo, Harkins, & Petty, 1981; Cacioppo & Petty, 1981). A thought listing exercise was employed in order to determine the thoughts generated by both the strong and weak messages (Brock, 1967; Greenwald & Albert, 1968). Survey participants were given either a strong or weak message and asked to write down the thoughts they had while reading the message. Participants were then asked to code their thoughts as to how favorable or unfavorable their thoughts were regarding “the existence of climate change.” The criterion to differentiate between strong and weak messages was a predominant

reaction. Predominant was determined to be 70% favorable thoughts for the strong message and 70% unfavorable thoughts for the weak message.

Results of this phase of message did not meet the criterion over the course of four trials (see Table 2). In addition, researcher scoring of these thoughts yielded no results that would have necessitated independent coding of the thought-listing exercise and, consequently, this strategy was not employed.

Testing of Message Parallelism

The third and final phase of message testing required that the messages be equivalent regarding believability, comprehensibility, complexity, and familiarity (Petty & Cacioppo, 1986a; see Appendix C). The intent is for the strong and weak messages to be equivalent in regards to these three factors so that they are only differentiated

Table 2: Pilot Study - Message Intended Outcomes

Trial	Message	N	% Favorable	% Unfavorable
1	Strong	46	50.0	30.4
	Weak	41	46.3	41.5
2	Strong	27	44.4	25.9
	Weak	27	40.7	37.0
3	Strong	23	60.9	26.1
	Weak	24	45.8	25.0
4	Strong	17	64.7	5.9
	Weak	16	18.8	50.0

regarding strength. Participants were asked “How believable was this message in making a case for the existence of climate change?” A believable message was defined for the participants as one that is reasonable or plausible, while an unbelievable message was defined as one that is doubtful or far-fetched. Participants were able to respond on a scale ranging from Extremely Unbelievable to Extremely Believable. In regards to comprehensibility, complexity, and familiarity, participants were asked to what extent they agreed with the following statements: The message was easy to understand; the message had a complex structure; and I am familiar with the message content. Participants scored these statements on a scale ranging from Strongly Disagree to Strongly Agree. An independent samples *t*-test revealed no significant differences between the strong and weak messages on the criteria of comprehensibility, complexity and familiarity. However, this test yielded a significant difference in the believability of these messages indicating that these messages were not parallel in nature (see Table 3).

Due to the failure of the persuasive messages to meet the intended outcomes criterion and the equivalent believability criterion, it was determined that these parallel messages could not be utilized in order to accurately test the Elaboration Likelihood Model. It was pointed out early in the development of the ELM that real-world applications of this model may present some confounding difficulties (Petty & Cacioppo, 1986a). The first difficulty was that there is a high likelihood that participants will have previously engaged in thinking regarding the issue presented increasing the potential that attitudes have been well-developed. The participant may also be less willing to process a message if he or she has already seen numerous messages pertaining to this issue. Secondly, developing messages regarding real issues may be problematic in that these

Table 3: Pilot Study - Message Believability, Comprehensibility, Complexity and Familiarity

Message	<i>N</i>	Mean	Standard Error	Sig (2-tailed)
<i>Believability</i>				
Strong	13	5.92	.239	<i>p</i> = .010
Weak	13	4.54	.433	
<i>Comprehensibility</i>				
Strong	13	6.08	.309	<i>p</i> = .131
Weak	13	5.31	.382	
<i>Complexity</i>				
Strong	13	3.00	.339	<i>p</i> = .799
Weak	13	3.15	.492	
<i>Familiarity</i>				
Strong	13	6.00	.196	<i>p</i> = .246
Weak	13	5.54	.332	

issues are dealing with information that is true. Attempting to develop real-world, issue arguments that are both strong and weak was deemed to be a difficult proposition.

As a result, the purpose of the broader study was still to determine the most effective communicator of persuasive messages about climate change in order to elicit changes in environmental belief and behavioral intention among winter recreationists. Rather than specifically testing the different aspects within the ELM, this study emphasized the influence of message source on change and how message source is influenced by participant involvement and social identity. In order to both pursue the purpose of this study and provide factual, leisure activity relevant information regarding climate change to all participants, the strong persuasive message was utilized in

order to explicitly outline the direct impacts of climate change on winter recreation. The key arguments include global temperature increases, decreases in snow cover, loss of alpine glaciers, and ski resort closures as well as behaviors in which the viewer may engage in order to mitigate the effects of climate change.

Population and Setting

Participants in the main study were 262 skiers and snowboarders utilizing both frontcountry (ski resort) and backcountry (nonski resort) recreational settings in the greater Salt Lake City region (see Figure 6). The sample consisted of 91.2% of participants who primarily engage in skiing and 8.8 % who primarily engage in snowboarding. The sample also consisted of 66.0% of primarily frontcountry users, 28.6% of primarily backcountry users, and 5.3% of users who recreate in both areas

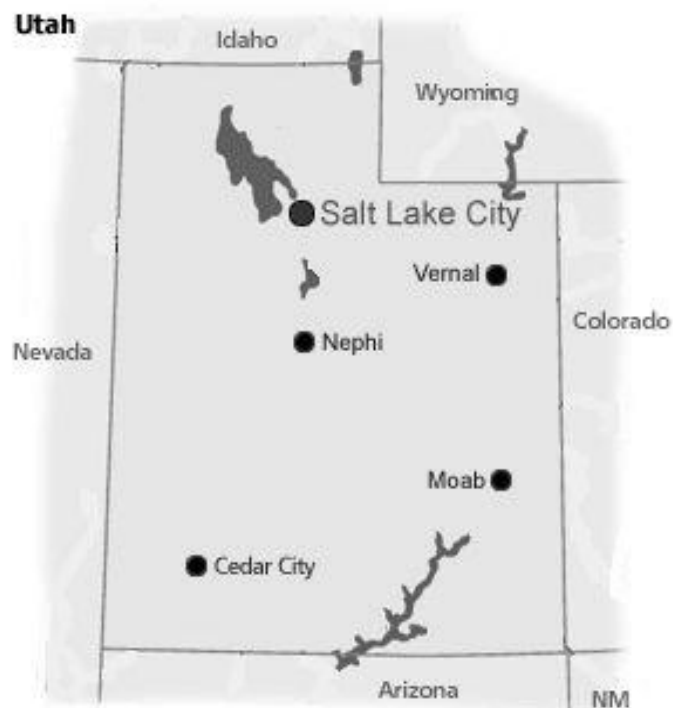


Figure 6: Location of Salt Lake City, Utah

equivalently. In addition, it was necessary for participants to have an e-mail account as they received two questionnaires via e-mail.

The frontcountry settings included the Salt Lake City ski resorts of Snowbird and Alta. The backcountry survey sites included popular access points in Big Cottonwood and Little Cottonwood Canyons, both adjacent to the Salt Lake valley. The Big Cottonwood Canyon site was the Spruces Campground trailhead. The Little Cottonwood Canyon site was the Spruces Campground trailhead. The Little Cottonwood Canyon sites included the Alta Central trailhead, the Grizzly Gulch trailhead, and the White Pine trailhead (see Figure 7). These survey sites were selected because of their

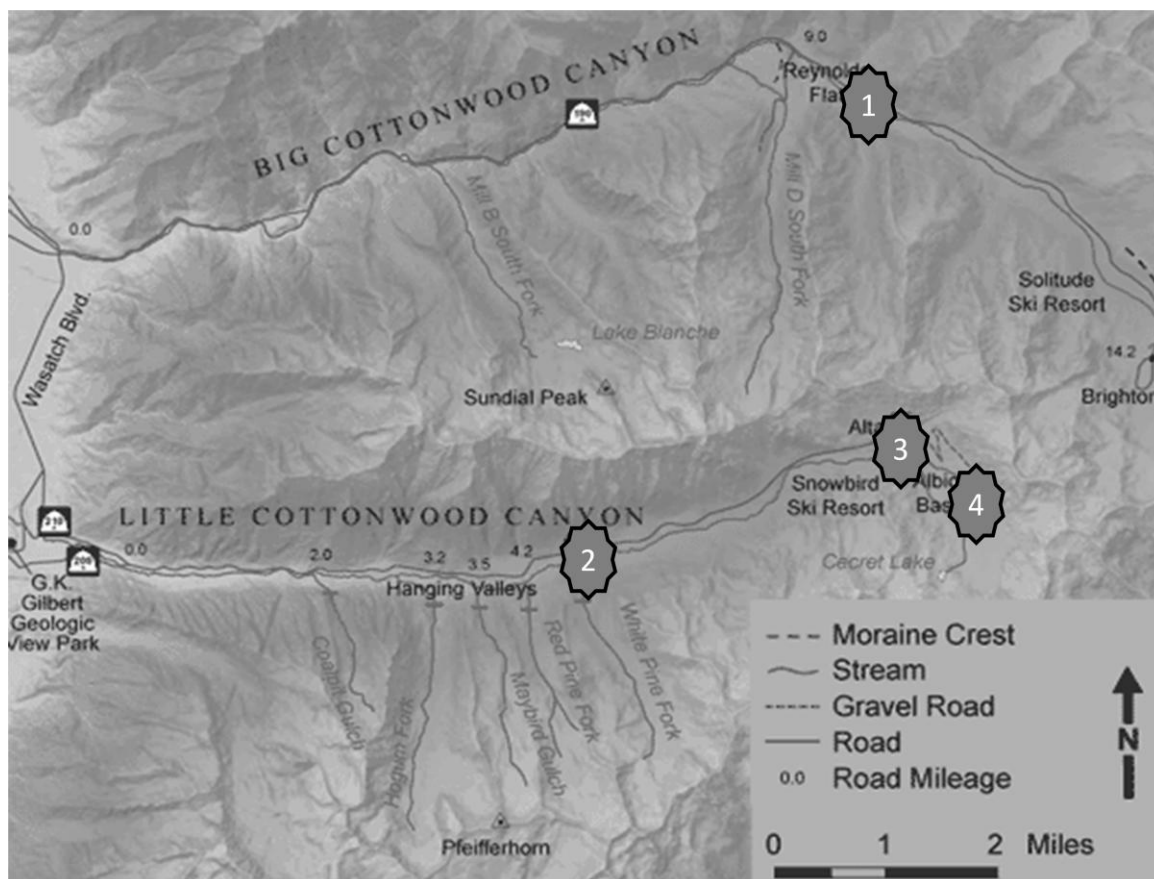


Figure 7: Big Cottonwood Canyon and Little Cottonwood Canyon Survey Locations
Big Cottonwood Canyon Sites: 1 = Spruces Campground Trailhead
Little Cottonwood Canyon Sites: 2 = White Pine Trailhead, 3 = Alta Central Trailhead, 4 = Grizzly Gulch Trailhead

high backcountry usage rates. Parking for all of the backcountry sites is free of charge and available either in adjacent parking areas or along either side of the canyon access roads. The majority of the terrain in these survey areas is under the jurisdiction of the U.S. Forest Service.

The Wasatch Mountains of Utah are commonly associated with “The Greatest Snow on Earth.” Seven world-class ski resorts are within a 40-minute drive of downtown Salt Lake City and seasonal snowfalls typically hover in the 600-750” range each winter. Aside from the numerous national parks present in Utah, winter recreation (typically skiing and snowboarding) is one of the major tourist draws for the state (Utah State University Cooperative Extension, 2012).

Sampling

Stratified random sampling was employed in order to ensure that a cross-section of winter recreationists was attained. Randomization for backcountry surveying was achieved through three different means. First, the weekdays on which sampling will take place were randomly selected. Second, the sampling sites were randomly selected on those particular days. Lastly, the treatment received was randomly assigned to the participants within each stratum. At frontcountry survey sites, sampling was agreed upon between the participating ski resort and the researcher.

Data were collected between January 31, 2012 and May 26, 2012. Pretest data were collected on both weekend days and three randomly selected weekdays. It was necessary to differentiate between frontcountry and backcountry survey times due to the time constraints of ski resort operation hours and the propensity of many winter

backcountry users to recreate at hours that do not conflict with normal employment schedules.

Frontcountry survey days and specific locations were coordinated with ski resorts. Alta Ski resort permitted 7 days of surveying on their premises and Snowbird Ski Resort permitted 2 days of surveying on their premises. Frontcountry survey times were dependent upon ski resort hours of operation and took place for approximately 7 hours (9:00am-3:00pm) on each survey day. Every unoccupied individual encountered was surveyed. Per agreement with the frontcountry sites, e-mail addresses were collected from participants and a link to the questionnaire was e-mailed to them directly.

Backcountry survey days were randomly selected between the two Cottonwood Canyons. Within each of the canyons, surveying was based upon the presence of vehicles at each of the sites; however, the order of survey locations within Little Cottonwood Canyon was randomly selected on each survey day. Surveying within each canyon took place for 8 hours (8:00am-4:00pm). All of the skiers and snowboarders encountered at the backcountry survey sites were asked to fill out a questionnaire or provide their e-mail address.

Measurement

A multitude of measures were employed to measure participant environmental belief, behavioral intention, leisure involvement, and group identification. Manipulation checks were also employed to determine the level of cognitive processing, message source credibility, and message source influence. Sociodemographic factors were also included.

Dependent Variables

Environmental belief. Environmental belief was measured utilizing three questions addressing beliefs regarding the existence of climate change, how certain he or she is that climate change is happening or not happening, and what he or she believes is causing climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). The first question in this series was “Do you think that climate change is happening?” Participants were then asked how sure they are that climate change is either happening or not happening. Lastly, they were asked whether they believe climate change is occurring as a result of natural processes, human actions or a combination of these factors. These questions have been utilized in numerous national surveys to gauge individual beliefs regarding the existence and causes of climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011).

Behavioral intention. Behavioral intention was measured using a 9-item scale developed to determine how likely participants’ are to engage in specific environmental behaviors (see Table 4).

The development of this scale utilized the behavioral intention component of the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and Stern’s (2000) four categories of environmental behavior: environmental activism; nonactivist behaviors in the public sphere; private-sphere environmentalism; and other environmentally significant behaviors. These items present 9 different environmental behaviors that have a positive impact in the mitigation of climate change. Respondents evaluated how likely or unlikely they would be to engage in these behaviors over a specified time period utilizing a 7-point Likert scale ranging from “Extremely Unlikely”

Table 4: Measures of Behavioral Intention

Environmental Activism

In the next two months, how likely would you be to take part in a public demonstration against climate change?

In the next two months, how likely would you be to become an active member of an organization attempting to stop climate change?

Nonactivist Behaviors in the Public Sphere

In the next two months, how likely would you be to sign a petition in favor of limiting the emission of carbon dioxide (CO₂)?

In the next two months, how likely would you be to tell a friend about not idling their car?

Private-Sphere Environmentalism

In the next two months, how likely would you be to purchase renewable energy for your home through your local power company?

In the next two months, how likely would you be to use public transportation at least once per week?

In the next two months, how likely would you be to lower your thermostat by two degrees?

In the next two months, how likely would you be to purchase two locally produced food items each week?

Other Environmentally Significant Behaviors

In the next two months, how likely would you be to support an energy reduction program at your school or place of employment?

Items rated on a scale ranging from Extremely Unlikely (1) to Extremely Likely (7).

to “Extremely Likely”. The intent was not to develop a scale of behavioral intention, but only to surmise participant intention to engage in these particular behaviors. The development of this scale utilized the behavioral intention component of the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and Stern’s (2000) four categories of environmental behavior: environmental activism; nonactivist behaviors in the public sphere; private-sphere environmentalism; and other environmentally significant behaviors. These items present 9 different environmental behaviors that have a positive impact in the mitigation of climate change. Respondents evaluated how likely or unlikely they would be to engage in these behaviors over a specified time period utilizing a 7-point Likert scale ranging from “Extremely Unlikely” to “Extremely Likely”. The intent was not to develop a scale of behavioral intention, but only to surmise participant intention to engage in these particular behaviors.

Independent Variables

Message source. The type of message viewed by the participant operated as the treatment variable. A persuasive message about climate change was provided using one of three message sources: in-group, ski resort source; in-group, ski equipment manufacturer source; or out-group, climate science source. The message sources were developed to be inclusive of as many segments of the winter recreation user groups as possible. The in-group, ski resort source cue was as follows:

The following important message about climate change is brought to you by
The American Ski Resort Community

The in-group, ski equipment manufacturer source cue was as follows:

The following important message about climate change is brought to you by
The American Ski Equipment Manufacturing Community

The out-group, climate science source cue was as follows:

The following important message about climate change is brought to you by
The American Climate Science Community

Leisure involvement. Investigation into the participant's level of leisure involvement utilized the Modified Involvement Scale (MIS; Kyle et al., 2007). The MIS is a 15-item scale that addresses the factors of attraction, centrality, social bonding, identity affirmation, and identity expression (see Table 5). Respondents evaluated each statement on a 7-point Likert scale from "Strongly Disagree" to "Strongly Agree". In past research utilizing this scale, all five components of the MIS have produced Cronbach α scores above 0.70 (Kyle, et al., 2007).

Social identity. Social identity was assessed using a 10-item group identification scale to measure the participant's level of in-group identification (Brown et al., 1986). This scale accounts for awareness of group membership, evaluation, and affect, which are the three facets included within the concept of social identity (see Table 6). Participants responded to statements on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree". This group identification scale has been widely utilized and has been one of the most reliable group identification scales. An initial Cronbach's α of 0.71 was found by Brown et al. (1986) with more recent studies ranging from an α of 0.72 to 0.88 (Dono, Webb, & Richardson, 2010; Jackson & Smith, 1999).

Collectively, leisure involvement and social identity were combined into a factorial categorization to understand how these two variables interact with the treatment

Table 5: Modified Involvement Scale Items

Attraction

Skiing/Snowboarding is one of the most enjoyable things I do

Skiing/Snowboarding is very important to me

Skiing/Snowboarding is one of the most satisfying things I do

Centrality

I find a lot of my life is organized around skiing/snowboarding.

Skiing/Snowboarding occupies a central role in my life.

To change my preference from skiing/snowboarding to another recreation activity would require major rethinking.

Social bonding

I enjoy discussing skiing/snowboarding with my friends.

Most of my friends are in some way connected with skiing/snowboarding.

Participating in skiing/snowboarding provides me with an opportunity to be with friends.

Identity affirmation

When I participate in skiing/snowboarding, I can really be myself.

I identify with the people and image associated with skiing/snowboarding.

When I'm skiing/snowboarding, I don't have to be concerned with the way I look.

Identity expression

You can tell a lot about a person by seeing them skiing/snowboarding.

Participating in skiing/snowboarding says a lot about whom I am.

When I participate in skiing/snowboarding, others see me the way I want them to see me.

Items rated on a scale ranging from Strongly Disagree (1) to Strongly Agree (7).

Table 6: Group Identification Scale Items

I am a person who considers the skier/snowboarder group important.
I am a person who identifies with the skier/snowboarder group.
I am a person who feels strong ties with the skier/snowboarder group.
I am a person who is glad to belong to the skier/snowboarder group.
I am a person who sees myself as belonging to the skier/snowboarder group.
I am a person who makes excuses for belonging to the skier/snowboarder group.
I am a person who tries to hide belonging to the skier/snowboarder group.
I am a person who feels held back by the skier/snowboarder group.
I am a person who is annoyed to say I'm a member of the skier/snowboarder group.
I am a person who criticizes the skier/snowboarder group.

Items rated on a scale ranging from Strongly Disagree (1) to Strongly Agree (7).

conditions. Involvement should indicate their propensity for cognitively processing the persuasive message. A low or moderate level of involvement should indicate that there is a higher propensity for reliance upon their social identity, in which a message viewer would defer to the message source and either cognitively process the message or not.

Manipulation Checks

Cognitive processing. In this study, cognitive processing was measured through two means. The first measure of cognitive processing was a thought-listing exercise (Brock, 1967; Greenwald, 1968). Participants were asked to write down three thoughts

they had while reading the message. After writing each thought, the participants rated to what extent their thought agrees or disagrees with the message he or she previously read. This was evaluated on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”.

The second measure of cognitive processing was an explicit measure about the level of cognitive effort in which the participant engaged. The following statements were presented: “I was trying hard to evaluate the message?” and “I put a great deal of effort into evaluating the message?” (Petty & Cacioppo, 1986a). Both of these were evaluated on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. Similar questions have been found to have a strong correlation ($p > 0.80$; Petty & Cacioppo, 1986a).

Source credibility. Source credibility was measured to assess Hovland, Janis, and Kelly’s (1953) factors of source expertise and source trustworthiness. A modified version of Ohanian’s (1990) scale was utilized. Respondents evaluated the statements on a 10-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. This scale contained 10 items measuring expertise and trustworthiness (see Table 7). The original scale also included attractiveness with a construct reliability for all three items of $\alpha > 0.88$ (Ohanian, 1990).

Source influence. In order to determine the effectiveness of the source in eliciting either peripheral route effects or central route effects, it was necessary to determine how the source influenced message attention. To determine if the message source was operating as a motivator of cognitive processing or acting as a peripheral cue, a question

Table 7: Source Credibility Items

Source trustworthiness

- I would consider the message source dependable.
- I would consider the message source to be honest.
- I would consider the message source to be reliable.
- I would consider the message source to be sincere.
- I would consider the message source to be trustworthy.

Source expertise

- I would consider the message source to be an expert.
- I would consider the message source to be experienced.
- I would consider the message source to be knowledgeable.
- I would consider the message source to be qualified.
- I would consider the message source to be skilled.

Items rated on a scale ranging from Strongly Disagree (1) to Strongly Agree (7).

asked the participants to respond regarding how much the message source influenced their thinking about the message. This question was, “The message source motivated me to think more about the message as whole.” This was ranked by the participant on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”.

Sociodemographics. In addition to the above scales, questions about demographic information were included. These sociodemographic aspects were age, level of education, salary, and primary location of residence.

Materials

Materials utilized for the collection of initial contact data included questionnaires, clipboards, pens, a letter from the University of Utah IRB endorsing this research, and miniature candy bars to provide to participants. Materials for the posttest and follow-up questionnaires included an internet survey account. Despite the fact that drawing for prizes have yielded only small increases in returns (Carlson, 1996), due to the repeated measure nature of this study, it was still worthwhile to employ this method in order to gain any statistical advantage possible. Therefore, gift certificates, lift tickets, and other material goods were obtained for a drawing. Participants who completed all three of the questionnaires were entered into a drawing for these prizes.

Procedures

Data were collected via self-administered questionnaire during three phases using a modified Dillman (2007) method and identified as pretest questionnaire, posttest questionnaire and follow-up questionnaire. Pretest data were collected at survey sites consistent with the previously outlined sampling method. Posttest data and follow-up data were collected via online questionnaires e-mailed to those participants who were contacted during the pretest data collection.

First and foremost, it was necessary to gain permission to access sampling areas. This proved most difficult in reaching the frontcountry users as the resorts were less willing to have a researcher study climate change on their property and many resort already engage in customer surveying. In gaining access to the trailheads in Big and

Little Cottonwood Canyons, it was confirmed with the US Forest Service that surveying is permitted.

Upon initial contact with the participants, they were asked about their willingness to participate in a survey about environmental beliefs. If they agreed to participate, they were informed that they would be receiving two subsequent questionnaires via e-mail over the next month that should be returned as soon as possible. The researcher informed the participants that they would be entered into a drawing for numerous prizes if they returned the two subsequent questionnaires and the maximum of entrants would be 1,200 people. The researcher then encouraged participants to fill out the questionnaire honestly and independently of anyone around them. The pretest questionnaire (see Appendix E) was distributed to participants as a self-administered questionnaire in order to reduce social desirability effects. The participant then filled out the pretest questionnaire as the researcher maintained a distance that provided the participant with some measure of privacy. Upon receipt of the questionnaire, the researcher offered a miniature candy bar to the participant to thank him or her for their time and to facilitate return of the two subsequent e-mail questionnaires.

At frontcountry survey sites, it was necessary to obtain participant e-mail addresses and then all three questionnaires were administered via online methods. This approach was agreed upon between the researcher and participating ski resorts.

The pretest questionnaire included the IRB approval, the measure of environmental belief, the measure of behavioral intention, the Modified Involvement Scale, the Group Identity Scale, a space for name, and a place for e-mail address so the subsequent e-mail questionnaires could be sent to participants at a later time. Both

verbally and on the questionnaire, participants were informed that their e-mail address would only be used for the purposes of this study and all of their responses would remain confidential.

Upon receipt of the questionnaire, participants were grouped based upon their scores on the Modified Involvement Scale and the Group Identification Scale. Once each week of surveying was completed, a median for both of these measures was calculated for all participants in order to classify each participant into one of the four groups: High identity-high involvement; High identity-low involvement; Low identity-high involvement; and Low identity-low involvement. Within each of these stratified groups, treatment conditions were randomly assigned in order to insure that all treatment/group combinations were adequately represented for later hypothesis testing. The process of determining comprehensive group means of involvement and group identity continued at the end of each survey week in order to more accurately stratify the sample population. This process also guided sampling as it was anticipated that the frontcountry and backcountry sampling sites would yield participants with different levels of involvement and group identity.

Approximately 1 week after their pretest questionnaire, participants were e-mailed the posttest questionnaire (see Appendix F) through the Zoomerang program (Zoomerang, 2012). The posttest questionnaire contained the IRB approval, one persuasive message about climate change, a measure of environmental belief, a measure of behavioral intention, two measures of cognitive processing, and questions addressing the source's credibility and influence on their message processing.

A process was also in place that attempted to increase response rates (Dillman, 2007). One week following the e-mailing of any of the online questionnaires, a reminder e-mail (see Appendix G) was sent to remind the participant that the questionnaire was sent to him or her, to provide a new questionnaire link if they no longer have the original e-mail, to thank him or her for their participation in the study, and as a reminder about the prize drawing requirements. Two weeks after the initial questionnaire was sent, another, more comprehensive e-mail was sent explaining in more detail the importance of this research and the need for participation (Appendix H).

The final questionnaire attempted to gauge a more longitudinal effect of the persuasive message. One month following the receipt of the posttest questionnaire, a follow-up e-mail questionnaire (see Appendix I) obtained a third measure of environmental belief and behavioral intention. The additional measures of environmental belief and behavioral intention provided some insight as to the persistence of these changes. Similar to the strategy previously mentioned, two reminder e-mails (see Appendices G and H) were sent to remind the participant that the questionnaire was sent to him or her, to provide a link to the questionnaire if he or she no longer has the original e-mail, to thank him or her for their participation in the study, and as a reminder about the prize drawing requirements.

Following the receipt of questionnaires, all participants who returned all of the questionnaires were entered into a drawing for the incentives. The winners were contacted via e-mail and prizes were mailed by the researcher.

Data Analysis

Data Cleaning

The data cleaning process utilized frequency tables to find missing, incorrect, or improperly entered data. Imputation of missing data was completed using the mean of each individual's scale scores.

Power Analysis

Power is the ability of statistical methods to find statistical significance when a treatment is effective (Lipsey, 1990). The desired level of statistical power is 0.80 (Murphy & Myers, 2004). The first consideration is the number of participants necessary to have adequate power required for the statistical test that this study required, which in this case is a repeated measures ANOVA. Utilizing a stratified sampling technique helped to keep the sample groups balanced making data analysis more effective.

It was also necessary to account for attrition due to the repeated measures nature of this study. Studies have indicated that mailed questionnaires will typically only receive approximately 20-40% return rate without follow-up contacts. However, personal contact has improved response rates to approximately 75% in some cases (Dillman, 2007). Studies that have utilized personal contact prior to a mailed questionnaire have reached return rates in the range of 85% (Gibbons & Ruddell, 1995).

Given a 50/50 split, $\pm 5\%$ sampling error, and a 95% confidence interval, a sample size of approximately 384 would be adequate for a population of approximately 1,000,000,000 (Dillman, 2007; Salant & Dillman, 1994). However, given the 3 predictor

variables and the repeated measures nature of this study, an initial sample size of 1,200 was sought in order to account for some level of participant attrition.

Data collection yielded initial contact with 676 participants. Of these initial contacts, 262 participants completed all three of the questionnaires, yielding a response rate of 39%. Given the end of the formal winter recreation season, no further participants were able to be acquired.

Testing of Statistical Hypotheses

Testing of all statistical hypotheses was accomplished through repeated measures ANOVA. In addition, manipulation checks were assessed using *t*-tests.

Dependent Variables: Environmental Belief and Behavioral Intention

Independent Variables: Message Source (peripheral cue), Leisure Involvement, and Social Identity (see Figure 8).

H1: If the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a message (control group).

H1a: Follow-up environmental belief scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

H2: If the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a

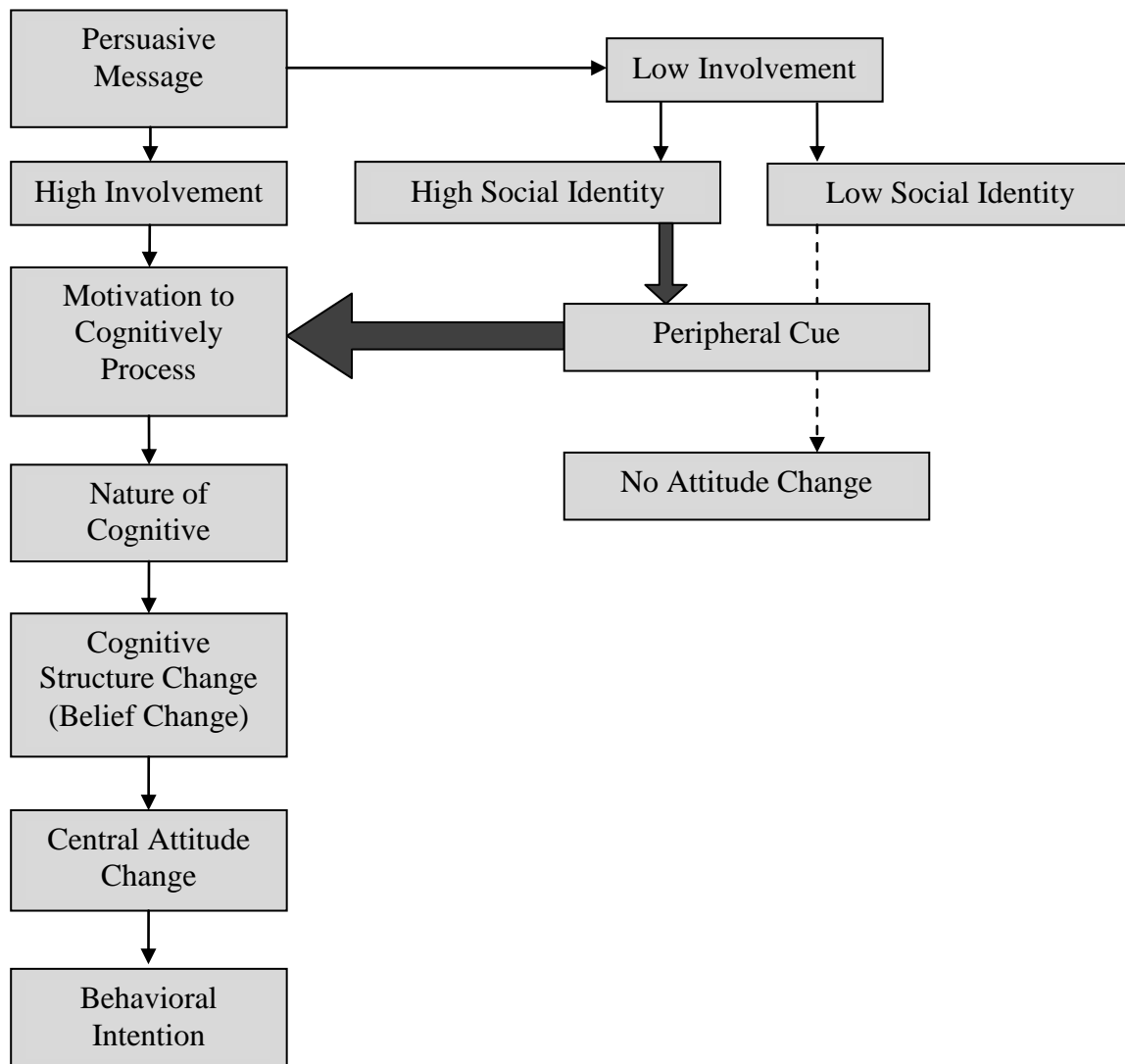


Figure 8: Proposed model of social identity peripheral cue influence on belief and behavioral intention change (Derived from Petty & Cacioppo, 1986b).

message (control group).

H2a: Follow-up behavioral intention scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

In hypotheses 1, 1a, 2, and 2a, the involvement factor will be the most prominent factor that influences environmental belief and behavioral intention change. A highly involved participant will cognitively process the cogent arguments contained in the message, which should elicit a positive environmental belief and behavioral intention as a result. Participants with a low level of involvement will defer to peripheral cues that will elicit an immediate, posttest change in environmental belief and behavioral intention. However, neither of these changes is durable and will degrade at the follow-up measurement. At follow-up, involved viewers will have more durable environmental belief and behavioral intention changes as a result of cognitive processing.

H3: For those participants with a low level of involvement, if the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity participants who did not receive a message (control group).

H3a: For those participants with a low level of involvement, if the persuasive message is effective, those participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-

group message source, low social identity treatment groups, and the participants who did not receive a message (control group).

H4: For those participants with a low level of involvement, if the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity participants who did not receive a message (control group).

H4a: For those participants with a low level of involvement, if the persuasive message is effective, participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-group message source, low social identity treatment groups, and the participants who did not receive a message (control group).

In hypotheses 3, 3a, 4, and 4a, the viewer's social identity and a socially relevant message source will be the most prominent aspects facilitating cognitive processing among participants with low levels of involvement. Participants receiving a message from an in-group message source will, in spite of their low level of involvement, cognitively process the arguments in the message and have positive changes in environmental belief and behavioral intention. Participants receiving a strong message and an out-group message source will use that non-socially-relevant message source as a peripheral cue and have an initial, positive environmental belief and behavioral intention. Long term, those participants with a low level of involvement and high level of group

identity receiving a message from an in-group message source will have a more positive environmental belief and behavioral intention due to cognitive processing.

Threats to Validity

Validity is the extent to which the results from a study can be generalized to the broader population. Validity can be broken down into internal and external validity. Internal validity can be further expanded to internal validity and statistical conclusion validity, while external validity includes both external validity and construct validity. Each of these will be expanded upon below and their influence on this study will be discussed.

Threats to Internal Validity

Internal validity is “the approximate validity with which we can infer that a relationship is causal” (Cook & Campbell, p. 37). Most of the internal validity threats were controlled for through random selection, random assignment of treatments, inclusion of all those sampled, and independent measurement means (Table 8).

Maturation was only partially controlled through the implementation of a panel study where the participants will act as their own control. However, there may have been some maturation due to the repeated measurement of environmental belief and behavioral intention.

Table 8: Threats to Internal Validity

Threat	Controlled	Justification
History	Yes	The use of control group accounted for any external events.
Maturation	Yes	Participants were exposed to only one treatment. Participants will be acting as their own control, so any maturation effect should be controlled.
Testing	Partially	Participants served as their own control and were only exposed to one treatment. The repeated measure in the study may have influenced outcomes during the second and third measurement.
Instrumentation	Yes	No changes after the start of surveying.
Statistical regression	Yes	All sampled participants were included.
Selection biases	Yes	Participant selection was random.
Attrition	No	Repeated measures led to some level of participant attrition.
Interaction with selection	Yes	Participants were randomly selected and treatments were randomly assigned to participants.
Diffusion of treatment	Yes	No participant interaction: Participants each received their own survey materials.
Differential selection	Yes	Participants were randomly selected.

Threats to Statistical Conclusion Validity

Statistical conclusion validity refers to the ability to both have enough statistical power in order to find an effect and to meet the necessary statistical assumptions (Creswell, 2003). The primary threat to statistical conclusion validity was a low number of participants (see Table 9). Given the end of the winter recreation season, additional participants were not able to be acquired in order to meet the necessary sample size.

Random irrelevances in experimental setting were not able to be controlled due to the initial survey setting. In addition, random heterogeneity was only partially controlled. The population is limited to winter recreationists; however, there is potential for a wide variety of individuals to be sampled within this group.

Table 9: Threats to Statistical Conclusion Validity

Threat	Controlled	Justification
Low statistical power	No	Additional participants were necessary
Reliability of measures	Yes	Measures determined to be reliable.
Reliability of treatment	Yes	Treatment and conditions were standardized: introductions, instructions to questionnaires, and appearance of researcher.
Random irrelevances in experimental setting	No	Outdoor and online survey setting was not controlled.
Random heterogeneity	Partially	Participants were all from a population of winter recreationists.

Threats to Construct Validity

Construct validity refers to “inadequate definitions and measures of variables” (Creswell, 2003, p. 171). Most of the threats to construct validity were controlled by proper definition of constructs and participant assurance that there was no desired result (see Table 10).

Mono-operation bias and monomethod bias were only partially controlled. The utilization of multiple treatment types allows for partial control of mono-operation bias. Multiple measures of cognitive processing is the only factor that helps to control monomethod bias.

Table 10: Threats to Construct Validity

Threat	Controlled	Justification
Inadequate preoperational explication of constructs	Yes	Constructs defined consistent with theory
Mono-operation bias	Partially	Multiple treatment types were utilized.
Mono-method bias	Partially	Only one dependent variable measure was utilized.
Evaluation apprehension	Yes	Participants were assured that there were no right or wrong answers
Researcher expectancy	Yes	Treatments were randomly selected and not administered in the presence of the researcher. Purpose of study was not stated explicitly.
Interaction of different treatments	Yes	Treatments were randomly assigned. Only one treatment per participant.

Threats to External Validity

A study has external validity if “the results obtained would apply in the real-world to other similar programs and approaches” (Tuckman, 1972, p. 4). Reactivity effect and experimenter effect were only partially controlled (see Table 11). Reactivity was partially controlled by treatments being assigned to all participants and by not explicitly stating the true purpose of the study. The experimenter effect was partially controlled by utilizing the same researcher with a consistent script for engaging with sample participants. Pretest sensitization was not able to be controlled due to a repeated measure on the dependent construct.

Table 11: Threats to External Validity

Threat	Controlled	Justification
Personological variable and treatment interaction	Yes	Participants were randomly selected along with random assignment of treatment.
Multiple treatment interference	Yes	Only one treatment was administered per participant.
Reactive effects	Partially	Treatment was administered via written questionnaire. Participants were not explicitly told the study purpose. All participants received a similar treatment.
Pretest sensitization	No	Pretest was given.
Experimenter effect	Partially	The researcher provided the same scripted introduction to the test to all participants. All participants were exposed to the same researcher.

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CHAPTER IV

ARTICLE I: THE DEVELOPMENT OF REAL-WORLD PERSUASIVE MESSAGES ABOUT CLIMATE CHANGE USING THE ELABORATION LIKELIHOOD MODEL

Abstract

The issue of climate change has become a problem that necessitates attention from the world's population. Given the scientific consensus surrounding the magnitude of climate change and its anthropogenic causes, the scale of public belief and action is relatively minor. There is a need to determine how to best influence the beliefs, attitudes, and behaviors of the general public through the use of persuasive messages about climate change. The Elaboration Likelihood Model (ELM) is considered to be one of the most comprehensive approaches to development and evaluation of persuasive communications. However, many difficulties have been pointed out when applying the ELM to real-world issues. Therefore, the purpose of this study was to develop and test persuasive messages about climate change through the criteria outlined in the Elaboration Likelihood Model.

Introduction

The issue of climate change has become a ubiquitous topic in society today. There are grave concerns among many scientists regarding the further impacts additional warming will have upon all facets of the human and nonhuman world. In order to avert further environmental degradation, there is a need to determine how to influence beliefs, attitudes, and behaviors related to climate change.

The Climate Change Message

Numerous studies from international agencies and researchers have exhibited substantial concern regarding the widespread impacts of climate change as a global environmental threat (Brundtland Report, 1987; Hansen et al., 2008; IPCC, 2007; Stern, 2006). A study of scientific consensus regarding climate change found that 97-98% of climate scientists publishing in the field are supporters of anthropogenic climate change and those who are not supporters have much less scientific expertise and prominence in the field (Anderegg, Prall, Harold, & Schneider, 2010). In spite of the vast majority of reputable scientists and scientific bodies that have supported human-induced climate change, public opinion is still highly conflicted on this issue. Essentially, "the *gap between* public perception and scientific reality is now enormous" (Hansen, 2009, p. 171).

There is far less consensus among the general public in regards to this issue and climate change continues to place quite low on the list of general public concerns (Gardner, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Leiserowitz et al., 2011; Newport, 2010). Only recently has climate change become the top environmental concern for

Americans, up from being the sixth most important concern in 2003 (Ansolabehere & Herzog, 2006). One public opinion poll found that 40% of Americans believe there is a lot of disagreement among scientists and only 39% believe that most climate scientists think climate change is happening (Leseirowitz et al., 2011). This same poll reported that only 15% of Americans knew that 81-100% of climate scientists believed that climate change is mostly caused by humans. Another poll of public opinion regarding the cause of climate change shows that only 50% of Americans believe climate change is caused by human activities as compared with 46% of the population that believe it is caused by natural systems (Newport, 2010). These numbers have been converging over the last decade, indicating inconsistent beliefs among the general public despite broad scientific consensus. In addition, another public opinion poll found that approximately 83% of Americans believe that climate change is occurring. However, this poll came on the heels of a summer that saw record-breaking temperatures, regional droughts, widespread hurricanes, and increased prominence of the subject due to presidential debates (Gardner, 2011). Essentially, the public's perception of climate change is susceptible to both the presence of climate change-derived weather conditions and issues brought to prominence through social means.

Despite a well-developed scientific consensus that supports both climate change and its anthropogenic causes, there is still some level of disbelief among the general public, which compromises society's ability to make the changes necessary in order to avert further environmental damage. There is a need to accurately inform the public about the true causes and effects of climate change. Given the general lack of public consensus

on this issue, it is clear that this message has not been delivered in a manner that has overwhelmingly altered the public's opinion on the issue or their subsequent behaviors.

Dual-Process Models

Dual process models such as the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986a; 1986b) and the Heuristic-Systematic Model (Chaiken, 1980; 1987; Chaiken, Liberman, & Eagly, 1989) have been shown to be effective in determining the conditions under which persuasion takes place. These dual-process approaches have been widely utilized in the development of persuasive messages. The Elaboration Likelihood Model is probably the most well-established and widely utilized dual process model (see Figure 9). The development of the Elaboration Likelihood Model integrated into one cohesive model what were previously treated as two individual models of persuasion (Petty & Cacioppo, 1986a; 1986b). Rather than operating under the assumption that, for example, a credible source would increase attitude change regardless, it was now postulated that there were variables, such as message involvement and argument quality, which may alter the effectiveness of a credible source. In general, the development of the ELM generated an interconnected and generalizable model by which to construct and evaluate persuasive communications.

The Elaboration Likelihood Model was developed with the intended purpose of identifying which variables are influential in particular persuasive communications and, if variables are influential, when those will become salient within the attitude change process (Petty & Cacioppo, 1986b). The change proposed in the ELM is accomplished through a dual-process strategy, which is made up of the central route and the peripheral

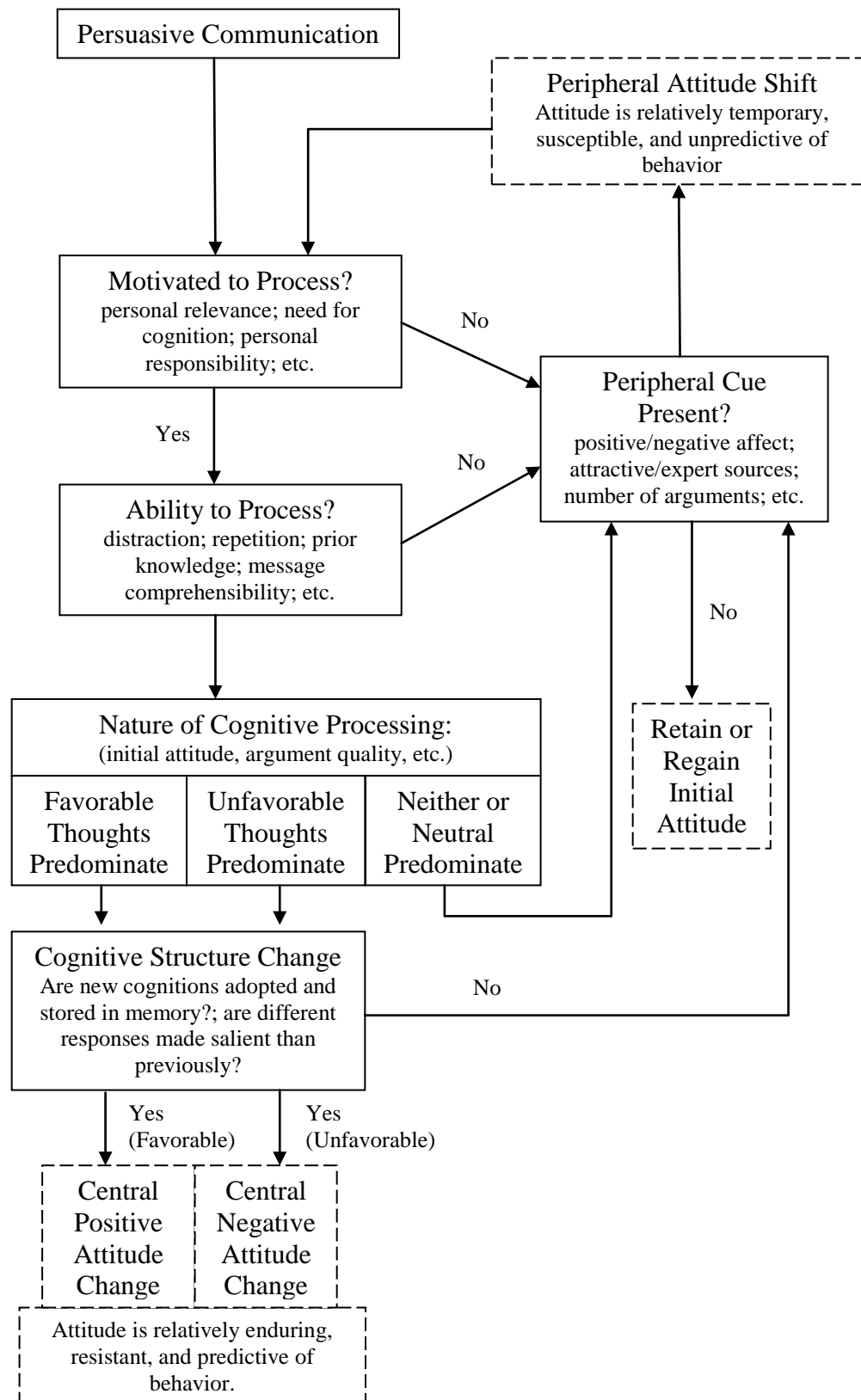


Figure 9: The Elaboration Likelihood Model (Petty & Cacioppo, 1986a; 1986b)

route. The primary aspect that differentiates the central route from the peripheral route is the amount of elaboration, or cognitive processing, undertaken by the viewer. In spite of this model focusing on two routes to persuasion, it is important to note that it is feasible for aspects from both routes to influence a viewer towards an attitude change (Petty et al., 1987).

It is first necessary to outline the circumstances under which the viewer of a message will come to proceed through either the central or the peripheral route. A viewer may proceed through either route based upon an elaboration continuum (Petty & Wegener, 1998). Within this model, several terms are used to explain the relationships that occur, including elaboration, motivation, and ability. *Elaboration* is defined as “the extent to which a person scrutinizes the issue-relevant arguments contained in the persuasive communication” (Petty & Cacioppo, 1986a, p. 7). This elaboration continuum consists of a viewer’s motivation and ability to attend to a persuasive message.

Motivation refers to the viewer’s “conscious intentions or goals” regarding the message such as its personal relevance to the viewer (Petty & Cacioppo, 1986a, p. 8). *Ability* refers to the understandability of the message and may be influenced by factors such as a viewer’s prior knowledge of the message content or the presence of a distraction. High motivation and ability to attend to a message will lead to a higher “elaboration likelihood” (Petty & Cacioppo, 1986a, p. 7). Consequently, a high level of elaboration likelihood is expected to lead a viewer through the central route, while a low level should lead the viewer through the peripheral route. Based upon varying levels of motivation and ability, the elaboration continuum can range from no elaboration to high elaboration (Petty & Cacioppo, 1986a).

Procession through the central route is characterized by a high level of cognitive effort. The viewer will typically attempt to elaborate upon the arguments or information contained within the message by scrutinizing the cogency of any assertions (Petty & Cacioppo, 1986b). As the viewer progresses through the central route, they are elaborating upon the message that is presented and how the arguments interact with their already existing attitudes. If the viewer determines that the arguments are cogent, then an attitudinal change takes place. This change may take place as the result of persuasive messages that are attempting to influence either positive or negative attitude changes.

Procession through the peripheral route is characterized by a lower level of cognitive effort. Via this route, the viewer will defer to a peripheral cue. Peripheral cues are stimuli external to any message argument or information and do not require excessive cognitive effort (Petty & Cacioppo, 1986a). Peripheral cues may include affect, source credibility, number of arguments present in the message, or attractiveness of the communicator. Rather than processing the arguments in the persuasive message, the viewer will determine, based on the peripheral cue, if an attitude is acquired. If the peripheral cue is salient to the viewer, there is greater potential that they will acquire the proposed attitude.

The research that formed the basis for the ELM was primarily carried out in a laboratory setting and utilized a hypothetical scenario from which to determine persuasion and attitudes (Petty & Cacioppo, 1986a; 1986b; Petty, Cacioppo, & Goldman, 1981). Early on, the researchers who outlined the postulates of the ELM provided a caveat:

In the “real world,” there are often constraints on the topics, arguments, and settings that can be employed. For example, the intended audience may be able to

counter-argue the only arguments available; or, the arguments may be compelling, but too complex to be understood fully by the audience. In many cases, the problem in inducing attitude change via the central route is even more basic – just motivating people to attend to and think about the message presented. (Petty & Cacioppo, 1986a, p. 23)

Essentially, this approach to persuasive messages may be less than effective when applied in nonlaboratory settings. This may be especially apparent in applying persuasive messaging through the ELM to climate change.

A search of literature utilizing the phrases Elaboration Likelihood Model and climate change yielded only two articles that specifically applied the model to this subject (Meijnders & Midden, 2001; Meijnders, Midden, & Wilke, 2001). Both of these articles tested fear as an influential aspect of the ELM. The authors exposed participants to different fear-based climate change messages in an attempt to elicit a response that would influence attitude towards an object (an energy-efficient light bulb) and intention to purchase that object due to the fact that it would help to mitigate the effects of climate change.

The first study found that negative emotion was useful in eliciting cognitive processing. In addition, stronger messages were more effective at influencing attitudes and intentions after message exposure and at a delayed measure. This study also investigated the influence of environmental concern, but found no significant results (Meijnders, Midden, & Wilke, 2001). The second study found that fear resulted in a more positive attitude towards the energy-saving bulbs (Meijnders & Midden, 2001). Both of these studies yielded results that confirm many of the facets that make up the ELM. However, similarly to the concerns expressed by the researchers responsible for the development of the ELM, these researchers also acknowledged that there are inherent

difficulties with studies carried out in a laboratory setting (Mejinders, Midden, & Wilke, 2001).

There are numerous variables and extenuating circumstances that surround application of this model both in a nonlaboratory setting and dealing with a real-world subject (Petty & Cacioppo, 1986a). Rather than determining changes in general belief or attitude about climate change, these previous studies looked at attitude towards a singular object that can mitigate climate change and intention to use that object. Therefore, the purpose of this study was to develop and test persuasive messages about climate change through the criteria outlined in the Elaboration Likelihood Model.

Methods

Participants

Participants were a convenience sample of undergraduate students at the University of Utah in Salt Lake City, Utah. Numerous samples were acquired in order to carry out the multiple phases of testing required for this study. To help contribute to a broader sample of participants, students from general education classes were surveyed to ensure that neither scientific nor nonscientific majors were disproportionately represented as level of scientific knowledge may have skewed the results.

Procedures

The purpose of this study was to develop the strong and weak versions of the persuasive message necessary for proper application of the Elaboration Likelihood Model (ELM). Data were collected during the summer and fall of 2011. All aspects of this study

were applied using previously outlined protocols (Petty & Cacioppo, 1986a). This study was divided into the following phases: (1) Argument development and testing; (2) Message development and testing of intended outcomes; and (3) Testing of message parallelism.

Consistent with previously outlined protocols (Petty & Cacioppo, 1986a), the message development process began with collection of message arguments. Potential strong arguments supporting climate change and its effects were developed utilizing the evidence in the IPCC (2007) report. Each argument contained one distinct case in support of climate change. Arguments were developed and tested individually to determine if certain arguments were more or less effective in creating holistic strong and weak messages. Seven strong arguments were developed that indicate the effects of human-caused climate change and seven parallel weak arguments were derived from the strong arguments (see Table 12).

These seven pairs of arguments were submitted for further testing to determine their usefulness for the broader study. Arguments were first tested individually for strength. Survey respondents were asked “Does this message make a weak or strong case for the existence of climate change?” and were asked to rate each argument on a scale ranging from “Extremely Weak” (1) to “Extremely Strong” (7).

The criteria set forth by the researcher required that the mean score of the strong arguments fall above the neutral score on the scale, the mean score of the weak arguments fall below the neutral score on the scale, and that these two means differ

Table 12: Parallel strong and weak climate change arguments.

Strong Arguments	Weak Arguments
<p>Global temperature increases Eleven of the last twelve years rank among the twelve warmest years since recording of temperatures began in 1850.</p>	<p>Global temperature increases Over the course of the last twelve years sales of fans are at their highest levels since tracking of these sales began in the late 1800s.</p>
<p>Melting Arctic ice Satellite data since 1978 show a decrease in sea ice of 2.7% per decade, which is equivalent to an area twice the size of Texas.</p>	<p>Melting Arctic ice Alaska fishermen have noticed a decrease in the number of days they have been able to ice fish since 1978.</p>
<p>Rising sea levels Global average sea level has risen at an average rate of 0.12 inches per year since 1993, totaling a 2.16 inch rise during this period.</p>	<p>Rising sea levels Globally, boat owners have lengthened their anchor lines by 0.12 inches per year since 1993, totaling a 2.16 inch increase during this period.</p>
<p>More extreme weather events As a result of warming temperatures and more energy in the climate system, there has been a significant increase in the strength of tropical cyclones in the North Atlantic.</p>	<p>More extreme weather events As a result of warming temperatures and more energy in the climate system, there are more clouds in the North Atlantic.</p>
<p>More variable precipitation Globally, the areas affected by extreme drought and extreme flooding have increased since the 1970s.</p>	<p>More variable precipitation Globally, some places have received less rain since 1970s.</p>
<p>Decreases in permanently frozen ground Frozen ground in arctic areas has decreased by about 7% since 1900, with decreases in spring of as much as 15%.</p>	<p>Decreases in permanently frozen ground The height of roads in the arctic has decreased since 1900, with even greater decreases in the spring.</p>
<p>Loss of alpine glaciers From 1850 to 2000, nearly 50% of alpine glaciers were lost. These glaciers are now on pace to lose 1% of their surface area every year.</p>	<p>Loss of alpine glaciers From 1850 to 2000, twice as many visitors complained about not being able to observe glaciers. These complaints are on pace to increase each year.</p>

significantly (Petty & Cacioppo, 1986a). Five argument pairs met this criterion and were utilized for the next phase.

After the passing the strength criterion, the five arguments that differed significantly around the strong/weak midpoint were included as part of either the strong or weak message. These messages consisted of a brief introduction and closing outlining the critical nature and evidence of human-caused climate change, and included either all five strong arguments or all five weak arguments.

The strong and weak messages were then tested for their intended outcome. Strong messages are intended to generate favorable thoughts while weak messages are intended to generate unfavorable thoughts (Petty & Cacioppo, 1986a). This was accomplished through the use of a thought-listing technique. Previous thought-listing exercises have utilized the coding specification of polarity, origin, and target (Cacioppo, Harkins, & Petty, 1981; Cacioppo & Petty, 1981). A thought-listing exercise was employed in order to determine the thoughts generated by both the strong and weak messages (Brock, 1967; Greenwald & Albert, 1968). Survey participants were given either a strong or weak message and asked to write down the thoughts they had while reading the message. Participants were then asked to code their thoughts as to how favorable or unfavorable their thoughts were regarding “the existence of climate change.”

The criterion to differentiate between strong and weak messages was a predominant reaction. Predominant was determined to be 70% favorable thoughts for the strong message and 70% unfavorable thoughts for the weak message.

The third and final phase of message development required that the messages be tested for equivalency regarding believability, comprehensibility, complexity, and

familiarity (Petty & Cacioppo, 1986a). The intent is for the strong and weak messages to be equivalent in regards to these four factors so that they are only differentiated regarding strength.

Participants were asked “How believable was this message in making a case for the existence of climate change?” A believable message was defined for the participants as one that is reasonable or plausible, while an unbelievable message was defined as one that is doubtful or far-fetched. Participants were able to respond on a scale ranging from Extremely Unbelievable (1) to Extremely Believable (7). In regards to comprehensibility, complexity and familiarity, participants were asked to what extent they agreed with the following statements: The message was easy to understand; the message had a complex structure; and I am familiar with the message content. Participants scored these statements on a scale ranging from Strongly Disagree (1) to Strongly Agree (7). The criteria for these tests were that there should be no significant difference between the mean scores on the strong message and the mean scores on the weak message (Petty & Cacioppo, 1986a).

Results

Argument Development and Testing

Forty-six respondents participated in Phase 1, yielding 23 responses for the strong and weak arguments, respectively. The data were analyzed using an independent samples *t*-test, which yielded four argument pairs that differed significantly.

In order to provide a more extensive number of arguments for the broader study, argument revisions for the three argument pairs that were not significantly different were

instituted. The arguments were then reevaluated. After argument revisions, an additional sample of participants ($N = 66$) evaluated the strong and weak messages with groups of 33 for the strong and weak arguments, respectively. As a result of this round of surveying, one additional argument pair differed significantly and was added to the pool of arguments that met the strength criterion (see Table 13).

Message Development and Testing of Intended Outcomes

Results of Phase 2, message development, did not meet the criterion over the course of four trials (see Table 14).

In addition, researcher scoring of these thoughts yielded no results that would

Table 13: Argument Strength Scores

Argument	Strength	<i>N</i>	Mean	Standard Error	Sig (2-tailed)
Global Temperature Increases	Strong	23	4.78	.226	$p < .001$
	Weak	23	3.04	.311	
Melting Arctic Ice	Strong	23	4.91	.313	$p = .025$
	Weak	23	3.91	.294	
Rising Sea Levels	Strong	23	4.91	.287	$p = .007$
	Weak	23	3.61	.365	
More Variable Precipitation	Strong	23	4.87	.283	$p < .001$
	Weak	23	3.22	.295	
Loss of Alpine Glaciers	Strong	33	4.15	.199	$p = .002$
	Weak	33	3.29	.180	

Table 14: Message Intended Outcomes

Trial	Message	<i>N</i>	% Favorable	% Unfavorable
1	Strong	46	50.0	30.4
	Weak	41	46.3	41.5
2	Strong	27	44.4	25.9
	Weak	27	40.7	37.0
3	Strong	23	60.9	26.1
	Weak	24	45.8	25.0
4	Strong	17	64.7	5.9
	Weak	16	18.8	50.0

have necessitated independent coding of the thought-listing exercise and, consequently, this strategy was not employed.

Testing of Message Parallelism

An independent samples *t*-test revealed no significant differences between the strong and weak messages on the criteria of comprehensibility ($p = .131$), complexity ($p = .799$), and familiarity ($p = .246$). However, this test yielded a significant difference in the believability of these messages, indicating that these messages were not parallel in nature ($p = .010$; see Table 15).

Discussion

The purpose of this study was to develop and test persuasive messages about climate change through the criteria outlined in the Elaboration Likelihood Model. Due to the failure of the strong and weak messages to meet the intended outcomes criterion and the equivalent believability criterion, it was determined that these parallel messages could not be utilized in order to accurately test the Elaboration Likelihood Model. As stated previously in the development of the ELM, real-world applications of this model may present some confounding difficulties (Mejinders, Midden, & Wilke, 2001; Petty & Cacioppo, 1986a).

Table 15: Testing of Message Parallelism

Message	<i>N</i>	Mean	Standard Error	Sig (2-tailed)
<i>Believability</i>				
Strong	13	5.92	.239	<i>p</i> = .010
Weak	13	4.54	.433	
<i>Comprehensibility</i>				
Strong	13	6.08	.309	<i>p</i> = .131
Weak	13	5.31	.382	
<i>Complexity</i>				
Strong	13	3.00	.339	<i>p</i> = .799
Weak	13	3.15	.492	
<i>Familiarity</i>				
Strong	13	6.00	.196	<i>p</i> = .246
Weak	13	5.54	.332	

The line of research, on which much of the Elaboration Likelihood Model was based, utilized the subject of senior-level comprehensive exams (Petty & Cacioppo, 1986a; 1986b). Participants were given both strong and weak arguments as to why the implementation of comprehensive exams would be beneficial for students and the university. The concept of comprehensive exams, being a new subject for these students, essentially created a clean slate in which persuasive processes and subsequent attitudes can be assessed. However, given a nonlaboratory setting and a message subject (e.g., climate change) about which participants may have preexisting attitudes, there are numerous difficulties that may make real-world application of the ELM quite difficult.

The first difficulty proposed is the strength of existing attitudes. When utilizing real-world settings and subjects, there is high likelihood that participants will have previously engaged in thinking regarding the issue presented. There is a higher potential that attitudes are changed under circumstances when an individual is learning about a subject for the first time. Climate change has become a ubiquitous topic in the mainstream media. It is likely that most individuals have engaged in some type of thought as to whether or not they agree with the existence, extent, causes, and effects of climate change. Or, given the polarization that climate change has created, many individuals may simply be deferring to the opinions of their preferred media sources, thus solidifying and justifying their existing attitude.

In addition to the development of attitudes on the subject, there is also the issue of counter-arguments. As beliefs and attitudes become well-developed, so do arguments that rebut information that may be dissonant already existing beliefs and attitudes. The subject of the arguments and messages was made apparent to participants upon beginning the

questionnaire. If the message runs consonant with their preexisting beliefs and attitudes, then these aspects are solidified. Should the message disagree with an individual's beliefs and attitudes, they are more able to recall arguments that would refute the proposed position.

There is also the problem of message fatigue. Given a real-world issue, there is an increased likelihood that an individual has been exposed to that issue on numerous occasions. These repeated exposures have the potential to lead to fatigue regarding the subject. The viewer may be less motivated to cognitively process a message if he or she has already been exposed to the issues contained in the message. There may be legitimate arguments put forth; however, previous exposure may cause the viewer to disregard the message.

In addition, the ability to process a message can also create problems for a viewer. Climate change is a complex issue in which both the causes and effects are often not visible. This necessitates some level of scientific understanding. Although these concepts can be made more accessible to the viewer, it is still highly feasible that some aspects may not be readily understandable to a large segment of the population.

Lastly, utilizing real issues is problematic, in that the message is dealing with information that is true. Attempting to develop real-world, issue arguments that are both strong and weak is a difficult proposition. This problem was made apparent in the significant difference that existed between the strong and weak messages regarding believability. Creating messages that both meet the needs of the ELM and utilizes completely factual information is difficult. Thus, in this pilot study, it was necessary to

use a combination of factual and nonfactual information, which proved problematic as viewers most likely ascertained that the weak arguments were fabricated.

Conclusions

The results from this study are highly indicative of the potential problems identified by the developers of the ELM when this model was originally proposed. The research that formed the basis for the ELM was primarily carried out in a laboratory setting and utilized a hypothetical scenario from which to determine persuasion and changes in beliefs, attitudes, and behavioral intention (Petty & Cacioppo, 1986a; 1986b; Petty, Cacioppo, & Goldman, 1981). Early on, the researchers who outlined the postulates of the ELM provided this caveat:

In the “real world,” there are often constraints on the topics, arguments, and settings that can be employed. For example, the intended audience may be able to counter-argue the only arguments available; or, the arguments may be compelling, but too complex to be understood fully by the audience. In many cases, the problem in inducing attitude change via the central route is even more basic – just motivating people to attend to and think about the message presented. (Petty & Cacioppo, 1986a, p. 23)

These results confirm that this approach to persuasive messages may be less than effective when applied to nonlaboratory settings. The lack of message influence makes apparent the difficulties of applying the ELM to persuasive messages about climate change.

Research and Practical Implications

The results of this study further exhibit the difficulty associated applying the ELM in a real-world setting. This finding suggests a greater need for further research

addressing the practical application of the Elaboration Likelihood Model. This model has been shown to be effective in laboratory settings. However, if the ELM does not function in the real-world with the same reliability that it does in a lab, then there is a need to reassess its relevance for future usage.

There is also a need for a more comprehensive approach regarding climate change messaging. It is likely that neither the winter recreation communities or climate scientists alone have the capacity to influence environmental beliefs and behavioral intentions. Additional investigation is necessary regarding which approaches to climate change messaging might be influential in eliciting changes among this segment of the population and the public in general.

Given the previously stated issues, future research should make inroads in the areas of the ELM and climate change messaging. There is a need to determine if the same factors that were effective in the laboratory development and testing of the ELM are also effective in a nonlaboratory setting. This may be most effectively accomplished through a qualitative analysis of the ELM. This approach may serve to identify message components that are effective in a real-world setting. Consequently, there is a need to diligently develop and test messages about climate change for use in the Elaboration Likelihood Model. Perceptions about climate change will continue to fluctuate as people continue to associate current weather conditions with whether or not climate change is or is not happening.

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CHAPTER V

ARTICLE II: THE EFFECTS OF IN-GROUP AND OUT-GROUP PERSUASIVE COMMUNICATIONS ABOUT CLIMATE CHANGE ON THE ENVIRONMENTAL BELIEFS AND BEHAVIORAL INTENTIONS OF WINTER RECREATIONISTS

Abstract

Climate change has become a ubiquitous topic in society today. The majority of the scientific community has concluded that climate change is occurring and that humans are responsible for the acceleration of this phenomenon. However, there is far less consensus among the general public in regards to this issue. Inconsistent precipitation and higher global surface temperatures associated with climate change have the potential to create serious implications for the future of winter recreation. Many of the impacts of climate change are less perceptible to the public in their daily lives. Therefore, it is necessary to address how to more effectively influence beliefs about climate change and the behavioral intentions of individuals who should have a vested interest in preserving climatic conditions that are favorable for winter recreation activities. The use of persuasive messaging has the potential to capitalize on an individual's involvement in

winter recreation activities. For individuals with low levels of involvement, the use of a salient, winter recreation message source may be an effective means of eliciting a response in spite of having a level of expertise less than that of the climate science community. This study examined the impact of socially relevant message sources on influencing the environmental beliefs and behavioral intentions of winter recreationists. Participants were skiers and snowboarders using frontcountry (resort) and backcountry winter recreation sites. A longitudinal, repeated measures design assessed participant environmental beliefs and behavioral intentions in three treatment groups (in-group source - ski resorts, in-group source - ski equipment manufacturers, out-group source - climate scientists) and a control group (no message) while accounting for leisure involvement and social identity. The data yielded no significant interaction effects. Manipulation checks did show higher levels of cognitive processing and source credibility for the climate science message source.

Introduction

Climate Change

Climate change, also known as global warming, refers to the “enhanced greenhouse effect resulting from anthropogenic, or human-caused, emissions of greenhouse gases” (Leiserowitz, 2003, p. 2). A sizeable body of knowledge has been established in an attempt to both legitimize the science of climate change and point toward human behaviors as the major contributor to these changes (Agenda 21, 1992; Brundtland, 1987; Hansen et al., 2008; IPCC, 2007; IUCN/UNEP/WWF, 1991; United Nations, 1972).

The Intergovernmental Panel on Climate Change (IPCC; 2007) concluded that “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level” (IPCC, 2007, p. 30). Regardless of natural planetary systems that may be influencing a minor level of change, there is substantial evidence in these studies to implicate human behavior as a major contributing factor to the acceleration of climate change. A study of scientific consensus regarding climate change found that 97-98% of climate scientists publishing in the field are supporters of anthropogenic climate change (Anderegg, Prall, Harold & Schneider, 2010).

However, there is far less consensus among the general public in regards to climate change and this issue continues to place quite low on the list of public concerns (Gardner, 2011; Leiserowitz, 2003; Leiserowitz, 2005; Leseiowitz et al., 2011; Newport, 2010). Only recently has climate change become the top environmental concern for Americans, up from being the sixth most important concern in 2003 (Ansolabehere & Herzog, 2006). One public opinion poll found that 40% of Americans believe there is a lot of disagreement among scientists and only 39% believe that most climate scientists think climate change is happening (Leseiowitz et al., 2011). Another poll shows that only 50% of Americans believe climate change is caused by human activities as compared with 46% of the population that believe it is caused by natural systems (Newport, 2010). A more recent poll found that approximately 83% of Americans believe that climate change is occurring. However, this poll came on the heels of a summer that saw record-breaking temperatures, regional droughts, widespread hurricanes, and increased prominence of the subject due to presidential debates (Gardner, 2011).

Despite a well-developed consensus that supports both climate change and its anthropogenic causes, there is still some level of disbelief among the general public. This disbelief compromises society's ability to make the changes necessary in order to avert further environmental damage. In disseminating information about climate change, it is critical to be aware of the fact that there is no one single approach that will be overwhelmingly effective for all of the population. This realization necessitates that messages about climate change be tailored to specific segments of the population.

Inconsistent precipitation and higher global surface temperatures associated with climate change have the potential to create serious implications for the future of winter recreation. Past climate observations, coupled with models of potential climate scenarios, all point towards decreases that may seriously threaten winter recreation within the next century.

There is an overall downward trend in global snow and ice cover. One study "ranks 2007 as having the third least extensive [snow] cover on record" (State of the Climate, 2007, p. S22). The fourth lowest snow cover on record was recorded in 2008 (Peterson & Baringer, 2008). In 2010, there was a high level of northern hemisphere snow cover. However, rapid warming led to melting of snow from December to May that was the largest observed in more than 40 years (Blunden, Arndt, & Baringer, 2010).

In addition to losses of snow cover, dramatic glacial changes are being observed the world over. In the European Alps, glaciers lost approximately 35% of their surface areas from 1850 through the 1970s. This loss increased to nearly 50% by the year 2000 and these glaciers are currently on pace to lose 1% of their surface area annually (Zemp, Haeberli, Hoelzle, & Paul, 2006).

The loss of snow and glaciers are already beginning to negatively influence the winter recreation industry. In 2006, 47 ski resorts in the European Alps did not open because of nonexistent or unreliable snow conditions (Schendler, 2007). In spite of what has been observed all over the world, there are even more negative implications for winter recreation on the horizon.

Climate models are simplified representations of natural processes and have been used to determine what climatic conditions might look like in a warming world. A model of ski resorts in the northeastern United States, found that without advances in snowmaking, only four resorts would be economically viable in the period 2070-2099 (Scott, Dawson, & Jones, 2006). The State of the Rockies Report Card (Zimmerman, O'Brady, & Hurlbutt, 2006) concludes that, if carbon dioxide emissions continue at their current trajectory, there will be an average of 50% loss in snowpack in the Rocky Mountain West and more sporadic precipitation patterns. All of these data and models point towards a threat to winter recreation. Climate change has the potential to be a motivating factor in creating change among winter recreation participants; however, there are difficulties associated with conveying this message to those outside of the scientific community.

Many of the indicators and impacts of climate change (e.g., CO₂ levels, longitudinal temperature increases, spring snowmelt times, and rising ocean levels) are less perceptible to the public in their daily lives. Individuals may be too distant from the direct or dramatic influences of climate change leading to low personal importance. Therefore, there is a need to determine how to make these impacts both proximal and relevant to individuals.

Recently, a call was issued for scientists to become more proficient and vociferous in the communication of scientific concepts as a means of bridging the gap between scientific knowledge and public understanding (Hassol, 2008; Miller et al., 2009). Because of their comprehensive knowledge of climate change, scientists should be the most obvious communicator of messages about climate change. In spite of a higher level of expertise on the subject, the scientific community's lower level social relevance to the general public may diminish its standing as the most effective climate change messenger. As a result, it is necessary to create a connection between climate change and some type of personally relevant factor in order to elicit social change. Thus, the ramifications of climate change should be prominent for those individuals who choose to engage in winter recreation activities (Behringer, Buerki, & Fuhrer, 2000).

Despite a well-developed body of research and scientific consensus regarding the existence of anthropogenic climate change, CO₂ concentrations have continued to rise annually since 1959 (Tans, 2010). This finding indicates that society has yet to find any compelling reasons to alter their beliefs about climate change or the behaviors that may mitigate the effects. Therefore, it is necessary to address how to more effectively influence beliefs about climate change and the behavioral intentions of individuals who should have a vested interest in preserving climatic conditions that are favorable for winter recreation activities.

Environmental Belief

A belief is “the subjective probability of a relation between the object of the belief and some other object, value, concept, or attribute” (Fishbein & Ajzen, 1975, p. 131). An environmental belief can be surmised to be the subjective probability of a relationship between an aspect of the environment and some other object, value, concept, or attribute. In drawing from the Theory of Reasoned Action, beliefs form the foundation for attitudes and, therefore, influencing environmental beliefs has the potential to be a starting point that influences environmental attitudes, behavioral intentions, and subsequent environmental behaviors (Fishbein & Ajzen, 1975).

There are two ways in which the term "believe in" can be defined (Fishbein & Ajzen, 1975; Sayre, 1997). The first usage of *believe in* focuses directly on the existence of a particular idea or institution. The second usage of *believe in* can mean trust in a particular idea or institution such as philanthropy or capitalism (Sayre, 1997). This difference has also been characterized as "belief in an object" versus "belief about an object" (Fishbein & Ajzen, 1975). In this study, environmental belief is defined as the subjective probability of the existence (attribute) of climate change (object of the belief).

It is likely that individuals who engage in outdoor recreation activities should have some connection to the natural environment. Numerous studies have looked at outdoor recreation and its influence on environmental attitudes and concern, of which environmental belief is an antecedent (Dunlap & Heffernan, 1975; Geisler, Martinson, & Wilkening, 1977; Jackson, 1986; Pinhey & Grimes, 1979; Theodori, Luloff, & Willits, 1998; Van Liere & Noe, 1981). Some studies have determined that strong affinity for an outdoor recreation activity can elicit a commitment to protect the resources necessary to

engage in that activity (Dunlap & Heffernan, 1975; Gale, 1972). This supports the importance of outdoor recreationists in engaging in resource- or area-specific preservation groups and organization (Tarrant & Green, 1999). Engagement in a specific outdoor recreation activity has the potential to be associated with activity-specific environmental beliefs and behavioral intention.

Behavioral Intention

Behavioral intention is “a person's relative strength of intention to perform a behavior” (Fishbein & Ajzen, 1975). It is asserted in the theories of reasoned action (Fishbein & Ajzen, 1975; 1981) and planned behavior (Ajzen, 1985; 1987) that behavior is directly influenced by an individual's intentions to engage in that behavior. These theories have been empirically tested in a multitude of settings with notable success (Ajzen & Fishbein, 1980; Armitage & Connor, 2001; Sheppard, Hartwick, & Warshaw, 1988; Van den Putte, 1991)

There is some amount of research that is supportive of engagement in outdoor recreation activities and environmental behavior (Thapa, Graefe, & Meyer, 2005; 2006). One study found that those engaged in recreational activities were likely to engage in green purchasing practices (Thapa, 2000). In addition, a study of scuba divers found that those participants who had a strong emotional connection to the activity had higher levels of self-reported environmental behaviors (Thapa, Graefe, & Meyer, 2005; 2006). In spite of limited research in this area, these results provide some foundational basis that outdoor recreationists have some increased propensity to engage in environmental behaviors.

However, the process under which environmental beliefs and behavioral intentions can be influenced requires further expansion.

The Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM) was developed with the intended purpose of identifying which variables are influential in persuasive communications and, if variables are influential, when those will become salient within the persuasive process (Petty & Cacioppo, 1986b). The changes in belief and intention, proposed in the ELM, are accomplished through a dual-process strategy, which is made up of a central route and a peripheral route. The primary aspect that differentiates the central route from the peripheral route is the amount of elaboration, or cognitive processing, undertaken by the viewer.

A viewer may proceed through either route based upon an elaboration continuum (Petty & Wegener, 1999). Elaboration is defined as “the extent to which a person scrutinizes the issue-relevant arguments contained in the persuasive communication” (Petty & Cacioppo, 1986a, p. 7). The elaboration continuum consists of the viewer’s motivation and ability to attend to a persuasive message. High motivation and ability to attend to a message will lead to a higher “elaboration likelihood” (Petty & Cacioppo, 1986a, p. 7). Consequently, a high level of elaboration likelihood is expected to lead a viewer through the central route, while a low level should lead the viewer through the peripheral route. Based upon varying levels of motivation and ability, the elaboration continuum can range from no elaboration to high elaboration (Petty & Cacioppo, 1986a).

Procession through the central route is characterized by a high level of cognitive effort. The viewer will typically attempt to elaborate upon the arguments or information contained within the message by scrutinizing the cogency of any assertions (Petty & Cacioppo, 1986b). If the viewer determines that the arguments in the message are cogent, then an attitudinal change takes place.

Procession through the peripheral route is characterized by a lower level of cognitive effort. Via this route, the viewer will defer to a peripheral cue. Peripheral cues are stimuli external to any message argument or information and do not require excessive cognitive effort (Petty & Cacioppo, 1986a). Peripheral cues may include affect, source credibility, number of arguments, or attractiveness of the communicator. If the peripheral cue is salient to the viewer, there is greater potential that he or she will acquire the proposed attitude. The primary difference between attitudes changed by these two routes is that central route attitude changes tend to persist due to engagement in cognitive processing (Petty & Cacioppo, 1986a).

Involvement and the Elaboration Likelihood Model

“Involvement refers to the strength or extent of the cognitive linkage between the self and stimulus object” (p. 399) and has been conceptualized as personal relevance (Kyle et al., 2007). A higher level of involvement between an individual and an issue presented in a persuasive message, the greater likelihood that they will proceed through the central route and engage in cognitive processing (Petty & Cacioppo, 1986a). Consequently, there is a higher likelihood that the persuasive message will lead to a change in environmental belief or behavioral intention.

The same theoretical backgrounds that have guided the usage of involvement in the ELM are also the foundation for the concept of leisure involvement. Involvement, as applied to leisure behavior, was buttressed by Gunter and Gunter (1980) as “the degree and type of the person’s investment in specific activity or situation” (p. 366). Gunter and Gunter’s notion of involvement incorporates three aspects: behavioral involvement (doing), cognitive involvement (knowing or understanding), and affectivity (feeling). Higher levels of the first two factors, coupled with positive affect, will lead to greater engagement and a “psychological fusion” between the person and the activity (Gunter & Gunter, 1980, p. 366).

The Modified Involvement Scale (MIS) utilizes attraction, centrality, social bonding, identity affirmation, and identity expression as the components of involvement (Kyle et al., 2007). The social aspects, which McIntyre and Pigram (1992) found in centrality, have been separated to create the social bonding dimension. In addition, the self expression dimension was divided to create identity affirmation and identity expression. Identity affirmation refers to “the degree to which leisure provides opportunities to affirm the self to the self” and identity expression is “the extent to which leisure provides opportunities to express the self to others” (Kyle et al., 2007, p. 405).

However, the two identity components and the social bonding component that exist within the MIS do not fully elucidate to what extent an individual’s leisure involvement and subsequent message involvement are influenced by relevant social groups. Thus, social identity may serve to be an important factor in motivating cognitive processing through the ELM and eliciting more widespread changes in environmental

belief and behavioral intention.

Social Identity and the Elaboration Likelihood Model.

Social identity is knowledge about the social groups to which the individual belongs and the value and emotional significance attached to their membership in those groups (Tajfel, 1978). Social identity is most concerned with the categorizations that take place within society and how this categorization process leads to certain social groups and associated identities. “Society not only defines but creates psychological reality. The individual realizes himself in society – that is, he recognizes his identity in socially defined terms and those definitions become reality as he lives in society” (Berger, 1966, p. 108). Individuals may belong to numerous social groups that create their social identity. However, depending on the context, certain identities may become more or less important to the individual (Hogg & Abrams, 1988). A social identity may increase in importance, making the group's associated norms, attitudes, or behaviors more prominent.

Much of an individual's existence is the result of his or her belonging to numerous social groups. It is through a process of social comparisons, an “us” versus “them” mentality, that much of society is constructed (Hogg & Abrams, 1988). Within society, groups exist in the presence of other groups and most groups obtain their meaning through comparison. As these categorizations become more focused, the intragroup differences will begin to be minimized and the intergroup differences are maximized (Hogg & McGarty, 1990). These differentiations are typically applied to an

individual's own group in a positive manner and any other group in a negative manner (Tajfel, 1981).

Through the identification and comparison processes, individuals come to identify similar others as in-group and dissimilar others as out-group (Stets & Burke, 2000). In-group individuals have a tendency to anchor their thoughts, attitudes, and behaviors via the fact that these characteristics are consistent with other members of the group, although these perceptions may not always be accurate due to the influence of accentuation, which is the emphasis of same-group similarities (Festinger, 1950). However, the same type of social identification that led a person to this group in the first place can be used to change these characteristics, as individuals are typically influenced by those within their social group.

Among the research reviewed, there was support for the influence of in-groups to more effectively influence cognitive processing (Castano et al., 2002; Clark & Maass, 1988; Mackie, Worth, & Asuncion, 1990). There are currently two competing processes regarding in-group sources and how message viewers with low involvement are influenced (Mackie, Gastardo-Conaco, & Skelly, 1992; Mackie, Worth, & Asuncion, 1990). The first theory proposes that, consistent with the ELM, an in-group reference within a persuasive communication may operate purely as a peripheral cue, which will not lead to cognitive processing, but may elicit some low level of attitude change. The second theory proposes that the existence of an in-group reference may increase personal relevance, lead to cognitive processing, and elicit a higher level of attitude change.

It is postulated that in-group references have a greater level of perceived credibility and an increased potential for eliciting change (Clark & Maass, 1988).

Messages from out-group sources have been less influential than messages from an in-group source, regardless of argument strength (Mackie, Worth, & Asuncion, 1990; Van Knippenberg, Lossie, & Wilke, 1994; Van Knippenberg & Wilke, 1992). The relevance of an in-group message may be increased as a result of the message content and the potential for this content to influence the in-group structure. Regardless of the in-group's actual credibility regarding a subject, it is perceived to be high because of their in-group standing (Clark & Maass, 1988). Thus, a higher credibility message source should lead to increased attention given to that respective message. The in-group is receiving positive biases while any out-groups are receiving negative biases (Mackie et al., 1990; 1992).

In sum, this study aimed to show that, for winter recreationists with low levels of involvement and high levels of social identity, it is feasible that persuasive messages provided by in-group message sources are capable of eliciting cognitive processing to the extent that environmental beliefs and behavioral intentions can be influenced longitudinally. The purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit environmental belief and behavioral intention changes among winter recreationists

Hypotheses

H1: If the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a message (control group).

H1a: Follow-up environmental belief scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

H2: If the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low involvement treatment groups, regardless of message source, compared to the two involvement groups who did not receive a message (control group).

H2a: Follow-up behavioral intention scores will be significantly higher for the high involvement treatment group compared to the low involvement treatment group and to both the low and high involvement participants who did not receive a message (control group).

H3: For those participants with a low level of involvement, if the persuasive message is effective, posttest environmental belief scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity groups who did not receive a message (control group).

H3a: For those participants with a low level of involvement, if the persuasive message is effective, those participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-group message source, low social identity treatment groups, and participants who did not receive a message (control group).

H4: For those participants with a low level of involvement, if the persuasive message is effective, posttest behavioral intention scores will be significantly higher for the high and low social identity treatment groups, regardless of message source, compared to the two social identity groups who did not receive a message (control group).

H4a: For those participants with a low level of involvement, if the persuasive message is effective, participants with a high social identity will have follow-up environmental belief scores significantly higher when exposed to a message from an in-group message source as compared to the scores of the treatment group receiving an out-group message source, low social identity treatment groups, and participants who did not receive a message (control group).

Methods

Population and Setting

Participants in this study were a stratified random sample of skiers and snowboarders utilizing both frontcountry (ski resort) and backcountry (nonski resort) recreational settings in greater Salt Lake City, Utah. Frontcountry sites included two Salt Lake City ski resorts and backcountry sites were four popular access points in Big Cottonwood and Little Cottonwood Canyons, both adjacent to the Salt Lake valley.

Initial contact occurred at the frontcountry and backcountry sites where participants either completed the first questionnaire or were given the opportunity to have the first questionnaire e-mailed to them. Initial contact was made with 676 individuals of

which 523 people completed the first questionnaire, which consisted of 27% women ($N = 140$) and 73% men ($N = 383$).

A total of 262 participants completed all three questionnaires, resulting in a response rate of 39%. Participants completed three questionnaires over the course of this study. Two reminder e-mails were sent to each nonresponder following all three of the questionnaires. The final sample consisted of 28% women ($N = 74$) and 72% men ($N = 188$). The mean age of respondents was 41.52 ($SD = 12.99$). The education ranges of participants were self-reported as the following: Completed high school (0.4%, $N = 1$); Some college (11.5%, $N = 30$); Completed college (42.0%, $N = 110$); Some graduate school (8.0%, $N = 21$); Completed graduate school (37.8%, $N = 99$). One individual (0.4%) did not indicate his or her level of education.

Questionnaires

The pretest questionnaire included measures of environmental belief and behavioral intention, a measure of leisure involvement, and a measure of social identity. Upon completing the questionnaire, participants were grouped based upon their scores on the leisure involvement and social identity measures. Once each week of surveying was completed, a median for both of these measures was calculated for all participants in order to classify each participant into one of the four groups: High identity-high involvement; High identity-low involvement; Low identity-high involvement; and Low identity-low involvement. Within each of these stratified groups, treatment conditions were randomly assigned in order to insure that all treatment/group combinations were adequately represented for later hypothesis testing.

Approximately 1 week after their pretest questionnaire, participants were e-mailed the intervention and the posttest questionnaire through the Zoomerang survey program. The posttest questionnaire contained one persuasive message about climate change, measures of environmental belief and behavioral intention, two measures of cognitive processing, and questions addressing the source's credibility and perceived influence of the source on message processing.

One month following the distribution of the posttest questionnaire, a follow-up e-mail questionnaire obtained a third measure of environmental belief and behavioral intention. This final questionnaire attempted to gauge the persistence of any changes in environmental belief and behavioral intention.

Measurement of *environmental belief* utilized three questions addressing individual's beliefs regarding the existence of climate change, how certain they were that climate change is happening or not happening, and what they believe is causing climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). The first question in this series was "Do you think that climate change is happening?" Participants were then asked how sure they were that climate change was either happening or not happening. Lastly, they were asked whether they believed climate change was occurring as a result of natural processes, human actions, or a combination of these factors. These questions have been utilized in numerous national surveys to gauge individual beliefs regarding the existence and causes of climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). *Behavioral intention* was measured using a 9-item scale developed to determine how likely participants were to engage in specific environmental behaviors that have the capacity to reduce a person's carbon dioxide emissions (Table 16).

Table 16: Measure of Behavioral Intention

Environmental Activism

In the next two months, how likely would you be to take part in a public demonstration against climate change?

In the next two months, how likely would you be to become an active member of an organization attempting to stop climate change?

Nonactivist Behaviors in the Public Sphere

In the next two months, how likely would you be to sign a petition in favor of limiting the emission of carbon dioxide (CO₂)?

In the next two months, how likely would you be to tell a friend about not idling their car?

Private-Sphere Environmentalism

In the next two months, how likely would you be to purchase renewable energy for your home through your local power company?

In the next two months, how likely would you be to use public transportation at least once per week?

In the next two months, how likely would you be to lower your thermostat by two degrees?

In the next two months, how likely would you be to purchase two locally produced food items each week?

Other Environmentally Significant Behaviors

In the next two months, how likely would you be to support an energy reduction program at your school or place of employment?

Items rated on a 7-point Likert scale ranging from Extremely Unlikely (1) to Extremely Likely (7).

The development of this scale utilized the behavioral intention component of the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and Stern's (2000) four categories of environmental behavior: environmental activism; nonactivist behaviors in the public sphere; private-sphere environmentalism; and other environmentally significant behaviors. These items present 9 different environmental behaviors known to have a positive impact in the mitigation of climate change. Respondents evaluated how likely or unlikely they would be to engage in these behaviors over a specified time period. The intent was not to develop a scale of behavioral intention, but only to surmise participant intention to engage in these particular behaviors. However, these 9 items had a Cronbach's α of 0.845.

Message source providing the climate change message operated as the treatment variable. The message sources were developed to be inclusive of as many segments of the winter recreation user groups as possible. A persuasive message about climate change was provided using one of three message sources. The in-group, ski resort source cue was as follows:

The following important message about climate change is brought to you by
The American Ski Resort Community

The in-group, ski equipment manufacturer source cue was as follows:

The following important message about climate change is brought to you by
The American Ski Equipment Manufacturing Community

The out-group, climate science source cue was as follows:

The following important message about climate change is brought to you by
The American Climate Science Community

Measure of *leisure involvement* utilized the Modified Involvement Scale (MIS; Kyle et al., 2007). The MIS is a 15-item scale that addresses the factors of attraction,

centrality, social bonding, identity affirmation, and identity expression. Respondents evaluated each statement on a 7-point Likert scale from “Strongly Disagree” to “Strongly Agree”. In past research utilizing this scale, all five components of the MIS have produced Cronbach α scores above 0.70 (Kyle et al., 2007). In this study, the MIS had a Cronbach's α of 0.894.

Social identity was assessed using a 10-item group identification scale to measure the participant's level of in-group identification (Brown et al., 1986). This scale accounts for awareness of group membership, evaluation, and affect, which are the three facets included within the concept of social identity. Participants responded to statements on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. This group identification scale has been widely utilized and has been one of the most reliable group identification scales. An initial Cronbach's α of 0.71 was found by Brown et al. (1986) with more recent studies ranging from an α of 0.72 to 0.88 (Dono, 2010; Jackson & Smith, 1999). In this study, the social identity had a Cronbach's α of 0.867.

Cognitive processing was measured through two means. The first measure of cognitive processing involved a thought-listing exercise (Brock, 1967; Greenwald, 1968). Participants were asked to write down three thoughts they had while reading the message. After writing each thought, the participants rated to what extent their thought agrees or disagrees with the message he or she previously read. This was evaluated on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”.

The second measure of *cognitive processing* was an explicit measure about the level of cognitive effort in which the participant engaged. The following statements were presented: “I was trying hard to evaluate the message?” and “I put a great deal of effort

into evaluating the message?” (Petty & Cacioppo, 1986a). Both of these were evaluated on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. Similar questions have been found to have a strong correlation ($p > 0.80$; Petty & Cacioppo, 1986a). In this study, these two factors had a Cronbach's α of 0.747.

Source credibility was measured to assess Hovland, Janis, and Kelly's (1953) factors of source expertise and source trustworthiness. A modified version of Ohanian's (1990) scale was utilized. Respondents evaluated the statements on a 10-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”. This scale contained 10 items measuring expertise and trustworthiness. The original scale also included attractiveness with a construct reliability for all three items of $\alpha > 0.88$ (Ohanian, 1990). In this study, the source credibility scale had a Cronbach's α of 0.970.

Source influence was also measured to determine the effectiveness of the source in eliciting either peripheral route effects or central route effects. To determine if the message source was operating as a motivator of cognitive processing or acting as a peripheral cue, a question asked the participants to respond regarding how much the message source influenced their thinking about the message. This question was, “The message source motivated me to think more about the message as whole.” This was ranked by the participant on a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree”.

In addition to the above scales, demographic information included age, level of education, salary, and primary location of residence.

Data Analysis

Testing of statistical hypotheses was conducted using a repeated measures ANOVA while accounting for treatment (treatment, control), message source (in-group ski resort, in-group equipment manufacturers, out-group climate scientists), involvement and identity. *T*-tests were used to determine differences in cognitive processing, source expertise, and source influence.

Although the social identity and involvement measures were highly correlated ($r = .452, p < .001$), each was analyzed separately so that researchers interested in each scale could compare their research to the present study. In order to maximize differences due to these individual difference measures, the middle third of each distribution was removed for both measures, leaving only extreme groups, comprising 30% at the upper and lower ends of the distributions. Hypotheses 1, 1a, 2, and 2a were tested with an interaction among treatment, involvement, and time that asked whether the treatment group changed more than the control group. Hypotheses 3, 3a, 4, and 4a were tested with interactions among treatment, social identity, and time that tested whether one group changed more than the other in response to certain message sources.

Results

Manipulations Checks

T-tests and univariate ANOVAs were used to determine statistical differences among manipulations. Cognitive processing, source credibility, and source influence were all assessed.

Two measures were utilized to evaluate the cognitive processing of participants who received treatment messages. The first measure was the average of the three self-reported scores assigned to each of the three thoughts in the thought listing exercise. The second measure was the sum of two questions about the extent to which each participant thought about the arguments within their treatment message.

For the thought listing exercise, and among those within the 30% high and low tails, participants with high levels of involvement ($M = 5.29$, $SD = 1.35$, $N = 60$) engaged in no greater level of cognitive processing as compared to participants with low levels of involvement ($M = 5.18$, $SD = 1.16$, $N = 54$), $p = .68$. Participants with high levels of social identity ($M = 5.47$, $SD = 1.34$, $N = 62$) engaged in a significantly greater level of cognitive processing as compared to participants with low levels of social identity ($M = 4.86$, $SD = 1.24$, $N = 45$), $p = .01$. Among all participants who completed all three surveys, there were no significant differences between levels of cognitive processing related to the source of the message: In-Group - Resort ($M = 5.11$, $SD = 1.33$); In-Group - Equipment Manufacturers ($M = 5.02$, $SD = 1.46$), and Out-Group - Climate Scientists ($M = 5.07$, $SD = 1.39$), $F(2, 162) = .05$, $p = .95$, $MSE = 1.95$, partial $\eta^2 = .00$.

For the self-reported cognitive processing questions, participants with high levels of involvement ($M = 8.51$, $SD = 3.02$, $n = 70$) engaged in no greater level of cognitive processing as compared to participant with low levels of involvement ($M = 8.57$, $SD = 3.04$, $N = 65$), $p = .92$. Participants with high levels of social identity ($M = 8.22$, $SD = 2.89$, $N = 67$) engaged in no greater level of cognitive processing as compared to participants with low levels of social identity ($M = 8.91$, $SD = 3.05$, $N = 57$), $p = .20$. Among all participants who completed all three questionnaires, a marginally significant

difference between levels of cognitive processing related to the source of the message tended to favor climate scientists: In-Group - Resort ($M = 8.55, SD = 2.60$); In-Group - Equipment Manufacturers ($M = 7.87, SD = 3.02$), and Out-Group - Climate Scientists ($M = 9.00, SD = 2.88$), $F(2, 193) = 2.69, p = .07$, $MSE = 21.69$, partial $\eta^2 = .03$.

The measure of source credibility consisted of 10 questions and accounted for the factors of source expertise and source trustworthiness. Among participants who completed all three questionnaires, a marginally significant difference between perceptions of source credibility among treatment groups tended to favor climate scientists: In-Group - Resort ($M = 4.17, SD = 1.19$); In-Group - Equipment Manufacturers ($M = 4.31, SD = 1.07$), and Out-Group - Climate Scientists ($M = 4.66, SD = 1.44$), $F(2, 194) = 2.72, p = .07$, $MSE = 419.05$, partial $\eta^2 = .03$.

Source influence was measured to determine the effectiveness of the source in eliciting either peripheral route effects or central route effects. Among participants who completed all three questionnaires, there was no significant difference between perceptions of source influence among treatment groups: In-Group - Resort ($M = 4.46, SD = 1.64$); In-Group - Equipment Manufacturers ($M = 4.48, SD = 1.62$), and Out-Group - Climate Scientists ($M = 4.65, SD = 1.53$), $F(2, 194) = .27, p = .77$, $MSE = .68$, partial $\eta^2 = .00$.

Hypothesis Testing

Environmental belief was composed of two aspects addressing the participant's beliefs regarding how sure they are that climate change is or is not happening, and the role of human influence in causing climate change (Leiserowitz, Maibach, Roser-Renouf,

& Smith, 2011). The behavioral intention scale measured how likely participants were to engage in 9 specific environmental behaviors that are capable of mitigating the effects of climate change. A third variable, a 3-point scale asking whether participants believed in the existence of climate change, was omitted because it had zero variance in several cells, violating the ANOVA assumption of homogeneity of variance. This was not considered to be a significant loss, as the second belief measure used a 7-point scale that captured this issue more effectively than the simpler 3-point scale. Tables 17, 18, and 19 show means for pretest, posttest, and follow-up measures. The dependent measures were analyzed in separate Treatment by Involvement by Time and Treatment by Social Identity by Time repeated measures ANOVAs. Bonferroni adjustments to protect the Type I error rate yielded an alpha criterion of .017 for significance.

Hypotheses 1 and 2 proposed that reading a climate change message would increase participants' two beliefs about climate change and would increase their intentions to engage in environmental behaviors. There is no evidence that reading the climate change message influenced participants' environmental beliefs and behavioral

Table 17: Means of how sure participants are that climate change is or is not happening. (1 item: 1 = Extremely sure climate change is not happening; 7 = Extremely sure climate change is happening)

	<i>N</i>	Time1		Time 2		Time 3	
		Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Involvement							
High	91	5.90	1.44	6.12	1.15	5.80	1.62
Low	92	5.63	1.69	5.91	1.23	5.78	1.42
Social Identity							
High	86	5.65	1.65	6.14	1.16	5.92	1.51
Low	84	5.73	1.62	5.86	1.25	5.77	1.37
Total	262	5.69	1.59	6.03	1.13	5.80	1.42

Table 18: Participant perceived causes of climate change (1 item: 1 = Climate change is not happening; 4 = Climate change is mostly caused by humans)

	<i>N</i>	Time 1		Time 2		Time 3	
		Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Involvement							
High	91	3.26	0.55	3.25	0.53	3.21	0.53
Low	92	3.34	0.63	3.29	0.60	3.26	0.63
Social Identity							
High	85	3.28	0.57	3.27	0.50	3.24	0.50
Low	82	3.27	0.63	3.21	0.68	3.26	0.58
Total	262	3.28	0.60	3.26	0.59	3.25	0.57

Table 19: Participant behavioral intention (9 items: 1 = Extremely unlikely to engage in this behavior; 7 = Extremely likely to engage in this behavior)

	<i>N</i>	Time 1		Time 2		Time 3	
		Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Involvement							
High	92	44.29	9.55	45.25	9.84	44.92	10.07
Low	92	41.87	10.45	41.43	10.03	41.24	10.28
Social Identity							
High	86	44.66	9.29	44.92	8.85	44.59	9.23
Low	84	40.40	10.49	40.48	11.05	39.65	11.13
Total	262	43.00	9.97	43.05	10.06	42.76	10.39

intentions, all treatment by time interaction p 's > .39 (See Tables 20, 21, and 22).

Hypothesis 1a and 2a asked whether participants with a higher level of involvement in winter recreation would sustain their change more or show a delayed effect of the climate change message regarding their environmental beliefs and behavioral intentions. These hypotheses proposed an interaction effect between time, involvement, and treatment and that the high involvement-message group would change more than any of the other groups. As shown, these hypotheses were not supported in any

Table 20: Three-way interaction of time, involvement, and treatment on strength of belief in climate change (1 item: 1 = Extremely sure climate change is not happening; 7 = Extremely sure climate change is happening)

Involvement		Time 1	Time 2	Time 3	Mean
Low	Control (<i>N</i> = 27)	5.63 (1.62)	5.74 (1.38)	5.48 (1.74)	5.62 (1.58)
	Treatment (<i>N</i> = 65)	5.63 (1.73)	5.98 (1.17)	5.91 (1.26)	5.84 (1.39)
High	Control (<i>N</i> = 19)	6.16 (1.01)	6.26 (0.73)	5.47 (1.84)	5.96 (1.19)
	Treatment (<i>N</i> = 72)	5.85 (1.54)	6.08 (1.24)	5.96 (1.46)	5.96 (1.41)
Mean		5.77 (1.57)	6.02 (1.93)	5.82 (1.48)	

Interaction effect of time, involvement, and treatment on strength of belief in climate change $F(1.83, 328.72) = 0.96, p = .96, MSE = .04, \text{partial } \eta^2 = .005$.

*Greenhouse-Geiser correction used for violation of Mauchley's test of sphericity.

of the belief or intention measures, all p 's > .39 (See Tables 20, 21, and 22).

Hypotheses 3 and 4 proposed that participants with a low level of involvement would respond more favorably to treatment message regardless of social identity than participants who received no message. These hypotheses were not supported in any of the environmental belief or behavioral intention measures, all p 's > .39 (Tables 23, 24, and 25).

Hypotheses 3a and 4a asked whether participants with a low level of involvement and a higher level of social identity with winter recreation would sustain their change or show a delayed effect of the climate change message regarding their climate change beliefs and behavioral intention. These hypotheses proposed that the high social identity group in conjunction with an in-group message would change more than any of the other groups. These hypotheses were not supported in any of the belief or intention measures in the overall time by conditions analysis, p 's > .39 (See Tables 23, 24, and 25).

Table 21: Three-way interaction effect of time, involvement, and treatment on perceived causes of climate change (1 item: 1 = Climate change is not happening; 4 = Climate change is mostly caused by humans)

Involvement		Time 1	Time 2	Time 3	Mean
Low	Control (<i>N</i> = 27)	3.33 (0.48)	3.26 (0.45)	3.19 (0.39)	3.26 (0.44)
	Treatment (<i>N</i> = 64)	3.36 (0.68)	3.30 (0.66)	3.29 (0.71)	3.32 (0.68)
High	Control (<i>N</i> = 20)	3.20 (0.52)	3.20 (0.52)	3.20 (0.52)	3.20 (0.52)
	Treatment (<i>N</i> = 67)	3.29 (0.58)	3.27 (0.51)	3.22 (0.52)	3.26 (0.54)
Mean		3.31 (0.59)	3.27 (0.56)	3.24 (0.58)	

Three-way interaction effect of time, involvement, and treatment on perceived causes of climate change $F(2, 348) = .68, p = .58, \text{MSE} = .059, \text{partial } \eta^2 = .004.$

Table 22: Three-way interaction effect of time, involvement, and treatment on behavioral intention (9 items: 1 = Extremely unlikely to engage in this behavior; 7 = Extremely likely to engage in this behavior)

Involvement		Time 1	Time 2	Time 3	Mean
Low	Control (<i>N</i> = 27)	39.56 (9.99)	38.44 (10.13)	37.07 (9.89)	38.36 (10.00)
	Treatment (<i>N</i> = 65)	42.83 (10.57)	42.68 (9.80)	42.97 (10.01)	42.83 (10.13)
High	Control (<i>N</i> = 20)	42.30 (11.99)	42.00 (13.27)	42.50 (11.82)	42.27 (12.36)
	Treatment (<i>N</i> = 72)	44.84 (8.77)	46.15 (8.56)	45.59 (9.52)	45.53 (8.95)
Mean		43.08 (10.06)	43.34 (10.09)	43.08 (10.32)	

Three-way interaction effect of time, involvement, and treatment on behavioral intention $F(2, 360) = 0.94, p = .39, \text{MSE} = 17.30, \text{partial } \eta^2 = .005.$

Table 23: Three-way interaction of time, social identity, and treatment type on strength of belief in climate change (1 item: 1 = Extremely sure climate change is not happening; 7 = Extremely sure climate change is happening)

Social Identity		<i>N</i>	Time 1	Time 2	Time 3	Mean
Low	Control	27	5.74 (1.43)	5.81 (1.42)	5.59 (1.50)	5.71 (1.45)
	In-Group Resort	22	5.41 (2.02)	5.95 (1.21)	5.86 (1.28)	5.74 (1.50)
	In-Group Equipment Manufacturers	19	6.05 (1.08)	6.00 (0.82)	5.79 (1.08)	5.95 (0.99)
	Out-Group Climate Science	16	5.75 (1.88)	5.63 (1.50)	5.94 (1.61)	5.77 (1.66)
High	Control	16	5.13 (1.89)	6.06 (0.99)	5.56 (1.75)	5.58 (1.54)
	In-Group Resort	21	5.67 (1.74)	6.29 (0.72)	6.48 (0.60)	6.15 (1.02)
	In-Group Equipment Manufacturers	28	5.64 (1.45)	5.82 (1.63)	5.93 (1.36)	5.79 (1.48)
	Out-Group Climate Science	21	6.05 (1.63)	6.48 (0.75)	5.62 (2.01)	6.05 (1.46)
Mean			5.69 (1.63)	6.00 (1.21)	5.85 (1.44)	

Three-way interaction of time, social identity, and treatment type on strength of belief in climate change $F(1.81, 458.58) = 1.06, p = .39, MSE = 1.66, \text{partial } \eta^2 = .019$.

*Greenhouse-Geiser correction used for violation of Mauchley's test of sphericity.

Discussion

Environmental Beliefs and Behavioral Intentions

This study aimed to show that, for winter recreationists with low levels of involvement and high levels of social identity, it is feasible that persuasive messages provided by in-group message sources are capable of eliciting cognitive processing to the extent that environmental beliefs and behavioral intentions can be influenced longitudinally. More broadly, this study attempted to determine which aspects of a

Table 24: Three-way interaction effect of time, social identity, and treatment type on causes of climate change (1 item: 1 = Climate change isn't happening; 4 = Climate change is mostly caused by humans)

Social Identity		<i>N</i>	Time 1	Time 2	Time 3	Mean
Low	Control	27	3.26 (0.53)	3.15 (0.46)	3.11 (0.42)	3.17 (0.47)
	In-Group Resort	20	3.35 (0.67)	3.30 (0.80)	3.30 (0.73)	3.32 (0.73)
	In-Group Equipment Manufacturers	13	3.37 (0.59)	3.37 (0.68)	3.37 (0.59)	3.37 (0.62)
	Out-Group Climate Science	14	3.29 (0.61)	3.21 (0.58)	3.36 (0.49)	3.29 (0.56)
High	Control	16	3.25 (0.45)	3.31 (0.48)	3.19 (0.40)	3.25 (0.44)
	In-Group Resort	21	3.33 (0.58)	3.29 (0.46)	3.29 (0.46)	3.30 (0.50)
	In-Group Equipment Manufacturers	27	3.15 (0.66)	3.26 (0.52)	3.22 (0.58)	3.21 (0.59)
	Out-Group Climate Science	19	3.47 (0.51)	3.21 (0.55)	3.26 (0.56)	3.31 (0.54)
Mean			3.30 (0.58)	3.26 (0.56)	3.25 (0.54)	

Three-way interaction effect of time, social identity, and treatment type on causes of climate change $F(2, 310) = .98, p = .44, MSE = .084, \text{partial } \eta^2 = .019.$

persuasive message and which personal characteristics might facilitate changes in environmental beliefs and behavioral intentions.

Our findings demonstrated no significant main effects related to any of the treatment conditions. In addition, there were no significant interaction effects for either treatment and involvement or treatment and social identity. These findings indicate that the message in general may not have been overly effective at eliciting any type of change among participants. Analyzing the treatment against both involvement and identity

Table 25: Three-way interaction effect of time, social identity, and treatment type on behavioral intention (9 items: 1 = Extremely unlikely to engage in this behavior; 7 = Extremely likely to engage in this behavior)

Social Identity		<i>N</i>	Time 1	Time 2	Time 3	Mean
Low	Control	27	37.43 (11.36)	36.70 (11.59)	34.93 (10.72)	36.35 (11.22)
	In-Group Resort	22	42.41 (7.89)	42.86 (9.76)	41.55 (9.99)	42.27 (9.21)
	In-Group Equipment Manufacturers	19	41.47 (9.41)	42.63 (6.92)	42.89 (6.44)	42.33 (7.59)
	Out-Group Climate Science	16	41.38 (12.92)	41.00 (14.58)	41.19 (14.35)	41.19 (13.95)
High	Control	16	42.50 (11.03)	44.19 (10.32)	43.13 (10.31)	43.27 (10.55)
	In-Group Resort	21	46.62 (9.34)	45.86 (8.14)	46.95 (7.89)	46.48 (8.46)
	In-Group Equipment Manufacturers	28	44.14 (10.28)	44.00 (10.08)	43.46 (10.23)	43.87 (10.19)
	Out-Group Climate Science	21	45.02 (6.15)	45.76 (6.79)	44.86 (8.34)	45.21 (7.09)
Mean			42.55 (10.09)	42.72 (10.22)	42.15 (10.48)	

Three-way interaction effect of time, social identity, and treatment type on behavioral intention $F(2, 324) = 1.01$, $p = .42$, $MSE = 18.75$, partial $\eta^2 = .018$.

provided no additional effect, which further refutes the proposed hypotheses. These findings are inconsistent with a study that found an in-group message source to be influential at eliciting changes in environmental attitude, of which belief is an antecedent (Mackie, Worth, & Asuncion, 1990). However, this study did utilize the issue of acid rain, which was less pervasive of an environmental issue as compared with the global problem of climate change. Results from this study do indicate that there is the potential for real-world persuasive messages to be applied successfully. However, there is a need

for more in-depth research and development of persuasive messages about climate change in order for these positive results to be realized.

Manipulation Checks

Manipulation checks provided indicators as to whether or not the treatment messages had the potential to begin eliciting changes in environmental belief and behavioral intention. The most notable finding among the manipulation checks was a higher level of cognitive processing among those with a higher social identity. This finding may be indicative of social identity as an additional factor that facilitates processing and could be included as a motivating factor in the central route of the ELM.

In addition, the manipulation checks indicate that the climate science source was slightly more credible and initiated a slightly higher level of processing in one of the two cognitive processing measures. These findings refute the hypothesized effect of an in-group source as the most effective messenger for those who are highly identified with winter recreation.

Problems Associated with Nonlaboratory Application of the ELM

The results from this study are highly indicative of the potential problems identified by the developers of the ELM when this model was originally proposed. The research that formed the basis for the ELM was primarily carried out in a laboratory setting and utilized a hypothetical scenario from which to determine persuasion and changes in beliefs, attitudes, and behavioral intention (Petty & Cacioppo, 1986a; 1986b;

Petty, Cacioppo, & Goldman, 1981). Early on, the researchers who outlined the postulates of the ELM provided this caveat:

In the “real world,” there are often constraints on the topics, arguments, and settings that can be employed. For example, the intended audience may be able to counter-argue the only arguments available; or, the arguments may be compelling, but too complex to be understood fully by the audience. In many cases, the problem in inducing attitude change via the central route is even more basic – just motivating people to attend to and think about the message presented. (Petty & Cacioppo, 1986a, p. 23)

Essentially, our results confirm that this approach to persuasive messages may be less than effective when applied to real-world settings. The lack of significant changes in environmental belief and behavioral intentions makes apparent the difficulties of applying the ELM to persuasive messages about climate change.

The line of research, on which much of the Elaboration Likelihood Model was based, utilized the subject of senior-level comprehensive exams (Petty & Cacioppo, 1986a; 1986b). Participants were given messages as to why the implementation of comprehensive exams would be beneficial for students and the university. The concept of comprehensive exams, being a new subject for these students, essentially created a clean slate in which persuasive processes, beliefs, attitudes, and behavioral intentions could be assessed. However, given a nonlaboratory setting and a message subject (e.g., climate change) about which participants may have preexisting beliefs and behavioral intentions, there are numerous difficulties that make real-world application of the ELM quite difficult.

The first problem which was apparent from the results was the strength of existing beliefs and behavioral intentions. Utilizing nonlaboratory settings and subjects, there is high likelihood that participants will have previously engaged in thinking regarding the

issue presented. There is a greater potential that beliefs and behavioral intentions are changed when an individual is learning about a subject for the first time. Climate change has become a ubiquitous topic in the mainstream media. It is likely that most individuals have engaged in some type of thought as to whether or not they agree with the existence, extent, causes, and effects of climate change. Or, given the polarization that climate change has created, many individuals may simply be deferring to the opinions of their preferred media sources, thus solidifying and justifying their already existing beliefs and intentions.

In addition, there is the issue of counter-arguments. As beliefs become well-developed so do arguments that rebut information that may be dissonant for already existing beliefs. The subject of the treatment messages was made apparent to participants upon beginning the questionnaire. If this message runs consonant with their preexisting beliefs and behavioral intentions, then these aspects are solidified. Should the message disagree with an individual's beliefs and intentions, ability to recall arguments that would refute the proposed position is increased, making individual change less likely.

There is also the problem of message fatigue. Given a real world subject, there is an increased likelihood that an individual has been exposed to that issue on numerous occasions. These repeated exposures have the potential to lead to fatigue regarding the subject. The viewer may be less motivated to cognitively process a message if they already have exposure to the issues contained in the message. There may be legitimate arguments put forth; however, previous exposure may cause the viewer to disregard the message, again making change more difficult.

The ability to process a message can also create problems for a viewer. Climate change is a complex issue in which both the causes and effects are often not visible. This necessitates some level of scientific understanding. Although these concepts can be made more accessible to the viewer, it is still highly feasible that some aspects may not have been readily understandable to a segment of the population.

Limitations

There were multiple limitations to this study. One limitation was the use of general message sources. Rather than attributing the messages to existing entities, general messaging organizations were utilized in order to provide an entity about which there would have been no conflicting information. Participant internet access while being exposed to treatments would have complicated the message if had been credited to an actual entity with an already existing statement regarding climate change. Usage of sources that were identifiable to participants may have been more influential; however, this approach would have created a confounding variable.

An additional limitation was the number of frontcountry (resort) winter recreationists that were surveyed. Frontcountry winter recreationists made up only 38% of the participants surveyed as compared with 62% backcountry winter recreationists. Frontcountry users were most likely underrepresented in the sample as compared with the broader population of winter recreationists. There is certain to be some differing levels of involvement, social identity, environmental belief, and behavioral intention that are unaccounted for due to this limitation. Additional survey days at frontcountry sites would

have improved this percentage. Surveying was also only completed at two frontcountry sites, which may have provided only a small segment of this general user type.

Another limitation was the longitudinal nature of this study. Those participants who have greater interest in either winter recreation or climate change may have had a higher likelihood of completing all three questionnaires. For the same reason that certain participants stayed in the study, it is also likely that other participants self-selected themselves out of the study due to a lack of interest in the subject. This limitation may have altered the data that were obtained.

Lastly, the use of a behavioral intention measure may not be fully indicative of actual behaviors in which participants are willing to engage. Behavioral intention is a predictor of behavior, but does not guarantee that participants would engage if given the opportunity. There may also have been some level of social desirability that influenced participant responses. However, given the longitudinal nature of this study, this measure was deemed the most practical for this study.

Conclusions and Implications

Essentially, the results of this study further exhibit the difficulty associated with changing beliefs and subsequent behavioral intentions in a real-world setting. This leads to a greater need for future research that addresses the practical application of the Elaboration Likelihood Model. This model has been shown to be effective in laboratory settings. However, if the ELM does not function in the nonlaboratory settings with the same reliability that it does in a lab, then there is a need to reassess its relevance for

future usage. This might best be approached with a qualitative analysis of the ELM in order to more clearly delineate barriers to and facilitators of persuasive change.

There is also a need for a more comprehensive approach regarding climate change messaging. It is likely that neither the winter recreation communities or climate scientists alone have the capacity to influence environmental beliefs and behavioral intentions. Additional investigation is necessary regarding which approaches to climate change messaging might be influential in eliciting changes among this segment of the population and the public in general. Again, a qualitative approach may provide greater understanding as to why individuals do not believe in climate change and which arguments may alter their positions.

Future research in this area should address both the ELM and climate change messaging. In order to advance the real-world effectiveness of the ELM, a qualitative study should be employed to determine which message aspects are most influential at eliciting change. In addition, a study should utilize existing winter recreation entities (resorts, businesses, athletes) as message sources to determine their effect on environmental beliefs and behavioral intentions. Lastly, a study that spanned multiple winters, while accounting for varying amounts of snow, might provide some indication as to how existing winter conditions might influence climate change perceptions among winter recreationists.

From a practical implication perspective, the findings from this study provide some insight as to which aspects can be leveraged in order to facilitate greater cognitive processing. Should the winter recreation industry be compelled to support the climate science community, leveraging social standing among skiers and snowboarders has the

capacity to elicit cognitive processing and elicit broader changes among this segment of the population. This also points towards more widespread influence in other areas of outdoor recreation that are associated with environmental issues and the need to motivate changes in environmental beliefs and behaviors.

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CHAPTER VI

ARTICLE III: A TENUOUS FUTURE: THE SKI INDUSTRY, CLIMATE CHANGE, AND WHAT NEEDS TO BE DONE

The 2011-2012 northern-hemispheric winter proved to be a bust in much of the United States. Many areas of the country saw only a low percentage of their average annual snowfall numbers and many resorts saw greatly diminished visitor numbers as a result. The ensuing summer has brought drought conditions to more than 50% of the United States, causing depletion of water resources and crop failures. Based on these anomalies, it appears as though the global climate may be on track for the more consistent cycle of boom and bust that scientists have predicted.

There is a broader need for understanding and action among all segments of the global community, including those in the winter recreation industry. The effects of climate change are already beginning to disrupt the conditions necessary for skiing and snowboarding. As climate change progresses, leaders in the winter recreation industry have the capacity to influence positive change in order to protect their own livelihood and to affect social change. This article will cover the findings by the climate science community, current and predicted effects of climate change on winter recreation, efforts by the winter recreation industry to mitigate those effects, perceptions of climate change,

and areas for further action by the ski industry.

Climate Conditions

Climate change, also known as global warming, refers to the “enhanced greenhouse effect resulting from anthropogenic, or human-caused, emissions of greenhouse gases.”¹ Scientists have created a sizeable body of knowledge in an attempt to both legitimize climate change and point toward human behaviors as the major contributor to these changes.^{2,3,4,5,6,7}

The United Nations Intergovernmental Panel on Climate Change has compiled one of the most comprehensive studies on the global impacts of climate change. This international group of scientists concluded that “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.” In addition, they outlined a number of warning signs that indicate mounting evidence of recent, human-caused climate change:

¹ Leiserowitz, A. A. (2003). *Global warming in the American mind: The roles of affect, imagery, and worldviews in risk perception, policy preferences and behavior*. Unpublished doctoral dissertation, University of Oregon.

² Agenda 21 (1992). Earth summit – the United Nations plan of action from Rio. Retrieved from <http://www.un.org/esa/dsd/agenda21/>

³ Brundtland Report (1987). Retrieved from www.anped.org/media/brundtland-pdf

⁴ Hansen, J., Sato, M., Pushker, K., Beerling, D., Berner, R., Masson-Delmotte, V., Pagani, M., Raymo, M., Royer, D. L., & Zachos, J. C. (2008). Target atmospheric CO₂: Where should humanity aim? *The Open Atmospheric Science Journal*, 2, 217-231.

⁵ Intergovernmental Panel on Climate Change. (2007). *Climate change 2007: Synthesis report*. Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

⁶ IUCN/UNEP/WWF. (1991). *Caring for the Earth: A Strategy for Sustainable Living*. Retrieved from <http://coombs.anu.edu.au/~vern/caring/caring.html>

⁷ United Nations conference on the human environment: declaration (1972, June). Retrieved from <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503&l=en>

1. “Eleven of the last twelve years (1995-2006) rank among the twelve warmest years in the instrumental record of global surface temperature (since 1850).”
2. “Sea levels rose . . . at an average rate of about 3.1 mm per year from 1993-2003.”
3. “The atmospheric concentrations of CO₂ and CH₄ [compounds believed to be responsible for climate change] in 2005 exceeded by far the natural range over the last 650,000 years.”
4. “Increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers.”
5. “Mountain glaciers and snow cover on average have declined in both hemispheres.”

Regardless of natural planetary systems that may be influencing a minor level of change, there is substantial evidence in the IPCC report to implicate human behavior as the major contributing factor to the acceleration of the climate change process.

Scientific Consensus

In recent years, there has been notable confusion as to whether or not the scientific community has concluded that humans are responsible for the climate change that is occurring. Much of this has been perpetuated by the media who are attempting to provide equal time and coverage to both sides of the climate debate. In spite of what appears to be a 50-50 split on the issue, the scientific community has come to the consensus that climate change is occurring and that humans are responsible.

One study has concluded that 97-98% of climate scientists publishing in the field are supporters of the assertion that humans are causing climate change. Those who are

not supporters have much less scientific expertise and are typically less prominent in the field of climate science.⁸ In spite of what mainstream media might be leading the public to believe, the scientific community has clearly established that their research supports human-caused hypothesis. However, this consensus has not been clearly conveyed outside of these ranks.

Public Perceptions of Climate Change

There is far less consensus among the general public with regards to climate change, and the issue continues to place quite low on the list of public concerns.^{9,10,11,12,13} Only recently has climate change become the top environmental concern for Americans, up from being the sixth most important concern in 2003.¹⁴ One public opinion poll found that 40% of Americans believe there is a lot of disagreement among scientists and only 39% believe that most climate scientists think climate change is happening.¹⁵ Another poll shows that only 50% of Americans believe climate change is caused by human

⁸ Anderegg, W. R., Prall, J. W., Harold, J., & Schneider, S. H. (2010). Expert credibility in climate change. *Proceedings of the National Academy of Sciences of the United States of America*, 107(27), 12107-12109

⁹ Gardner, T. (2011). More Americans believe world is warming: Reuters/Ipsos. Retrieved from <http://www.reuters.com/article/2011/09/15/us-usa-poll-ipsos-idUSTRE78D5B220110915>

¹⁰ Leiserowitz, A. A. (2003). *Global warming in the American mind: The roles of affect, imagery, and worldviews in risk perception, policy preferences and behavior*. Unpublished doctoral dissertation, University of Oregon.

¹¹ Leiserowitz, A. A. (2005). American risk perceptions: Is climate change dangerous? *Risk Analysis*, 25(6), 1433-1442.

¹² Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (2011) *Climate change in the American Mind: Americans' global warming beliefs and attitudes in May 2011*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication.

¹³ Newport, F. (2010, March). Americans' global warming concerns continue to drop. Retrieved from <http://www.gallup.com/poll/126560/americans-global-warming-concerns-continue-drop.aspx#1>

¹⁴ Ansolabehere, S. & Herzog, H. J. (2006). Climate tops Americans' environmental concerns, MIT survey finds. Retrieved from <http://web.mit.edu/mitei/research/spotlights/climate-change.html>

¹⁵ Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (2011) *Climate change in the American Mind: Americans' global warming beliefs and attitudes in May 2011*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication.

activities as compared with 46% of the population that believe it is caused by natural systems.¹⁶ A more recent poll found that approximately 83% of Americans believe that climate change is occurring. However, this poll came on the heels of a summer that saw record-breaking temperatures, regional droughts, widespread hurricanes, and increased prominence of the subject due to presidential debates.¹⁷ Given the extent of the scientific consensus, the general public is far less convinced and also more susceptible to short-term changes of opinion when factors such as immediate weather conditions come into play.

Skier and Snowboarder Perceptions of Climate Change

A study of backcountry and resort skiers and snowboarders in the winter of 2011-2012 yielded results more closely indicative of the opinions stated by the climate science community. This study found that the vast majority of skiers and snowboarders surveyed (93%) believe that climate change is occurring. Skiers and snowboarders who are more highly involved in winter recreation are also more likely to strongly believe that climate change is occurring. Within this sample population, 93% believed that human behaviors are at least partly responsible for these changes. These findings may indicate that the community of skiers and snowboarders are more knowledgeable about the anthropogenic hypothesis and potentially more aware of the effects that are already occurring. However, the observed effects are highly predictive of climate change's damage to the winter recreation industry.

¹⁶ Newport, F. (2010, March). Americans' global warming concerns continue to drop. Retrieved from <http://www.gallup.com/poll/126560/americans-global-warming-concerns-continue-drop.aspx#1>

¹⁷ Gardner, T. (2011). More Americans believe world is warming: Reuters/Ipsos. Retrieved from <http://www.reuters.com/article/2011/09/15/us-usa-poll-ipsos-idUSTRE78D5B220110915>

Recent Trends and the Future of Winter Recreation

Inconsistent precipitation and higher global surface temperatures associated with climate change are likely to disrupt future winter recreation opportunities. Past climate observations, coupled with models of potential climate scenarios, all point towards snowpack decreases that may seriously threaten economic viability of large-scale winter recreation within the next century.

For starters, there is an overall downward trend in global snow and ice cover. One study “ranks 2007 as having the third least extensive [snow] cover on record”.¹⁸ The fourth lowest snow cover on record was recorded in 2008.¹⁹ In 2010, there was a high level of northern hemisphere snow cover. However, rapid warming led to melting of snow from December to May that was the largest observed in more than 40 years.²⁰

In addition to losses of snow cover, dramatic glacial changes are being observed the world over. In the European Alps, glaciers lost approximately 35% of their surface areas from 1850 through the 1970s. This loss increased to nearly 50% by the year 2000 and these glaciers are currently on pace to lose 1% of their surface area annually.²¹

The loss of snow and glaciers are already beginning to negatively influence the winter recreation industry. In 2006, 47 ski resorts in the European Alps did not open because of nonexistent or unreliable snow conditions.²² In spite of what has been

¹⁸ State of the Climate in 2007 (2007). *Bulletin of the American Meteorological Society*, 89(7).

¹⁹ Peterson, T. C., & Baringer, M. O. (Eds.) (2009). State of the climate in 2008. *Bulletin of the American Meteorological Society*, **90**, S1-S196.

²⁰ Blunden, J., Arndt, D. S., & Baringer, M. O. (Eds.) (2011). State of the climate in 2010. *Bulletin of the American Meteorological Society*, **92**(6), S1-S266.

²¹ Zemp, M., Haeberli, W., Hoelzle, M. & Paul, F. (2006). Alpine glaciers to disappear within decades? *Geophysical Research Letters*, 33, 1-4.

²² Schendler, A. (2007, March). *Towards a clean energy future: Energy policy and climate change on public lands*. Aspen Skiing Company’s Testimony to the U.S. House of Representatives Committee on Natural Resources, Subcommittee on Energy and Mineral Resources. Washington, DC.

observed all over the world, there are even more negative implications for winter recreation on the horizon.

Climate models are simplified, yet reliable representations of natural processes and have been used to determine what climatic conditions might look like in a warming world. A model of ski resorts in the United States northeast found that without advances in snowmaking, only four resorts would be economically viable in the period 2070-2099.²³ The State of the Rockies Report Card²⁴ concludes that, if carbon dioxide emissions continue at their current trajectory, there will be an average of 50% loss in snowpack in the Rocky Mountain West and more sporadic precipitation patterns. All of these data and models point towards a threat to winter recreation. Climate change has the potential to be a motivating factor in creating change among winter recreation participants; however, there are difficulties associated with conveying this message to those outside of the scientific community.

Current Ski Industry Activism

In general, there is a need for the ski industry to be proactive in acknowledging the existence of climate change and taking action towards mitigating its effects. Aside from the obvious sustainability of this industry, these mountainous areas also support community water supplies through snowpack. This is not just an opportunity for the ski industry to protect the viability of their industry, but also to protect community resources.

²³ Scott, D., Dawson, J. & Jones, B. (2006). Climate change vulnerability of the US Northeast winter recreation – tourism sector. *Mitigation and Adaptation Strategies for Global Change*, 13(5-6), 577-596.

²⁴ Zimmerman, G. O'Brady, C. & Hurlbutt, B. (2006). *Climate change: Modeling a warmer Rockies and assessing implications*. The 2006 Colorado College State of the Rockies Report Card.

There are a number of resorts who have taken climate change and sustainability on as their mantras. Aspen, Grand Targhee, Alta, and Mt. Abram, among others, should be praised for their efforts in bringing climate change and sustainability to the forefront of the industry. Energy and water conservation, implementation of recycling programs, and development of alternative energy strategies are all critical steps in the right direction. However, there is still a need for a broader segment of the ski industry, including equipment manufacturers, to begin increasing the extent to which they acknowledge climate change and become active in efforts to mitigate its effects.

Areas for Further Action

There is now clear evidence that supports the effects of climate change and the need for immediate and decisive action. Regardless as to why skiers and snowboarders believe in climate change, there is a need for the winter recreation industry to acknowledge that their clientele is aware that climate change is taking place. It is no longer feasible for the ski community to purely make operational changes or incorporate a single link on their website to publicize well-intentioned, yet altogether "token" environmental accomplishments to their patrons. The ski industry has the capacity and the responsibility to begin influencing more broad change on a variety of economic, political, and social fronts.

The economic impact and political clout that the ski industry has in their respective states is a powerful bargaining chip to facilitate broader change. A 2007 report identified that Colorado's ski industry had a market share of approximately \$1.92 billion

in revenue.²⁵ The ski industry is also connected more broadly to transportation, real estate, and a variety of other economic sectors. This includes direct employment for tens of thousands of residents and countless other indirect jobs. Rather than just leveraging that economic weight to generate greater short-term economic advantages, the ski industry should make the critical importance of their industry and the need to maintain climatic conditions evident to the general public for purposes of self-preservation and to promote the common good.

Politically, the ski industry has the potential to influence the policy and policymakers that may mitigate the effects of climate change. In 2011, Aspen Skiing Company along with prominent skiers and snowboarders took the opportunity to lobby congress regarding the issue of climate change.²⁶ Decreases in state revenue and loss of jobs are often effective political motivators. Through the identification of climate change as the source of revenue and job loss, the ski industry can influence policymakers to support legislation that might begin to mitigate the damages to their industry.

Advocacy may be the broadest means by which the ski industry has the capacity to influence change. First and foremost, the ski industry can facilitate a greater level of understanding between their patrons and the scientific community. As noted earlier, "the *gap between public perception and scientific reality is now enormous.*"²⁷ In addition, there is some level of conflict among scientists as to engaging in advocacy due to the

²⁵ Williamson, S., Ruth, M., Ross, K., & Irani, D. (2008). Economic impacts of climate change in Colorado. Retrieved from <http://www.cier.umd.edu/climateadaptation/Colorado%20Economic%20Impacts%20of%20Climate%20Change.pdf>

²⁶ Condon, S. (2011). Truckee's Jeremy Jones to lobby congress to regulate carbon pollution. Retrieved from <http://www.sierrasun.com/article/20110913/NEWS/110919971>

²⁷ Hansen, J. (2009) *Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity*. New York: Bloomsbury USA.

issue of bias.²⁸ Yet, by simply acknowledging that climate change is taking place is a step in the right direction towards providing credibility to a scientific community that has long understood and corroborated the science underlying climate change. Through press releases, public education campaigns, and the application of interpretive principles, the ski industry can validate climate change and further perpetuate the process of persuasion.

There are certain interpretive principles that have the potential to make skiers and snowboarders engaged with the issue of climate change. The most critical of these principles is the need for interpretive communications to be relevant to the recipients. Freeman Tilden, the father of interpretation, made this quite evident when he wrote that “Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor [or message viewer] will be sterile.”²⁹ In creating interpretive communications, it is the interpreter’s responsibility to develop some type of meaning for the individual. People have a tendency to be more egocentric than altruistic or ecocentric; thus, what is conveyed to them must appeal to this “Me” mentality. The communicator must be able to create a message that addresses the message viewer’s chief interest, which is “whatever touches his personality, his experiences, and his ideals. Interest in something that concerns himself.”²⁹ In a study of the social identity of skiers and snowboarders, those with higher levels of social identity tended to think more about climate change messages than those with lower levels.³⁰ The more individuals think about persuasive messages the more likely they are to alter their

²⁸ Cole, N., & Watrous, S. (2007). Across the great divide: Supporting scientists as effective messengers in the public sphere. In S. C. Moser, & L. Dilling (Eds.), *Creating a climate for change* (pp. 180-199). Cambridge: Cambridge University Press.

²⁹ Tilden, F. (2007). *Interpreting our heritage*. Chapel Hill, NC: The University of North Carolina Press.

³⁰ Sarnoff, P. J. (2012) The effect of in-group and out-group persuasive communications about climate change on the environmental beliefs and behavioral intentions of winter recreationists. Unpublished doctoral dissertation, University of Utah.

beliefs and attitudes. The findings from this study, coupled with the interpretive principle of relevance, may indicate that skiers and snowboarders have the capacity to be positively influenced when the climate change message relates to something they find personally relevant.

In addition, the concept of revelation is a critical next step in creating positive change related to climate change. If relevance is the spark, then what is done with that spark is revelation. Once attention has been gained, there is an even greater need to take advantage of this attention and put it to good use. Revelation is the opportunity for the horizons to be broadened.³¹ Again, Tilden was keenly attuned to this necessity to link relevance with revelation: “If you cannot connect his ego with the chain of your revelation, he may not quit you physically, but you have lost his interest.”³² Once the attention of skiers and snowboarders is obtained, there is a prime opportunity to reveal the critical nature of climate change and its influence on the future of winter recreation.

Lastly is the concept of provocation. Provocation refers to some type of change in either attitude or behavior as a result of the interpretation that has been received by the individual. Again, one of Tilden’s principles directly states that “The chief aim of interpretation is not instruction, but provocation. It is not desirous to provide an individual with endless amounts of information.” It was proposed that the primary goal of interpretation should be environmental stewardship.³³ The potential for response provocation addressed the three levels of goals: entry-level goals, ownership goals and empowerment goals. The most critical of these goals in provoking some type of positive

³¹ Beck, L. & Cable, T. (2002). *Interpretation for the 21st century*. Champaign, IL: Sagamore Publishing.

³² Tilden, F. (2007). *Interpreting our heritage*. Chapel Hill, NC: The University of North Carolina Press.

³³ Knapp, D. (2007). *Applied interpretation*. Fort Collins, CO: National Association for Interpretation.

response are the empowerment goals. These provide an individual with the knowledge, drive, and ability to change their previously held beliefs and, potentially, to act upon them. Beck and Cable stated the importance of messages that “broaden horizons” and create the drive for them to “act upon that new found breadth.” Completing this entire interpretive process must incorporate some aspect that provides an outlet for skiers and snowboarders to engage in behaviors that can mitigate the effects of climate change.

Further, by helping to alter the collective behaviors of skiers and snowboarders off the mountain, the ski industry has even greater capacity to mitigate the increasing effects of climate change. Many of the behaviors that are responsible for greenhouse gas emissions take place when skiers and snowboarders are not engaging in their activity of choice. Encouraging use of active (biking or walking) and public transportation, reduction in home energy use, purchasing alternative energy, and providing opportunities to become politically active (e.g., signing petitions) are all means that can easily facilitate positive change. Informing patrons about the need to participate in these constructive behaviors and then providing opportunities to make these changes will advance the cause well beyond the immediate sphere of the ski industry. For example, allowing local power companies to sell wind power credits at their resorts, educating patrons about public transportation options, and distributing petitions about climate issues are all reasonable measures.

Conclusion

As climate change continues to progress, it becomes more and more critical for all facets of society to implement strategies that will mitigate its effects. It is no longer

intellectually honest, morally defensible, or economically practical for resort owners, equipment manufacturers, or affiliated industries to deny the existence of climate change or to avoid the subject in the hopes that it will go away. The vast majority their clientele already perceive climate change as real and problematic. If not for the common good, then surely for the purposes of self-preservation, the next steps for ski industry leaders are to publicly acknowledge climate change as a real issue, take mitigating action within their own operations, and facilitate opportunities for positive change among their existing patrons.

CHAPTER VII

DISCUSSION

The purpose of this study was to determine the most effective communicator of persuasive messages about climate change in order to elicit changes in environmental belief and behavioral intention among winter recreationists. More specifically, this study aimed to show that, for winter recreationists with low levels of involvement and high levels of social identity, it is feasible that persuasive messages provided by in-group message sources are capable of eliciting cognitive processing to the extent that environmental beliefs and behavioral intentions can be influenced longitudinally. In general, the message development criteria were not met and the results did not support the hypotheses that an in-group, social source is more influential than an out-group, scientific source at eliciting changes in environmental belief and behavioral intention. This chapter includes concluding remarks, implications for future research, and implications for practical application.

Concluding Remarks

In spite of a lack of significant results, the results of this study addressed the theoretical and practical difficulties associated with the real-world application of persuasive messages and the Elaboration Likelihood Model through the lens of climate

change. The results of all three articles from this broader study address important issues to advance these areas of research.

The purpose of the pilot study was to develop and test persuasive messages about climate change through the criteria outlined in the Elaboration Likelihood Model. Due to the failure of the developed messages to meet the established criteria (Petty & Cacioppo, 1986), it was determined that the Elaboration Likelihood Model could not be accurately tested. As stated previously, the development and application of messages for the ELM can present problems in real-world settings (Mejinders, Midden, & Wilke, 2001; Petty & Cacioppo, 1986). The results of this pilot study were consistent with these earlier concerns about real-world persuasive messages.

This study aimed to show that, for winter recreationists with low levels of involvement and high levels of social identity, it is feasible that persuasive messages provided by in-group message sources are capable of eliciting cognitive processing to the extent that environmental beliefs and behavioral intentions can be influenced longitudinally. The results of this study did not support the proposed hypotheses, but did yield some important results in the form of understanding the credibility of different message sources and how effective those message sources are at eliciting cognitive processing. These findings do have implications for furthering this area of research as well as application in recreation and environmental settings.

The ELM has been effective in laboratory settings. However, if the ELM does not function in the real-world with the same reliability that it does in a lab, then there is a need to reassess its relevance for future usage. In addition, there is also a need for a more comprehensive approach regarding climate change messaging. It is likely that neither the

winter recreation communities nor climate scientists alone have the capacity to influence environmental beliefs and behavioral intentions. Additional investigation is necessary regarding which approaches to climate change messaging might be influential in eliciting changes among this segment of the population and the public in general.

The practical application piece takes advantage of the reviewed literature, pilot study, and main study in order to investigate more fully how one segment of the recreation community can begin applying persuasive strategies in order to support their own industry and the environment. This synthesis has the potential to be more broadly applied to other areas of the recreation field as there are environmental issues, including climate change, that typically require attention from all users regardless of their level of activity involvement.

Implications for Future Research

This study provides an important step in advancing research surrounding both the real-world utility of the Elaboration Likelihood Model and persuasive messaging regarding the issue of climate change. There are numerous research questions that arise from this study including the following: Can the ELM be applied in a real-world setting with the same reliability as a laboratory setting? Are there adjustments to the ELM that will make it more reliable in real-world settings? Which aspects of the climate change message will elicit a change response and are there aspects that are being overlooked? Will actual message sources facilitate a greater change response? These questions serve to provide only a small sampling that may serve to advance understanding of the ELM and climate change messaging.

An early critique of the ELM, stated that the development and application of messages can present problems in nonlaboratory settings (Petty & Cacioppo, 1986). Although the ELM does provide a solid foundation from which to begin researching, there is still a need to evaluate how influential messages are when they carry over from a laboratory setting to a real-world setting. Issues of distraction, social desirability, and researcher influence may all serve to confound the results yielded in these two physical settings. Research addressing this difference of setting has the potential to reveal changes in the operation of the ELM.

In addition, the difference between a real-world message subject and a hypothetical subject poses problems. The influence of a subject about which a participant has no prior knowledge is going to elicit a different response than under circumstances where a participant has previously been exposed to a subject. A more thorough comparison utilizing thought listing strategies may yield noticeable differences between these two applications of the ELM. A qualitative or mixed methods approach may also serve to more comprehensively evaluate variations regarding message subject. These findings may provide adjustments to the ELM that create multiple models of which one might be applicable to hypothetical topics and another might be more effective when addressing real-world message subjects.

Regarding messaging that specifically applied to the issue of climate change, there is a distinct need to determine exactly which arguments might influence a change response. Essentially, this research needs to ask participants, "what argument in a message about climate change would most effectively influence your beliefs about climate change and would cause you to alter your environmental behaviors?" This would

equate to a needs assessment as to what unconvinced individuals would require in order to have their opinions changed. It may be likely that there are no arguments that will elicit a change response, but determining this factor would be invaluable to further research on climate change messaging.

Further investigation into message source should address the usage of actual message sources. There may be a higher likelihood that individuals will determine that actual sources are more closely associated with their in-group. Buy in from prominent individuals, agencies, or businesses in the ski industry that already have well-established public statements about climate change may operate in a more effective manner for creating a change response. The familiarity of these sources and their actual vested interest in preserving winter recreation may elicit a higher level of cognitive processing and create a stronger response among individuals.

Implications for Practical Application

This study found that the vast majority of skiers and snowboarders surveyed (93%) believe that climate change is occurring. Skiers and snowboarders who are more highly involved in winter recreation are also more likely to strongly believe that climate change is occurring. Within the sample population, 93% of respondents believed that human behaviors are at least partly responsible for these changes. These findings may indicate that the community of skiers and snowboarders are more knowledgeable about the scientific support for climate change and potentially more aware of the effects that are already occurring. This may also indicate that this segment of the population has the

potential to be swayed given the proper messaging from the correct source. Under these circumstances, the ski industry may be able to influence broader public change.

Through social means, the ski industry has the capacity to influence change. First and foremost, the ski industry can facilitate a greater level of understanding between their patrons and the scientific community. As noted earlier, "the gap between public perception and scientific reality is now enormous" (Hansen, 2009). In addition, there is some level of conflict among scientists as to engaging in advocacy due to the issue of bias (Cole & Watrous, 2007). Yet, by simply acknowledging that climate change is taking place is a step in the right direction towards providing credibility to a scientific community that has long understood and corroborated the science underlying climate change. Through press releases and public education campaigns, the ski industry can validate climate change and further perpetuate the process of public opinion change.

There are also numerous barriers that typically prevent individuals from engaging in behaviors that are beneficial to the environment. By helping to alter the collective behaviors of skiers and snowboarders off the mountain, there is even greater capacity to mitigate the further effects of climate change. Many of the behaviors that are responsible for greenhouse gas emissions take place when skiers and snowboarders are not engaging in their activity of choice. Encouraging use of active (biking or walking) and public transportation, reduction in home energy use, purchasing alternative energy, and providing opportunities to become politically active (e.g., signing petitions) are all means that can easily facilitate positive change. Informing patrons about the need to participate in these constructive behaviors and then providing opportunities to make these changes will advance the cause well beyond the immediate sphere of the ski industry. For

example, allowing local power companies to sell wind power, educating patrons about public transportation options, and distributing petitions about climate issues are all reasonable measures.

There is now clear evidence that supports the effects of climate change and the need for immediate and decisive action. Regardless as to why skiers and snowboarders believe in climate change, there is a need for the winter recreation industry to acknowledge that their clientele is aware that climate change is taking place. However, it is no longer feasible for the ski community to purely make operational changes and have a single link on their website to publicize their environmental accomplishments to their patrons. The ski industry has the capacity and the responsibility to begin influencing broad change in order to help mitigate the effects of climate change and to, potentially, create a future where winter activities continue to be recreational options.

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APPENDIX A

STRONG AND WEAK ARGUMENTS

Strong Arguments	Weak Arguments
<p>Global temperature increases Eleven of the last twelve years rank among the twelve warmest years since recording of temperatures began in 1850.</p>	<p>Global temperature increases Over the course of the last twelve years sales of fans are at their highest levels since tracking of these sales began in the late 1800s.</p>
<p>Melting Arctic ice Satellite data since 1978 show a decrease in sea ice of 2.7% per decade, which is equivalent to an area twice the size of Texas.</p>	<p>Melting Arctic ice Alaska fishermen have noticed a decrease in the number of days they have been able to ice fish since 1978.</p>
<p>Rising sea levels Global average sea level has risen at an average rate of 0.12 inches per year since 1993, totaling a 2.16 inch rise during this period.</p>	<p>Rising sea levels Globally, boat owners have lengthened their anchor lines by 0.12 inches per year since 1993, totaling a 2.16 inch increase during this period.</p>
<p>More extreme weather events As a result of warming temperatures and more energy in the climate system, there has been a significant increase in the strength of tropical cyclones in the North Atlantic.</p>	<p>More extreme weather events As a result of warming temperatures and more energy in the climate system, there are more clouds in the North Atlantic.</p>
<p>More variable precipitation Globally, the areas affected by extreme drought and extreme flooding have increased since the 1970s.</p>	<p>More variable precipitation Globally, some places have received less rain since 1970s.</p>
<p>Decreases in permanently frozen ground Frozen ground in arctic areas has decreased by about 7% since 1900, with decreases in spring of as much as 15%.</p>	<p>Decreases in permanently frozen ground The height of roads in the arctic has decreased since 1900, with even greater decreases in the spring.</p>
<p>Loss of alpine glaciers From 1850 to 2000, nearly 50% of alpine glaciers were lost. These glaciers are now on pace to lose 1% of their surface area every year.</p>	<p>Loss of alpine glaciers From 1850 to 2000, twice as many visitors complained about not being able to observe glaciers. These complaints are on pace to increase each year.</p>

APPENDIX B

INTENDED OUTCOMES QUESTIONNAIRE

Student Attitudes Towards Environmental Issues

The purpose of this research study is to understand student attitudes towards different environmental issues. I would like you to respond to the following questionnaire items. This questionnaire is anonymous, so please do not write your name on the questionnaire.

It should take 5-10 minutes to complete the questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions, complaints, or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

Thank you for your participation in this study.

Please write your academic major: _____

For this survey you will be asked to read a message and then engage in a thought listing exercise. After the message there will be a list of boxes in which you will write down the thoughts you had while you read the message. Simply write down the first idea you had in the first box, the second idea in the second box, etc. Please put only one idea or thought in each box. You should try to record only those ideas that you were thinking while reading the message. Please state your thoughts and ideas as concisely as possible . . . a phrase is sufficient. IGNORE SPELLING, GRAMMAR AND PUNCTUATION.

PLEASE WRITE LEGIBLY.

We have provided more boxes than we think people will need to insure that everyone will have plenty of room to write the ideas they had while reading the message. Don't worry if you don't fill every space. Please be completely honest and list all of the thoughts that you had.

After each thought you will be asked to score how favorable or unfavorable this thought is about the issue presented in the message.

Here is an **example** using another issue so you understand how to score your thoughts.

Comprehensive examinations should be instituted for graduating seniors because students at universities with comprehensive exams typically have 30% higher grade point averages.

#1 Comprehensive exams could be an added benefit when trying to impress potential employer.

Please rate how favorable or unfavorable this thought is regarding the institution of comprehensive examinations (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the implementation of comprehensive exams.

#2 Trying to add another requirement to my busy schedule would make it even more difficult to find time to spend with my family.

Please rate how favorable or unfavorable this thought is regarding the institution of comprehensive examinations (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the implementation of comprehensive exams.

Please read the following message:

Climate Change

Climate change is a critical environmental issue that is currently facing the world. The drastic increase in atmospheric carbon dioxide due to burning of fossil fuels is rapidly accelerating the effects of climate change. Some of these effects include the following:

- **Global temperature increases**
Eleven of the last twelve years [1995-2006] rank among the twelve warmest years since recording of temperatures began in 1850.
- **Melting Arctic ice**
Satellite data since 1978 show a decrease in sea ice of 2.7% per decade, which is equivalent to an area twice the size of Texas.
- **Rising sea levels**
Global average sea level has risen at an average rate of 0.12 inches per year since 1993, totaling a 2.16 inch rise during this period.
- **More extreme weather events**
As a result of warming temperatures and more energy in the climate system, there has been a significant increase in the strength of tropical cyclones in the North Atlantic.
- **More variable precipitation**
Globally, the areas affected by extreme drought and extreme flooding have increased since the 1970s.

These numerous consequences point towards the rapid advancement of climate change, which is quickly becoming an urgent environmental problem that requires public attention.

After writing each thought, please rate each thought or idea as to how favorable or unfavorable it is regarding:

The existence of climate change

(After writing your thought in each box, circle one response on the favorability scale)

#1

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#2

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#3

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#4

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#5

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#6

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#7

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#8

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

Thank you for filling out this questionnaire.

Student Attitudes Towards Environmental Issues

The purpose of this research study is to understand student attitudes towards different environmental issues. I would like you to respond to the following questionnaire items. This questionnaire is anonymous, so please do not write your name on the questionnaire.

It should take 5-10 minutes to complete the questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

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Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

Thank you for your participation in this study.

Please write your academic major: _____

For this survey you will be asked to read a message and then engage in a thought listing exercise. After the message there will be a list of boxes in which you will write down the thoughts you had while you read the message. Simply write down the first idea you had in the first box, the second idea in the second box, etc. Please put only one idea or thought in each box. You should try to record only those ideas that you were thinking while reading the message. Please state your thoughts and ideas as concisely as possible . . . a phrase is sufficient. IGNORE SPELLING, GRAMMAR AND PUNCTUATION.

PLEASE WRITE LEGIBLY.

We have deliberately provided more space than we think people will need to insure that everyone will have plenty of room to write the ideas they had while reading the message. Don't worry if you don't fill every space. Please be completely honest and list all of the thoughts that you had.

After each thought you will be asked to score how favorable or unfavorable this thought is about the issue presented in the message.

Here is an **example** using another issue so you understand how to score your thoughts.

Comprehensive examinations should be instituted for graduating seniors because students at universities with comprehensive exams typically have 30% higher grade point averages.

#1 Comprehensive exams could be an added benefit when trying to find a job.

Please rate how favorable or unfavorable this thought is regarding the institution of comprehensive examinations (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the implementation of comprehensive exams.

#2 Trying to add another requirement to my busy schedule would make it even more difficult to find time to spend with my family.

Please rate how favorable or unfavorable this thought is regarding the institution of comprehensive examinations (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the implementation of comprehensive exams.

Please read the following message:

Climate Change

Climate change is a critical environmental issue that is currently facing the world. The drastic increase in atmospheric carbon dioxide due to burning of fossil fuels is rapidly accelerating the effects of climate change. Some of these effects include the following:

- **Global temperature increases**
Over the course of the last twelve years sales of fans are at their highest levels since tracking of these sales began in the late 1800s.
- **Melting Arctic ice**
Alaska fishermen have noticed a decrease in the number of days they have been able to ice fish since 1978.
- **Rising sea levels**
Globally, boat owners have lengthened their anchor lines by 0.12 inches per year since 1993, totaling a 2.16 inch increase during this period.
- **More extreme weather events**
As a result of warming temperatures and more energy in the climate system, there are more clouds in the North Atlantic.
- **More variable precipitation**
Globally, some places have received less rain and other places have received more rain since 1970s.

These numerous consequences point towards the rapid advancement of climate change, which is quickly becoming an urgent environmental problem that requires public attention.

After writing each thought, please rate each thought or idea as to how favorable or unfavorable it is regarding:

The existence of climate change

(After writing your thought in each box, circle one response on the favorability scale)

#1

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#2

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#3

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#4

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
 ...regarding the existence of climate change.

#5

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
...regarding the existence of climate change.

#6

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
...regarding the existence of climate change.

#7

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
...regarding the existence of climate change.

#8

Please rate how favorable or unfavorable this thought is regarding the existence of climate change (Circle one)

Unfavorable **Mixed View** **Favorable**
...regarding the existence of climate change.

Thank you for filling out this questionnaire.

APPENDIX C

TESTING OF MESSAGE PARALLELISM

Student Attitudes Towards Environmental Issues

The purpose of this research study is to understand student's attitudes towards different environmental issues. I would like you to respond to the following questionnaire items. This questionnaire is anonymous, so please do not write your name on the questionnaire. It should take 5 minutes to complete the questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions complaints or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

Thank you for your participation in this study.

Please write your academic major: _____

In this questionnaire you will read a message and then respond to some questions regarding that message.

There are no right or wrong answers, so please answer honestly.

Please read the following message:

Climate Change

Climate change is a critical environmental issue that is currently facing the world. The drastic increase in atmospheric carbon dioxide due to burning of fossil fuels is rapidly accelerating the effects of climate change. Some of these effects include the following:

- **Global temperature increases**
Eleven of the last twelve years [1995-2006] rank among the twelve warmest years since recording of temperatures began in 1850.
- **Melting Arctic ice**
Satellite data since 1978 show a decrease in sea ice of 2.7% per decade, which is equivalent to an area twice the size of Texas.
- **Rising sea levels**
Global average sea level has risen at an average rate of 0.12 inches per year since 1993, totaling a 2.16 inch rise during this period.
- **More extreme weather events**
As a result of warming temperatures and more energy in the climate system, there has been a significant increase in the strength of tropical cyclones in the North Atlantic.
- **More variable precipitation**
Globally, the areas affected by extreme drought and extreme flooding have increased since the 1970s.

These numerous consequences point towards the rapid advancement of climate change, which is quickly becoming an urgent environmental problem that requires public attention.

Please rate the believability of this message.

A **believable** message is one that is reasonable or plausible.

An **unbelievable** message is one that is doubtful or far-fetched.

How **believable** was this message in making a case for the existence of climate change? (Circle One)

Extremely Unbelievable	Unbelievable	Somewhat Unbelievable	Mixed View	Somewhat Believable	Believable	Extremely Believable
---------------------------	--------------	--------------------------	---------------	------------------------	------------	-------------------------

Now think again about the entire message that you read. Please rate how strongly you agree or disagree with the following statements in regard to that message:

The message was easy to understand (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

The message had a complex structure (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

I am familiar with the message content (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

Thank you for filling out this questionnaire.

Student Attitudes Towards Environmental Issues

The purpose of this research study is to understand student's attitudes towards different environmental issues. I would like you to respond to the following questionnaire items. This questionnaire is anonymous, so please do not write your name on the questionnaire. It should take 5 minutes to complete the questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions complaints or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

Thank you for your participation in this study.

Please write your academic major: _____

In this questionnaire you will read a message and then respond to some questions regarding that message.

There are no right or wrong answers, so please answer honestly.

Please read the following message:

Climate Change

Climate change is a critical environmental issue that is currently facing the world. The drastic increase in atmospheric carbon dioxide due to burning of fossil fuels is rapidly accelerating the effects of climate change. Some of these effects include the following:

- **Global temperature increases**
Over the course of the last twelve years sales of fans are at their highest levels since tracking of these sales began in the late 1800s.
- **Melting Arctic ice**
Alaska fishermen have noticed a decrease in the number of days they have been able to ice fish since 1978.
- **Rising sea levels**
Globally, boat owners have lengthened their anchor lines by 0.12 inches per year since 1993, totaling a 2.16 inch increase during this period.
- **More extreme weather events**
As a result of warming temperatures and more energy in the climate system, there are more clouds in the North Atlantic.
- **More variable precipitation**
Globally, some places have received less rain and other places have received more rain since 1970s.

These numerous consequences point towards the rapid advancement of climate change, which is quickly becoming an urgent environmental problem that requires public attention.

Please rate how believable you believe this message to be.

A **believable** message is one that is reasonable or plausible.

An **unbelievable** message is one that is doubtful or far-fetched.

How **believable** was this message in making a case for the existence of climate change? (Circle One)

Extremely Unbelievable	Unbelievable	Somewhat Unbelievable	Mixed View	Somewhat Believable	Believable	Extremely Believable
---------------------------	--------------	--------------------------	---------------	------------------------	------------	-------------------------

Now think again about the entire message that you read. Please rate how strongly you agree or disagree with the following statements in regard to that message:

The message was easy to understand (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

The message had a complex structure (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

I am familiar with the message content (Circle One).

Strongly Disagree	Disagree	Somewhat Disagree	Mixed View	Somewhat Agree	Agree	Strongly Agree
----------------------	----------	----------------------	---------------	-------------------	-------	-------------------

Thank you for filling out this questionnaire.

APPENDIX D

PRETEST SURVEY QUESTIONNAIRE

Environmental Attitudes of Winter Recreationists

The purpose of this study is to evaluate the environmental attitudes of winter recreationists. Please respond to the following questionnaire items.

It should take 10 minutes to complete this questionnaire. Participation in this study is voluntary and you can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions complaints or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

In addition to this questionnaire, two additional questionnaires will be e-mailed to you. You will receive one in approximately a week and another questionnaire approximately a month later. If you complete and return all of the questionnaires, you will be entered into a drawing for lift tickets, gift cards and other prizes. Only a maximum of 1,200 people will be entered so your odds are good.

Please provide us with your e-mail address so that we can send you these questionnaires.

Your e-mail address will only be used for the purpose of this research study.

E-mail address

Thank you for your participation in this study!

First you will be asked your opinions about climate change.

1. Climate change is the increased warming of the earth and more erratic changes in weather patterns resulting from people's emissions of greenhouse gases such as carbon dioxide. Do you think that climate change is happening? (Select One)

_____ Yes

_____ No

_____ Don't know

2. How sure are you that climate change is or is not happening?

Climate change is not happening			Climate change is happening			
Extremely Sure	Very Sure	Somewhat Sure	Neither	Somewhat Sure	Very Sure	Extremely Sure
: 1 :	: 2 :	: 3 :	: 4 :	: 5 :	: 6 :	: 7 :

3. Assuming that climate change is happening, do you think it is. . . (Select One)

_____ Caused mostly by human activities

_____ Caused by both human activities and natural changes

_____ Caused mostly by natural changes in the environment

_____ None of the above because climate change isn't happening

_____ Don't know

_____ Other: _____

Below is a list of behaviors that have the potential to minimize the effects of climate change. Please rate how likely it is that you would do each of these behaviors over the next two months. There are no right or wrong answers. We are interested in your honest opinions. (Please circle one number on the scale following each statement)

In the next two months, how likely would you be to take part in a public demonstration against climate change?

Extremely unlikely			Neither			Extremely likely
: 1 :	: 2 :	: 3 :	: 4 :	: 5 :	: 6 :	: 7 :

In the next two months, how likely would you be to become an active member of an organization attempting to stop climate change?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to sign a petition in favor of limiting the emission of carbon dioxide (CO₂)?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to tell a friend about not idling their car?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to purchase renewable energy for your home through your local power company?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to use public transportation at least once per week?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to lower your thermostat by two degrees?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

In the next two months, how likely would you be to purchase two locally produced food items each week?

Extremely unlikely			Neither				Extremely likely
: 1	:	2	:	3	:	4	:
5	:	6	:	7	:		

I am a person who is glad to belong to the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who sees myself as belonging to the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who makes excuses for belonging to the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who tries to hide belonging to the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who feels held back by the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who is annoyed to say I'm a member of the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I am a person who criticizes the skier/snowboarder group.

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

Using the activity in which you most often participate (Skiing or Snowboarding), please answer the following questions regarding your participation in that activity (Skiing or Snowboarding): (Please circle one number on the scale following each statement)

Skiing/Snowboarding is one of the most enjoyable things I do

Strongly disagree			Neither			Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

I identify with the people and image associated with skiing/snowboarding.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

When I'm skiing/snowboarding, I don't have to be concerned with the way I look.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

You can tell a lot about a person by seeing them skiing/snowboarding.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

Participating in skiing/snowboarding says a lot about whom I am.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

When I participate in skiing/snowboarding, others see me the way I want them to see me.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

Remember that you will be receiving two more questionnaires through e-mail. Please fill these out and return them to be entered into a drawing for lift tickets, gift cards and other prizes.

You will only be entered if all three of the e-mail questionnaires are completed and returned.

Thank you again for your participation!

APPENDIX E

POSTTEST SURVEY QUESTIONNAIRE

Environmental Attitudes of Winter Recreationists

Thank you for your continued participation in this research study.

Again, the purpose of this study is to evaluate the environmental attitudes of winter recreationists. First you will read a message and then you will respond to some questionnaire items.

It should take 15 minutes to complete this questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions complaints or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

In addition to this questionnaire, one additional questionnaire will be e-mailed to you. You will receive the third questionnaire in approximately a month. If you complete and return all three of the questionnaires, you will be entered into a drawing for lift tickets, gift cards and other prizes. Only a maximum of 1,200 people will be entered so your odds are good.

First you will learn about the source that is providing the message that you will read in just in a few moments.

[In-group, ski resort source cue:]

The following important message about climate change is brought to you by
The American Ski Resort Community

[In-group, ski equipment manufacturer source cue:]

The following important message about climate change is brought to you by
The American Ski Equipment Manufacturing Community

[Out-group, climate science source cue:]

The following important message about climate change is brought to you by
The American Climate Science Community

Please identify the extent to which you agree with the following statements. (Please circle one number on the scale following each statement)

I would consider the source that is providing the message to be . . .

I would consider the message source to be dependable.

Strongly disagree				Neither				Strongly agree
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

I would consider the message source to be honest.

Strongly disagree				Neither				Strongly agree
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

I would consider the message source to be reliable.

Strongly disagree				Neither				Strongly agree
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

I would consider the message source to be sincere.

Strongly disagree				Neither				Strongly agree
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

I would consider the message source to be trustworthy.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

I would consider the message source to be an expert.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

I would consider the message source to be experienced.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

I would consider the message source to be knowledgeable.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

I would consider the message source to be qualified.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

I would consider the message source to be skilled.

Strongly disagree				Neither				Strongly agree
: 1	: 2	: 3	: 4	: 5	: 6	: 7	:	:

Next you will read a message from the previously mentioned source.

Skiers and Snowboarders:

Many human behaviors contribute to climate change and now climate change is beginning to affect winter.

Some of these effects include the following:

Global temperature increases

Eleven of the last twelve years rank among the warmest years since recording of temperatures began in 1850.

Decreases in snow cover

Since the 1950s there has been an estimated 5% annual loss of snow cover in the northern hemisphere. This has led to winter seasons that are less snowy and shorter in length.

Loss of alpine glaciers

From 1850 until the 1970s, alpine glaciers lost 35% of their surface area. By the year 2000, this loss increased to nearly 50% and these glaciers are on pace to lose 1% of their surface area every year.

Ski resort closures

In 2006, 47 ski resorts in the Alps did not open due to unreliable or nonexistent snow conditions.

However, there are steps you can take in your daily life off the mountain to help slow climate change's influence on skiing and snowboarding:

- Ride public transportation to work or school.
- Lower your thermostat just a few degrees in the winter.
- Purchase renewable energy for your home.
- Buy locally produced food items.
- Join organizations, sign petitions, or get involved in campaigns in favor of the reduction of carbon dioxide emissions.
- Encourage your school or employer to engage in energy reduction strategies.
- Talk with your family and friends about how they can reduce their energy usage.

**Skiers and snowboarders:
Winter needs your help**

Next you will be asked about your opinions regarding climate change.

Do you think that climate change is happening? (Select One)

_____ Yes

_____ No

_____ Don't know

How sure are you that climate change is or is not occurring? (Please select one number on the following scale)

<u>Climate change is not happening</u>					<u>Climate change is happening</u>		
Extremely	Very	Somewhat		Somewhat	Very	Extremely	
Sure	Sure	Sure	Neither	Sure	Sure	Sure	
: 1	: 2	: 3	: 4	: 5	: 6	: 7	

Assuming that climate change is happening, do you think it is. . . (Select One)

_____ Caused mostly by human activities

_____ Caused by both human activities and natural changes

_____ Caused mostly by natural changes in the environment

_____ None of the above because climate change isn't happening

_____ Other: _____

Think back to the message that you read about climate change. We are interested in understanding what you were thinking about while you read that message.

Simply write down one thought you had in the first box, another thought in the second box, etc. Please put only one thought or idea in each box. You should try to record only those thoughts you had while you were reading the message. Please state your thoughts and ideas as concisely as possible . . . a phrase is sufficient. **IGNORE SPELLING, GRAMMAR AND PUNCTUATION.** Please be completely honest in listing the thoughts that you had.

After each thought you will be asked to score how well each thought agrees or disagrees with what was presented in the message you read about climate change.

#1

Please rate how much this thought agrees or disagrees with the climate change message that you read: (Circle One)

Strongly Disagrees	Disagrees	Somewhat Disagrees	Mixed View	Somewhat Agrees	Agrees	Strongly Agrees
-------------------------------	------------------	-------------------------------	-----------------------	----------------------------	---------------	----------------------------

#2

Please rate how much this thought agrees or disagrees with the climate change message that you read: (Circle One)

Strongly Disagrees	Disagrees	Somewhat Disagrees	Mixed View	Somewhat Agrees	Agrees	Strongly Agrees
-------------------------------	------------------	-------------------------------	-----------------------	----------------------------	---------------	----------------------------

#3

Please rate how much this thought agrees or disagrees with the climate change message that you read: (Circle One)

Strongly Disagrees	Disagrees	Somewhat Disagrees	Mixed View	Somewhat Agrees	Agrees	Strongly Agrees
-------------------------------	------------------	-------------------------------	-----------------------	----------------------------	---------------	----------------------------

In the next two months, how likely would you be to sign a petition in favor of limiting the emission of carbon dioxide (CO₂)?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to tell a friend about not idling their car?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to purchase renewable energy for your home through your local power company?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to use public transportation at least once a week?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to lower your thermostat by two degrees?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to purchase two locally produced food items each week?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to support an energy reduction program at your school or place of employment?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

These final questions will ask for a little information about yourself.

Age: _____

Zip code or country of primary residence:

Level of Education: Some high school
 Completed high school
 Some college
 Completed college
 Some graduate school
 Completed graduate school

Annual Household Income: Under \$24,999
 \$25,000 - \$49,999
 \$50,000 - \$74,999
 \$75,000 - \$99,999
 \$100,000 - \$149,999
 \$150,000 - \$199,999
 \$200,000 - \$249,999
 \$250,000 or above

Remember that you will be receiving one more e-mail questionnaire in approximately one month. Please fill this out and return them to be entered into a drawing for lift tickets, gift cards and other prizes. The third and final questionnaire will only take approximately 5 minutes to complete.

You will only be entered if all three questionnaires are completed and returned.

Thank you again for your participation!

APPENDIX F

FIRST E-MAIL REMINDER

Last week a questionnaire about the environmental attitudes of skiers and snowboarders was e-mailed to you.

We are especially grateful for your help because it is only by asking people like you to share your opinions that we can better understand the environmental and leisure behaviors of those who recreate in the Wasatch Mountains.

A link to this questionnaire can be found at the bottom of this message.

If you have any questions, feel free to contact me at philip.sarnoff@hsc.utah.edu.

Sincerely,

Philip J. Sarnoff
Ph.D. Candidate
Department of Parks, Recreation and Tourism
University of Utah

APPENDIX G

SECOND E-MAIL REMINDER

Two weeks ago, I e-mailed you a questionnaire link seeking information about your environmental attitudes. As of today, I have not received your completed questionnaire.

Every questionnaire is important. You are one of a small number of skiers and snowboarders chosen through a random sampling process. For results to represent the skiers and snowboarders recreating in the Wasatch Mountains, it is important that every questionnaire be completed. Without your help, conclusions we draw from the questionnaires that we have already received from other skiers and snowboarders may be wrong.

A link to this questionnaire can be found at the bottom of this message.

Thank you.

Phil Sarnoff
Department of Parks, Recreation and Tourism
University of Utah

(Vaske, 2008)

APPENDIX H

FOLLOW-UP SURVEY QUESTIONNAIRE

Environmental Attitudes of Winter Recreationists

Thank you for continuing to participate in this research study.

Again, the purpose of this study is to evaluate the environmental attitudes of winter recreationists. I would like you to respond to the following questionnaire items.

It should take 5 minutes to complete this questionnaire. Participation in this study is voluntary. You can choose not to take part. You can choose not to finish the questionnaire or omit any question you prefer not to answer.

By returning this questionnaire, you are giving your consent to participate.

If you have any questions complaints or if you feel you have been harmed by this research please contact Phil Sarnoff in the Department of Parks, Recreation and Tourism at philip.sarnoff@hsc.utah.edu.

Contact the Institutional Review Board (IRB) at 801-581-3655 or irb@hsc.utah.edu if you have questions regarding your rights as a research participant or if you have questions, complaints or concerns which you do not feel you can discuss with the investigator.

If you complete and return this final questionnaire, you will be entered into a drawing for lift tickets, gift cards and other prizes. Only a maximum of 1,200 people will be entered so your odds are good.

Thank you again for your participation!

First you will be asked your opinions about climate change.

1. Do you think that climate change is happening? (Select One)

_____ Yes

_____ No

_____ Don't know

2. How sure are you that climate change is or is not occurring?

<u>Climate change is not happening</u>				<u>Climate change is happening</u>		
Extremely Sure	Very Sure	Somewhat Sure	Neither	Somewhat Sure	Very Sure	Extremely Sure
: 1	: 2	: 3	: 4	: 5	: 6	: 7 :

3. Assuming that climate change is happening, do you think it is. . . (Select One)

_____ Caused mostly by human activities

_____ Caused by both human activities and natural changes

_____ Caused mostly by natural changes in the environment

_____ None of the above because climate change isn't happening

_____ Other: _____

Below is a list of behaviors that have the potential to minimize the effects of climate change. Please rate how likely it is that you would do each of these behaviors over the next two months. There are no right or wrong answers. We are interested in your honest opinions. (Please circle one number on the scale following each statement)

In the next two months, how likely would you be to take part in a public demonstration against climate change?

Extremely unlikely	2	3	Neither	5	6	Extremely likely
: 1	:	:	: 4	:	:	: 7 :

In the next two months, how likely would you be to become an active member of an organization attempting to stop climate change?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to sign a petition in favor of limiting the emission of carbon dioxide (CO₂)?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to tell a friend about not idling their car?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to purchase renewable energy for your home through your local power company?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to use public transportation at least once a week?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to lower your thermostat by two degrees?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to purchase two locally produced food items each week?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

In the next two months, how likely would you be to support an energy reduction program at your school or place of employment?

Extremely unlikely				Neither				Extremely likely
: 1	:	2	:	3	:	4	:	5
:		6	:	7	:			:

Thank you for your participation in this questionnaire. If you have completed all three questionnaires then you will be entered in a drawing for lift tickets, gift cards and other prizes. If you are selected as a winner then you will be notified via e-mail at the completion of this study.

Thank you again for your participation!