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DAY HIKERS AND BEAR SAFETY: AN ELABORATION PERSPECTIVE ON COMMUNICATION IN YELLOWSTONE NATIONAL PARK

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Day hikers and bear safety: An elaboration perspective on communication in Yellowstone National Park.

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As the National Park Service (NPS) celebrates its 100th year, Yellowstone National Park – the world's first national park - is dealing with a variety of difficult and complex challenges. Human-wildlife conflict has become a flashpoint for these challenges, as increased visitation results in fewer managers dealing with more people in the park. A recent spate of deaths of day hikers in the park due to grizzly bears set further focus on this point. Yellowstone officials realized that effective communication strategies are more important than ever before.

This research was part of a broader project designed to examine the effectiveness of wildlife safety communications for visitors. The purpose of this research was to evaluate and improve the effectiveness of communications regarding bear safety and day hikers in Yellowstone using three theoretical frameworks. The theory of planned behavior helps reveal drivers of rational human behaviors. The elaboration likelihood model, including this research's quantified conceptualization of elaboration, provides an understanding of how to influence the drivers of human behaviors identified by the theory of planned behavior. Lastly, wildlife value orientations help managers understand how to frame interpretive messages to increase the amount of thoughtful processing day hikers use when evaluating bear safety messages. Intercept survey questionnaires were conducted in the park with day hikers on site at two different trails in the summer of 2016. Overall, 777 day hiker groups were intercepted, in which 14 (1.8%) did not speak enough English to participate. From the remaining 763 groups, 647 individuals agreed to complete the survey for a response rate of 85%.

This research sought to merge together two major theories: the elaboration likelihood model and the theory of planned behavior. Using confirmatory factor analysis and structural equation modeling, it improved upon previous research attempting to develop an elaboration scale. Higher levels of elaboration were more predictive of multiple bear safety behavioral intentions. Additionally, elaboration was found to positively influence all the antecedents of bear spray behavioral intentions according to the theory of planned behavior. The effect of elaboration on bear spray behaviors was also partially mediated by the components of the theory of planned behavior. Lastly, visitors with different wildlife value orientations found different types of messages about bear safety more or less relevant. Messages that are identified as relevant by people are likely to increase their elaboration.

Future research should continue to develop and apply the elaboration scale in conjunction with the theory of planned behavior to a variety of contexts. Managers can use these results to understand how their communication strategies are affecting visitor behaviors, and thus improve their communications. Additionally, research should continue to explore how to create communications that visitors find relevant. The goal of this study is to provide insight about the relationship between communication and visitor behaviors in park and conservation area settings and create a transferable framework for a variety of contexts.

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CHAPTER I

Introduction

Many managers of park and protected areas around the world are charged with the difficult task of protecting natural resources while providing for public enjoyment. This balancing act becomes particularly complex as some parks experience record-breaking levels of visitation (NPS, 2017a). The result of this high level of use is that many challenges in park and protected areas are inherently challenges with visitation and human use (Manfredo, 2008). In light of this, managers need efficient and effective tools to help build their capacities for visitor use management.

Park and protected areas have unique managerial conditions as they are commonly in large wilderness landscapes, have relatively few staff, and seemingly ever-challenging budgets. The result of this is that direct management techniques (i.e. enforcement, rationing, banning, etc.) are sometimes impractical. Additionally, over-regulation and restriction can hinder some of the social values associated with large wilderness parks, and visitors often prefer indirect management (like communication) to resolve issues (Manning, 2003; 2011). The collective result of this is that indirect, "soft-handed" management techniques, like communication, have been an important part of fulfilling many protected areas' dual mandate of providing for enjoyment while protecting resources.

The human-centered interests in park and protected area management has led to lines of inquiry focusing on how people relate to, what they think about, and how they behave in their natural environment (Teel, Dietsch, & Manfredo, 2015). With an intense interest in human behavior in the specific context of the protected area environment, much research has drawn on theories regarding human behavior that are rooted in social psychology (Teel et al., 2015). In

relation to communication as a management tool, two theories are often relied upon in park and protected area management: the theory of planned behavior (Ajzen, 1991) and the elaboration likelihood model (Petty & Cacioppo, 1986).

The theory of planned behavior (TPB) (Ajzen, 1991) has been used to model human behavior by a variety of different research areas, including human dimensions of natural resources. This theory posits that human behavioral intentions are predicted by attitudes towards a behavior, subjective norms associated with the behavior, and perceived behavioral control in performing the behavior. Although this theory provides us with an understanding of the components that indicate *why* people intend to behave, it does not explain *how* to influence those components.

Around the same time as TPB was beginning to form, other researchers focused on the *process* of attitude change. An example of a theory focusing on the process of attitude change (persuasion) through communication is the elaboration likelihood model (ELM) (Petty & Cacioppo, 1986). ELM suggests that attitude change occurs by receiving and processing information through either a central or peripheral route, with the central route being indicative of long-lasting attitude change. Importantly, this change in attitudes may lead to an increase in appropriate behaviors (Ajzen, 1991). ELM has been used to construct and frame communication in a few protected areas, but empirical evidence regarding the process of elaboration is only beginning to emerge (Vezeau et al., 2015). The emerging research shows that higher levels of elaboration (defined as interest, awareness, and cognitive engagement) are indicative of the central route of processing and have a strong relationship with intended behaviors (Vezeau et al., 2015).

Juxtaposing TPB and ELM, TPB is descriptive and shows us where we can influence behavioral intentions. ELM on the other hand, attempts to influence these points to change behavior in an intended direction. Although these two concepts are sometimes discussed together, this research seeks to join these two theories together in an empirical fashion. According to the theoretical foundations of ELM, higher levels of elaboration should have an influence on attitudes. Situated within TPB, this could lead to desired behavior change. Additionally, park visitors are diverse and likely have multiple, differing beliefs and interests about any particular subject. Therefore, a meaningful simplification of park visitors can help to understand how to increase elaboration levels. Value orientations have been successfully used to segment people into groups based on basic beliefs structures. It is proposed in this research that these value orientations will demonstrate that different types of messaging about a subject are more or less relevant to respondents. As the elaborative central route depends on interrupting heuristic processing by making content relevant, people with different value orientations may have different levels of elaboration depending on the relevancy, or importance, of the messages provided. To further explore the concepts described above, this dissertation focuses on bear safety communication in Yellowstone National Park.

Background

Study site

Yellowstone National Park (YNP), the world's first national park, may be one of the world's most well-known parks. Located in a relatively remote area of the western United States and spanning three states (Idaho, Montana, and Wyoming), YNP is a destination for about 4 million people annually (NPS, 2017b). Even with YNP's expansive 2 million acres of recommended wilderness (NPS, 2017c), this high level of visitation requires intensive

management in some parts of the park to conserve YNP's resources unimpaired (Manning, 2011).

Part of YNP's draw is the uniqueness of the geological, historical, and biological resources that provide a basis for outstanding recreational pursuits in the park. Geologically, YNP is exceedingly unique. With over 500 active geysers in any given year (and possibly 700 total), YNP contains over half of the *world's* geysers; this means there are more geysers inside of YNP's boundaries than in the rest of the world combined (Bryan, 2008). Additionally, as the world's first national park, YNP contains rich historical resources that are unique to the area (Runte, 2010). Yellowstone National Park also offers outstanding wildlife viewing opportunities, specifically for megafauna. As wildlife viewing continues to grow in the U.S. (U.S. Department of the Interior [U.S. DOI], U.S. Fish and Wildlife Service & U.S. Department of Commerce, U.S. Census Bureau, 2011), enthusiasts may find YNP a perfect environment. In fact, one of the main reasons people visit national parks in the U.S. is to view wildlife (Manfredo, 2008). Yellowstone National Park possibly provides the best and most unique opportunities in the contiguous United States for viewing bears (*Ursus artcos & U. americanus)* (Richardson et al., 2014), wolves (*Canis lupus)* (Montag, Patterson, & Freimund, 2005), elk (*Cervus elaphus*), and large herds of wild bison (*Bison bison)* among many other species. However, with millions of visitors annually and large, free-roaming wildlife species, conflict is bound to occur between humans and wildlife in YNP.

Wildlife safety in Yellowstone National Park

Although recreationists have notable deleterious impacts on wildlife (Boyle & Samson, 1985; Gunther et al., 2004; Markegard, 2014), the focus of this section is on the negative impacts of wildlife to visitors. Undoubtedly, the vast majority of human-wildlife interactions result in a

positive outcome for people (Markegard, 2014; Montag et al., 2005). However, visitors are injured by wildlife every year at YNP. Statistically, the most dangerous species of wildlife in YNP are bison, which injure about 3.95 people per year (Olliff & Caslick, 2003). Nearly all bison incidents in YNP have occurred in developed areas and are likely a result from visitors approaching bison at too close of a distance (Olliff & Caslick, 2003). This has resulted not only in human injuries, but also fatalities (Olliff & Caslick, 2003). Incidents with elk also occur annually, especially around the Mammoth area of YNP (Olliff & Caslick, 2003). Curiously, incidents with coyotes (*Canis latrans)* that result in human injury have also been prevalent (less than annually however), mostly due to humans feeding or approaching them (Olliff & Caslick, 2003). Few or isolated incidents (with no fatalities) have also been reported with red foxes (*Vulpes vulpes),* pine martens (*Martes americana),* moose (*Alces alces)*, mountain lions (*Puma concolor*), common ravens (*Corvus corax)*, and ground squirrels (*Spermophilus* spp.) (Olliff & Caslick, 2003).

Statistics aside, people often perceive grizzly bears as the most dangerous species of wildlife in YNP (Olliff & Caslick, 2003). There is some merit to this argument, as grizzly bear-human conflicts are more likely to result in death when compared with other species in YNP. Grizzly bear-human incidents occur at a rate of about 1 per year in the backcountry and about 0.1 per year in developed areas (NPS, 2017d). Although incidents with grizzly bears have been decreasing over the last few decades, three deaths occurred in YNP between 1963 and 1999 due to grizzly bears (Olliff & Caslick, 2003). More recently in 2011, two park visitors were fatally injured by grizzly bears in two separate incidents in YNP (NPS, 2017d). In 2015, an additional person was killed by a grizzly bear in YNP (NPS, 2017d). Unlike bison, an overwhelming number of grizzly bear-human incidents occur in the backcountry (Olliff & Caslick, 2003). It is

also worth noting that bears involved in human-bear incidents are more likely to die due to human causes (Gunther, et al., 2004).

Managers at YNP have had a specific interest in evaluating their bear safety efforts since the recent deaths due to grizzly bears since 2011. Due to the rate of incident with backcountry users (NPS, 2017d), a focus has been set on this group. However, there are two types of backcountry users in YNP: overnight users and day hikers. In YNP, overnight users have a mandatory contact point with rangers to pick up their permit. These overnight users are notified of closures, hazards, and are also required to view a video regarding bear safety in YNP. Unlike overnight users, day hikers have no mandatory point of contact and are probably less experienced than overnight users in the backcountry. There is also no information regarding how many people are day hiking in YNP's backcountry (NPS, 2017d), although it is almost certainly higher than overnight users. Due to their relatively high-risk, high use numbers, inexperience, and lack of mandatory contact, there is specific concern about bear safety behaviors of day hikers in the backcountry. Additionally, the three deaths since 2011 have all occurred to day hikers in YNP's backcountry.

Managers at YNP have developed numerous communication resources to try and persuade backcountry day hikers to engage in bear safety behaviors. These resources include the park newspaper, interpretive talks, pamphlets, the park website, social media posts, signs (in restrooms, at trailheads, at the entrance, in campgrounds, etc.), tabletop notifications in restaurants, and maps. However, these resources are often developed from atheoretical perspectives and may not be as effective as a theory-driven approach to communication about bear safety. By using a theory-driven approach to communication about bear safety with day

hikers, YNP may be better able to experiment with and refine messages, protect park resources, and provide enjoyment for visitors who experience the backcountry.

Paradigmatic approach

Paradigms stem from shared normative commitments relating to epistemology, axiology, and ontology. Although in many other sciences (such as physics, chemistry, and biology) there is often widespread agreement about these normative commitments, the same cannot be said for the social sciences (Kuhn, 1970). In fact, Kuhn (1970), who is widely regarded as popularizing the idea of paradigm shifts in the sciences, believed that paradigms in the social sciences are *not appropriate.* The social sciences, compared to the natural sciences, do not have the same kind of agreement about normative commitments, and therefore the idea of paradigms in the social sciences does not make sense from Kuhn's perspective. In fact, it was this level of agreement in the natural sciences (and the juxtaposition of that agreement with the disagreement in the social sciences) that prompted Kuhn (1970) to write *The Structure of Scientific Revolutions*. To Kuhn (1970), a paradigm is something that separated the social and natural sciences.

Most social scientists do subscribe to some type of paradigm, even though it is not crafted after Kuhn's original vision. For social scientists, a paradigm is a convenient way to describe how individual scientist views the world. In light of this, it is hard to argue that one paradigm is right and another is wrong in the social sciences. However, some paradigms can be more or less useful for a particular situation. In the applied field of conservation social science, the issues addressed range widely, and the same paradigm cannot be used with equal success across all issues. Due to this, conservation social scientists should strive to be pragmatists when approaching their research. They should be able to choose the paradigm that best addresses the

issue they are dealing with. In conservation social science, paradigms should be chosen to best address the issue at hand.

However, individual scientists often have biases towards paradigms. This can lead us to choosing issues and topics that lend themselves well to our favored paradigm. This research is approached from a post-positivism paradigm. Post-positivism suggests that there is some form of "true" reality, but that we can never know it perfectly and we will always be somewhat incorrect because of this. Due to this line of thinking, much of the emphasis is on theory falsification in a post-positivist paradigm instead of theory verification (Popper, 1968). However, like positivism, post-positivism focuses on prediction of phenomenon, adopts a nomothetic perspective, and expects researchers to remain as objective as possible (Ponterotto, 2005). Post-positivism commonly adopts quantitative methods to meet the normative commitments stated above.

A last additional note about post-positivism in conservation social sciences is that it is often an appropriate paradigm choice when working with other scientists. Specifically when working with natural scientists, the normative commitments of the post-positivist paradigm can act as a shared language between natural scientists and conservation social scientists. This is particularly important, as a lack of a shared language has been identified as one of the most impactful barriers to the integration of social science in conservation (Fox et al., 2006). By using a post-positivist paradigm, the social-ecological frameworks we strive for become more achievable.

Literature Review

Elaboration likelihood model

The ELM is one of the most commonly used persuasive communication theories (Teng, Khong, & Goh, 2014). The ELM states that there are two routes to persuasion: the central and

the peripheral routes (Petty & Cacioppo, 1986) (Figure 1). The central route of persuasion tends to be taken by people who are motivated and able to process a message and results in a logical, careful processing of a message, which is where the term "elaboration" comes from (Petty & Cacioppo, 1986). However, if people are unmotivated, unable, or unwilling to engage is such careful consideration and thoughtful processing, the peripheral route of persuasion may be more effective in changing attitudes (Petty & Cacioppo, 1986). Unlike the central route, where message content plays a major role in persuasion (Petty & Cacioppo, 1986), the peripheral route of persuasion relies on subtle and often subconscious cues. Variables like the number of arguments in a persuasive message, the authority from which the message comes from, and the conditions under which the message is presented are more important for the peripheral route to persuasion (Petty & Cacioppo, 1986). Although the routes are presented as a dichotomy, it is likely that people use both (in varying levels) to process a message (Petty, Wegener, & Fabrigar, 1997).

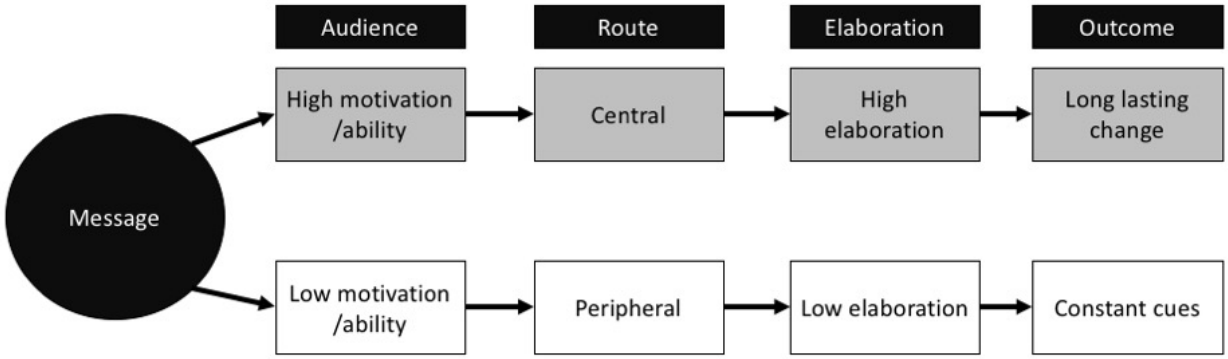

Figure 1: Elaboration likelihood model (Kenrick, Neuberg, & Cialdini, 2002; Petty & Cacioppo, 1986).

Persuasion in the ELM is about changing attitudes towards a specific object. This persuasion towards a desired attitude can occur through either the central or the peripheral route.

However, there have been some notable differences between the two approaches. Although peripheral routes to persuasion can be effective for a short period of time, attitude changes that result from this route tend to be "less accessible, persistent, and resistant to subsequent attacking messages..." (Petty, McMichael, & Brannon, 1992, p.82). Central routes of persuasion tend "to be relatively accessible, persistent over time, predictive of behavior, and resistant to change…" (Petty et al., 1992, p. 81) due to higher levels of elaboration.

The ELM in park and protected area management has been used as a conceptual framework for understanding how messages are processed, although some studies using TPB have included sections discussing ELM (Reigner et al., 2009). Most of the attention that ELM has received in park and protected area management has come from the field of interpretation (Ablett & Dyer, 2009; Brown et al., 2010; Ham & Krumpe, 1996; Ham et al., 2008; Lackey & Ham, 2003; Vezeau, 2014). Introduced originally to the field of park, recreation, and tourism management as a useful theoretical framework by Petty et al. (1992), it was soon picked up by other professionals within the field. Ham and Krumpe (1996), researchers who focused on environmental interpretation, were early adopters of the theoretical framework.

One of the more thorough uses of ELM in the United States in a conservation social science setting was during a series of studies in Yosemite National Park regarding food storage and American black bears. The assessment of communications used to address the food storage behaviors of overnight visitors to Yosemite National Park was a major focus of these studies (Lackey & Ham, 2003). The research found that visitors were subjected to over 600 persuasion attempts and that visitors were receiving information about food storage (Lackey & Ham, 2003). However, this higher level of knowledge did not result in higher compliance with the policies regarding food storage in Yosemite National Park (Lackey & Ham, 2003). The authors leave the

reader with a message in the final paragraph for future research needs: "…we need to better understand the link between message content and design, and visitors' processing of and compliance with those messages" (Lackey & Ham, p. 37). In other words, how do we increase elaboration?

Ham et al. (2008) began to explore the relationship between communication, elaboration, and visitor compliance in research undertaken in Australia. The elaboration likelihood model, in addition to TPB, served as a theoretical framework for their studies. The behaviors of interest were to persuade walkers in a park to pick up trash, persuade visitors to not feed birds, and to get people to keep their dogs on a leash (Ham et al., 2008).

The series of research projects by Ham et al. (2008) are unique. They targeted salient beliefs, measured these beliefs between compliers and non-compliers, implemented a strategic communication strategy, and measured its effects in the form of observed action and salient beliefs after an exposure to a persuasion attempt. ELM and TPB were the frameworks that the persuasive strategies were crafted around (Ham et al., 2008). Importantly, these research projects used a quasi-experimental design to observe real-world effects of persuasion strategies (although questionnaires were also administered after the observation period).

The important part of Ham et al. (2008) and Lackey and Ham's (2003) research is that it provides some empirical evidence of the effect of ELM in park and protected area management. Specifically for the research in Australia (Ham et al., 2008), the design and focus on ELM provided new insights in how to persuade visitors to park and protected areas. However, much of the body of research focused on the relationship between messaging, beliefs, and behaviors. Ham et al. (2008) implied that a change in beliefs could infer that either a central route (change in beliefs occurred) or a peripheral route (change in beliefs did not occur) was used in persuasion.

A better measure of effectiveness in ELM may be looking at elaboration as a continuous, quantifiable concept instead of a dichotomous route.

In research sponsored by Toyota and Friends of Great Smoky Mountain National Park, ELM was used to evaluate the effectiveness of a junior ranger program in influencing environmental stewardship behaviors not only within the park, but also at home (Vezeau, 2014). A major contribution of this research was the operationalization of the missing component for ELM: elaboration. The research argued that elaboration is a quantifiable, multi-dimensional concept consisting of interest, awareness, and cognitive engagement as suggested by theory (Petty & Cacioppo, 1986). Developing indicators to measure each dimension of the construct, the research found robust evidence that elaboration can be measured (Vezeau et al., 2015). In addition, elaboration was highly predictive of behavioral intentions making it a useful framework for communication. Lastly, by measuring elaboration as a continuous variable, it removes the "either/or" dichotomy of the peripheral or central route, and places elaboration on a continuum. A continuum of elaboration is more realistic and theoretically sound than a dichotomous perspective (Petty, et al., 1997). Viewing elaboration on a spectrum changes the question from *if* elaboration was engaged to *how much* elaboration was engaged.

The research specified here seeks to quantify the concept of elaboration regarding bear safety while hiking in YNP by adapting the constructs and improving the model presented by Vezeau et al. (2015). Following theory and concepts in the literature, Vezeau et al. (2015) conceptualized elaboration as interest, awareness, and cognitive engagement. However, measurement issues presented themselves during the research. A particular challenge with the research was that awareness displayed little variance and was dropped from the full model, leaving cognitive engagement and interest as the sole dimensions of elaboration. Although still

predictive of intended behaviors, elaboration as measured in the study was missing an important theoretical component as originally conceptualized.

Relevancy and elaboration.

Research in social psychology concludes that most decisions people make are based on peripheral route processes and not the elaborative processing that much research is based on (Bargh & Chartrand, 1999). The reason for this is that people have a limited capacity in their ability to centrally process information like a persuasive message (Bargh & Chartrand, 1999; Gilbert, Pelham, & Krull, 1988). People reserve their cognitive processing capacity for situations where it would be most important.

How can managers interrupt the commonplace peripheral processing of visitors to encourage central route processing of information and messages? Both the ELM as outlined by Petty and Cacioppo (1986) and Ham's (2013) approach to persuasive communication indicate that the relevancy of a message is a key prerequisite for elaboration to occur. Relevant messages would be considered more important and therefore more likely to be elaborated upon by visitors. In sum, relevancy increases motivation for people to process messages using higher levels of elaboration.

Relevancy has been defined in different ways when it comes to persuasion research. Early research in social psychology defined relevancy as ego involvement (or issue involvement) (Petty & Cacioppo, 1979). Ego involvement occurs when people are personally affected by something. For instance, a new recycling program in your neighborhood would have a higher level of ego involvement than a recycling program in a different neighborhood. Higher levels of ego involvement have been shown to lead to higher levels of elaboration (Petty & Cacioppo, 1979). Some researchers have also defined relevancy as how important a message is to an

individual (Pratkanis & Greenwald, 1993). This same research found that when there are many different messages to choose from, people first scan a message for its importance before further pursuing it. Research in online marketing has applied this idea to develop the concept of preference matching, where elaboration likelihood is higher if information is appealing to an individual (Tam & Ho, 2005). This is similar to importance, where information is presented that has been determined to be important to an individual. In this research, relevancy follows lines of research that define it as how important a message is to hikers. Regardless of how relevancy is operationalized, it is usually considered the "why" portion of the message, as opposed to the "what" portion of the message. For instance, most bear safety messages in YNP say that bears are dangerous (why) and describe what people can do about this (what). The importance of messages should not be overlooked, as it is a prerequisite for elaboration to occur.

The theory of planned behavior

Perhaps no theory of human behavior has attracted as much attention as the theory of planned behavior (TPB) (Ajzen, 1991). An updated version of the earlier theory of reasoned action (Ajzen & Fishbein, 1980), TPB has proved to be useful in predicting the behavioral intentions (an antecedent of actual behavior) of humans regarding social behaviors (Madden, Ellen, and Ajzen, 1992). According to TPB, behavioral intentions can be predicted by attitudes towards a behavior, the subjective norms about performing a behavior, and a person's perceived behavioral control (Ajzen, 1991). Attitudes are a positive or negative evaluation based on a person's beliefs about the outcomes of performing a particular behavior (Ajzen, 1991; Ajzen & Driver, 1991). For instance, someone may have positive attitudes about hiking because they believe it will reduce their stress. People tend to form attitudes about nearly everything (Briñol, Petty, & Wheeler, 2006). Subjective norms are the group-level influence and often help establish

how appropriate a behavior is in a setting (Teel et al., 2015). For example, although someone may desire to go hiking by him or herself in grizzly bear country, they know other hikers, rangers in the park, or their family would disapprove of the behavior. Perceived behavioral control is a person's belief that they are able to perform a certain behavior. An example of this would be where a person has positive attitudes towards bear-spray and expresses favorable subjective norms, but they are not able to find bear-spray or buy bear-spray (due to cost).

Early use of TPB in fields related to the conservation social sciences tried to predict participation in recreation activities (Ajzen & Driver, 1991). This research found the TPB model to be quite successful. Further research became more specific and applied. TPB has been applied successfully to hunting participation (Hrubes, Ajzen, & Daigle, 2001), use of bear canisters in Yosemite National Park (Martin & McCurdy, 2009), cattle rancher's management of wildlife (Willcox, Giuliano, & Monroe, 2012), and deer hunting in Oregon (Shrestha et al., 2012) among others. Although not true in every study (see Shrestha et al., 2012), attitudes and subjective norms tend to be the best predictors of behavioral intentions, especially in wildlife related research (Willcox et al., 2012).

In contrast to TPB, ELM allows us to understand how to influence attitudes, which in turn are predictive of behavior (Ajzen, 1991). ELM is a communication theory, focusing on a message and the process of how it influences attitude change. TPB is more descriptive and shows us what factors contribute to a behavior and potential leverage areas where the behavior can be influenced (Ham, 2013). Both theories agree that attitudes are one of the strongest predictors of behavior (Ajzen, 1991; Petty & Cacioppi, 1981). In fact, attitudes are used as a stand-alone predictor of behavioral intentions in some conservation social science studies (Pate et al., 1996; Vaske & Donnelly, 1999). One can imagine the model of ELM flowing into TPB, where the

persuasive argument, most likely via the central route, connect to the attitudes in TPB, with stronger attitudes guiding behavior towards a favorable action (Krosnick & Petty, 1995).

Wildlife value orientations

Value orientations are a part of the cognitive hierarchy, which is sometimes referred to as the value-attitude-behavior hierarchy (Homer & Kahle, 1988; Kluckholn, 1951) (Figure 2). Understanding the cognitive hierarchy helps researchers develop ideas about how people relate to their environment (Vaske et al., 2001). From the bottom to the top of the inverted pyramid these hierarchical levels are values, value orientations, beliefs, attitudes and norms, behavioral intentions, and actual behavior. Each level influences and interacts with the next. Values tend to be few, abstract, widely shared by individuals in a culture, stable across situations, and relatively resistant to change (Fulton, Manfredo, & Lipscomb, 1996; Rokeach, 1973). Beliefs are domain specific and relate to a specific topic, like national parks or wildlife. Patterns of beliefs, both in direction and strength, comprise a value orientation.

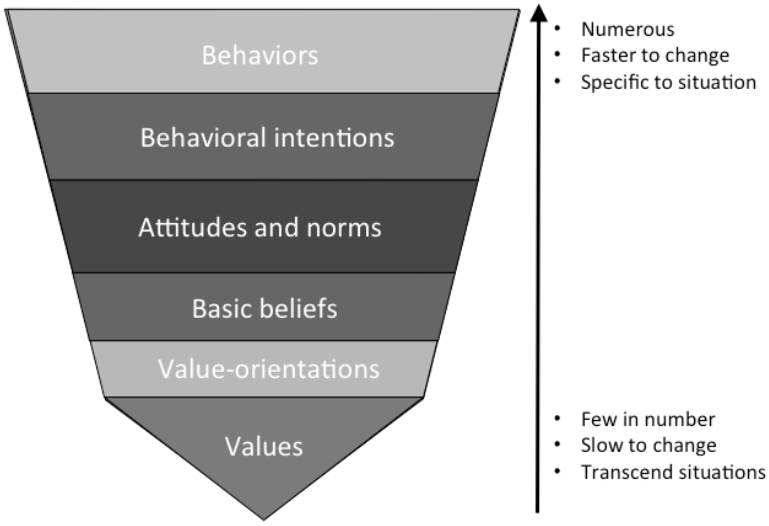

Figure 2: Cognitive hierarchy adapted from Vaske & Donnelly (1999).

Value orientations have proven useful as they help explain variation in attitudes, subjective norms, and behavioral intentions (Fulton et al., 1996; Whittaker et al., 2006). Value orientations also give meaning to abstract values (Manfredo & Dayer, 2004). As explained by Manfredo, Teel, and Zinn (2009), "…two different people might hold with equal importance a value related to humanitarian treatment of all living things. Yet this value might motivate one person to kill an injured animal quickly and another person to attempt to save its life. The difference is rooted in how the value is oriented" (p.38). As detailed above in the TPB, attitudes are a positive or negative evaluation of a subject or object based upon a person's beliefs about the outcome of the attitude subject (Ajzen, 1991). Norms are social or group-level influences that help people determine how appropriate something (like a behavior) is in a particular context (Teel et al., 2015). Behavioral intentions are a close antecedent to actual behaviors (Ajzen, 2001).

Although value orientations have been used in a variety of contexts in conservation social science (i.e. Borrie & Freimund, 2002), research regarding wildlife value orientations (WVOs) is by and far the most well-developed and applied. WVOs were originally developed by Fulton et al. (1996). In this research using Colorado residents, they measured basic beliefs about wildlife and used confirmatory processes to identify WVOs, and then validated WVOs within the context of the cognitive hierarchy. Eight different belief dimensions were identified, including wildlife use, wildlife rights, recreational wildlife experience, bequest and existence, hunting/anti-hunting, residential wildlife experience, wildlife education, and fishing/anti-fishing. These eight different belief dimensions underwent a principal components analysis with varimax rotation and exposed two different value orientations: wildlife benefits/existence and wildlife rights/use. Both WVOs proved useful in predicting attitudes towards wildlife viewing, as suggested by the cognitive hierarchy.

Since Fulton et al.'s (1996) original article, WVOs have resulted in an abundance of research. Hunters, wildlife viewers, and general outdoor recreationists were shown to have different WVOs (Hrubes et al., 2001). Wildlife value orientations have also been useful in predicting what kind of recreational activities someone participates in (Fulton et al., 1996). Additionally, WVOs can influence an individual's support, attitudes, and intentions for wildlife related management actions (Bright, Manfredo, & Fulton, 2000; Manfredo et al., 1999). More severe responses to wildlife are associated with people who have a utilitarian value orientation (Manfredo, Teel, & Bright, 2003; Perry-Hill et al., 2014). Wildlife value orientations are also valuable for understanding human relationships with wildlife in a global context (Manfredo & Dayer, 2004).

It is also worth noting that WVOs in some locations in the U.S. are gradually shifting away from the idea that wildlife exists for human use and enjoyment (Manfredo et al., 2003). Part of the reason this shift may be occurring is due to the rise of post-materialist values in the U.S., which in turn is driven by increasing urbanization (Inglehart, 1997; Manfredo et al., 2003). Areas with higher incomes, higher levels of education, and urban areas were associated with shifts away from utilitarian WVOs (Manfredo et al., 2003). Some research is beginning to suggest that this change is also happening on a global scale as developing nations begin to obtain more security (Miller et al., 2016).

Recent research has refined and improved the measurement and terminology associated with WVOs, including the incorporation of qualitative research (Deruiter & Donnelly, 2002; Jacobs, Vaske, Sijtsma, 2014; Manfredo, Teel, & Henry, 2009; Teel & Manfredo, 2009). According to the refined WVO research there are two value orientations: mutualism and domination. Mutualism is measured by two different belief dimensions: social affiliation and

caring. Domination is also measured by two different belief dimensions: appropriate use and hunting. These two different WVOs (mutualism and domination) can be used to further segment groups of people into four discreet typologies: traditionalists (high domination, low mutualism), pluralists (high domination, high mutualism), mutualists (high mutualism, low domination), and distanced (low mutualism, low domination). Proportions of the four typologies also vary from state to state (Teel & Manfredo, 2009).

The mutualism-domination WVOs spurred new research in the conservation social sciences. In the U.S., WVO typologies showed significant differences and levels of agreement regarding a variety of topics related to hunting, logging, private property rights, and predator management (Teel & Manfredo, 2009). International research was also conducted under this WVOs framework. In Germany, WVOs were predictive of support for reintroduction of bison and the migration of wolves in Germany (Heremann, Voß, & Menzel, 2013). Additionally, WVOs were also predictive of support for lethal control of agriculturally harmful wildlife species, like geese and deer, in the Netherlands (Sijtsma, Vaske, & Jacobs, 2012). The refined WVO measures appear to be theoretically and empirically robust instruments for understanding the relationship between humans and wildlife.

Wildlife value orientations can play an important role in park and protected area management, like in the national parks of the United States. Wildlife viewing opportunities are one of the top reasons people visit national parks (Manfredo, 2008). However, wildlife-human interactions in protected areas can also lead to conflict. Some of this conflict, specifically from large carnivores, can be a serious threat to people (Woodroffe & Ginsberg, 1998). Additionally, wildlife-human conflicts are often driven by human behaviors and are more common in and

around protected areas (DiStefano, 2005). Understanding how people relate to wildlife (through WVOs) in a protected area can help address wildlife-human conflicts (Teel et al., 2010).

One way that WVOs can be used in protected areas to address human-wildlife conflict is through targeted messaging. Audience characteristics play an important role in persuasive communication (Hall, Ham, & Lackey, 2010), and WVOs can help identify differences in an audience regarding wildlife. It is likely that visitors with different WVOs will find different types of "why" messages relevant (Bright et al., 2000). Because of this, messages should be crafted to address the different types of relationships visitors have with wildlife (Hermann et al., 2013). This may have multiple benefits, including the incorporation of different perspectives and greater success in persuasion (Hermann et al., 2013).

Bear safety behaviors

For this research, bear safety behaviors are behaviors recommended by YNP that visitors can adopt to increase their physical safety while hiking. Although these behaviors can be very similar among different types of bear species (like between black bears and grizzly bears), there are also some differences among these behaviors in regards to species. For instance, while carrying and knowing how to use bear-spray is recommended in areas where brown (grizzly) bears are present (NPS, 2017e), this is usually not recommended in areas where only black bears are present. In fact, in some areas where black bear and human interactions are common (like the national parks of the Sierra Nevada Mountains of California, e.g. Yosemite National Park) it is *illegal* to carry bear spray (NPS, 2017f).

Currently in Yellowstone National Park, grizzly bears injure more people than black bears (NPS, 2017d). Additionally, all of the recorded fatalities that resulted from a bear attack in YNP have been attributed to grizzly bears (one bear was of an unknown species) (NPS, 2017d).

For this reason, the bear safety messaging at YNP focuses on behaviors more specific to grizzly bears. However, as stated earlier, much of the bear safety behaviors overlap in regards to species.

Bear safety behaviors can broadly be described in two categories: avoidance and defense. Avoidance is by far the best way to reduce the risk of a negative bear-encounter. Avoidance includes things like making noise while hiking, traveling in groups of 3 more (which may make you louder and more noticeable), watching for signs of bears, avoiding dawn/dusk hiking, and proper food storage (NPS, 2017g). Defense bear safety behaviors are used when avoidance fails. Defense behaviors include not running, using/carrying bear-spray, and playing "dead" if a bear does make contact (NPS, 2017h).

Bear spray has received a considerable amount of attention regarding bear safety for day hikers. This is likely because bear spray has been shown to be very effective in deterring an aggressive bear. This includes both black and brown bears, but seems to be particularly effective for deterring aggressive brown bears (Herrero & Higgins, 1995). Yellowstone National Park communications feature bear spray prominently in much of the materials. An example of this is the tabletop information signs that are found in many park concession restaurants (Figure 3).

Figure 3: Tabletop bear spray message at YNP

Conceptual model

To illustrate the connections between WVOs, TPB, and ELM, a conceptual model that fuses the theoretical framework presented in the literature review is displayed below (Figure 4). In this conceptual model, messages that match people's WVOs will be identified as more important, increasing their elaboration likelihood. In turn, higher levels of elaboration would have a positive impact on the TPB components (e.g., attitudes, subjective norms, and perceived behavioral control). The components of the TPB would then have a positive impact on behavioral intentions. Collectively, the conceptual model provides an understanding of how the theoretical frameworks works together to create better communication strategies.

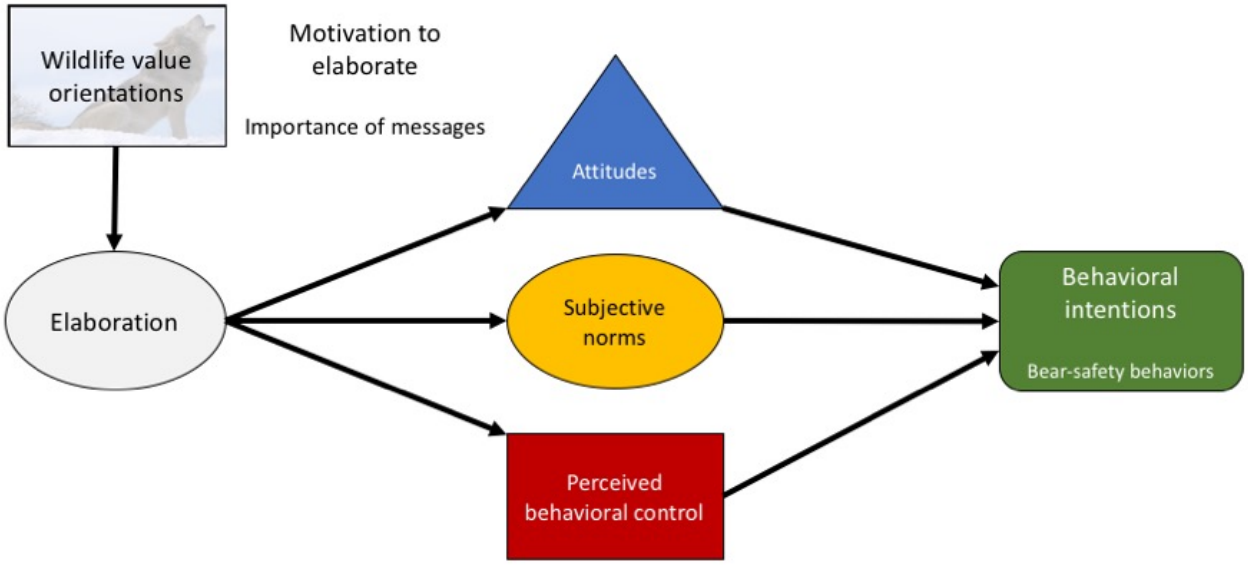

Figure 4: Conceptual model of theoretical framework

Problem statement

Communication plays an important role in managing park and protected areas. Communications generally take form as a persuasive attempt to encourage visitors to engage in appropriate behavior. However, many decisions about communications in protected areas are made from an atheoretical perspective and instead rely on "institutional formats or styles, or on

the basis of staff intuition about what will 'work'" (Hall et al., 2010). Additionally, many assumptions are made about the relationships between persuasion and behaviors without empirical evidence. If persuasive communication continues to play an important role in park and protected area management, it is essential to establish a theoretical basis that allows managers of park and protected areas to understand how they can effectively persuade visitors to engage in appropriate behaviors, evaluate effects of messages, and improve communication.

Purpose statement

The purpose of this dissertation is to understand the relationship between persuasive communication and visitor behaviors in park and protected areas. Specifically, this dissertation relates to bear safety in YNP. The purpose is addressed in three different ways: 1) by defining a bear safety elaboration and intended bear safety behaviors scale and examining their relationship, 2) by merging ELM and TPB to understand how behavior is impacted, and 3) by determining the relevancy of different messages to park visitors with diverse WVOs.

Through these different undertakings, this dissertation can contribute to the greater conservation social science field by:

1. Confirming an elaboration scale in a different context than originally constructed.
2. Empirically linking two related theories (ELM and TPB) in park and protected area management in a novel way to understand *how* to influence behaviors.
3. Describing wildlife value orientations in a national park context.
4. Advancing the idea of relevancy in messaging to a diverse population of visitors.

To specifically address the applied management concerns of YNP, this dissertation can:

1. Develop a tool for assessing different communication strategies.
2. Increase persuasion of visitors to engage in appropriate behaviors.

3. Decrease the need for additional direct management approaches.
4. Provide an understanding of a diversified approach to communication.
5. Guide communication approaches towards including more "why" in addition to "what" messages.
6. Increase persuasion effectiveness by incorporating more relevant content to visitors.

Limitations

One assumption being made is that visitors have been exposed to some kind of persuasive communication. There is ample evidence for this assumption, however. Lackey and Ham (2003) showed that visitors were presented with over 600 non-personal persuasion attempts about food storage in Yosemite National Park. Additionally, visitors were able to recall some of these messages. It is assumed that this is also true for visitors at Yellowstone National Park regarding bear safety.

With smartphones, social media, and other digital resources, park managers are becoming less able to control the messages that they find important. This dissertation focuses on improving YNP's communications with visitors. However, park visitors may be turning to non-NPS resources for information as well. These non-NPS sources are not evaluated in this study, but may have significant influences on visitors regarding bear safety.

The influence of past experiences with bears is not measured in this study. For instance, if someone has had a close, negative encounter with a bear before, this may alter his or her answers on the survey instrument. It is unlikely that these people represent a high proportion of respondents.

Due to limitations of time, funding, and staff, sampling could only occur at two different trailheads in the park. These trailheads were selected as a sampling frame to represent YNP day

hikers. The two trails selected for sampling are Lonestar Geyser trail and Mount Washburn. Although no official use numbers exist, these backcountry trails see anecdotally moderate levels of use by day hikers. One trail, Lonestar Geyser, also shares use with overnight hikers and bicyclists. However, the hikers on these trails may not be representative of all hikers in the park. Therefore, generalizations need to be made cautiously when using the results from this research.

Wildlife value orientations provide a useful framework for understanding how park visitors differ in their relationships with wildlife. However, there is no way (without measuring) to identify visitors based on their WVOs. This may make matching the message with the audience difficult for park managers. However, some research has shown that presenting people with a diversity of messages may be beneficial, as they are exposed to different perspectives (Hermann et al., 2013).

The global indicators used to measure the components of the TPB in this research are limited in their usefulness to understand what drives a person's attitudes, subjective norms, and/or perceived behavioral control. The expectancy-valence model of the TPB (Ajzen & Driver, 1991) would provide more information about what may influence people's attitudes, subjective norms, and/or perceived behavioral control. This understanding may provide additional insight about how to influence visitors' behaviors (Ham, 2013). However, measuring TPB components according to the expectancy-valence measures would make the survey instrument unnecessarily burdensome to participants.

One assumption in many structural equation modeling (SEM) approaches to research is that the relationships in the model are recursive (linear). That is that elaboration influences attitudes, and that attitudes do not in return influence elaboration. A counter example to this (support for a non-recursive model) is that people with more positive attitudes may then

elaborate on a subject more. Although it is likely that these relationships exist, accounting for them is outside of the scope of this study. Future research may find value in exploring the non-recursive relationships between the variables presented.

The paradigmatic approach to this research provides some limiting factors as well. The models used in this research assume some kind of cause and effect between variables. Although this may be supported for consolidated data, the problem of "the average hiker who does not exist" is likely to be apparent. The relationships supported by the model may not generalize to the individual, and the subjective experiences of people are not incorporated in this model in a meaningful way. Qualitative research may reveal new meanings and information about people's relationships with wildlife and how that translates to behaviors in a park and protected area context.

Even with the noted limitations above, I believe the model presented to be appropriate for this dissertation. Providing evidence regarding the use of theoretical framing of persuasive messages in park and protected areas can further research efforts as well as improve management. Additionally, understanding how to appeal to visitors' relationships with wildlife may help increase the relevancy of messages. This study is only a step in understanding the role of elaboration in interpretation in park and protected area management.

Dissertation structure

This dissertation is organized in a three article format. Each of the chapters following this one is designed to be an independent academic article. Due to this formatting, each chapter will have its own sections (i.e. literature review, methods, analysis, results, etc.). The fifth chapter, following the three articles, discusses the three articles together. Due to the structure of this dissertation, each manuscript will contain its own references, tables, and figures section. There

will also be a references section that contains all references towards the end of this dissertation. An outline of the articles is presented below.

Article One (Chapter II)

This article is titled *Measuring elaboration and evaluating its influence on behaviors.* It uses confirmatory factor analysis to develop a scale for bear safety elaboration, as well as principal axis factoring to develop a bear safety intended behaviors scale. Structural equation modeling is then used to assess the predictive validity of the bear safety elaboration scale and ensure it is a useful instrument.

Article Two (Chapter III)

This article is titled *An empirical model of elaboration's influence on the theory of planned behavior.* It merges two theories together (ELM and TPB) through structural equation modeling. This article will explore the relationship between the drivers of behavior according to TPB (e.g. attitudes, subjective norms, and perceived behavioral control), the impact of elaboration on the components of TPB, and the two theories' relationship with behavioral intentions.

Article Three (Chapter IV)

This article is titled *Targeting your audience: Wildlife value orientations and the relevance of messages about bear safety.* The research used confirmatory factor analysis, cluster analysis, and analysis of variance (ANOVA) to explore how important different messages about bear safety are to visitors with diverse relationships with wildlife as assessed by WVOs. This article is designed to explore how visitors may be more or less likely to elaborate on bear safety behaviors depending on the types of messages provided to them.

Summary

This dissertation is designed to understand the relationship between persuasive communication and behaviors regarding bear safety in a protected area setting. Using theory to build statistical models, it tests the empirical relationship between theoretical factors. If successful, this research would support adopting a theoretical perspective based on the elaboration likelihood model when engaging park visitors with persuasive communication. Additionally, this dissertation is designed to understand how people's relationships with wildlife may influence the types of messages that are relevant to them. Improving relevancy of messages is a key component to influencing visitors' behaviors. Overall, this dissertation is designed to help park managers achieve conservation goals through improved indirect management techniques.

CHAPTER II (Manuscript 1): Measuring elaboration and evaluating its influence on behavioral intentions

Target journal: *Environmental Education Research*

MEASURING ELABORATION AND EVALUATING ITS INFLUENCE ON BEHAVIORAL INTENTIONS

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Abstract

The focus of this study is on developing a scale that measures elaboration as originally conceptualized by Vezeau et al. (2015), and then tests whether the elaboration scale is able to predict a variety of related behaviors. Confirmatory factor analysis was used to investigate the validity and reliability of the scale. The results suggest that the scale was successful in improving upon previous research in that all theoretical constructs were present in the second-order model of elaboration. Additionally, structural equation modeling was used to examine the predictive validity of the elaboration scale, which was successful in predicting a variety of related behaviors. This research advances the theoretical understanding and measurement of elaboration. Results can be used for evaluating interpretation efforts, including the assessment of programs and materials. Additionally, the results provide further evidence of elaboration as a measured construct and opens a variety of new avenues for research in environmental interpretation and informal education.

Introduction

Interpretation, or informal education, is an important management strategy for protecting valuable resources, reducing environmental impact, and keeping visitors safe in park and protected areas around the world. With a recent surge in visitation to national parks in the US, developing effective interpretation programs has perhaps never been more important. For instance, in 2015, 51 national parks in the US broke their visitation records, and the national park system as a whole saw record-breaking levels of visitation with over 300,000,000 recreation visits (NPS, 2017a). With such high levels of visitation in national parks, managers need to be able to develop effective interpretation strategies to help them achieve their management goals. Interpretation is a valuable management tool for a variety of different reasons. For instance, in many large wilderness parks it is often impractical to have more direct means of management, like enforcement, due to limited staff and funding. Additionally, many visitors prefer interpretation based management strategies instead of more direct management approaches, such as permitting or restrictions (Manning, 2011). Lastly, over-regulation may infringe on some of the social values associated with wilderness settings (Manning, 2003). For these reasons, interpretation is likely to remain a cornerstone of the management techniques used in park and protected areas.

Research suggests that interpretation, when applied appropriately, can be highly successful at influencing visitor behaviors to address management issues in park and protected areas (Brown, Ham, & Hughes, 2010; Ham, 2013). Part of the success of interpretation depends on how much visitors "elaborate" on a message (Petty & Cacioppo, 1986; Ham, 2013). Elaboration, a thoughtful processing of information defined as raised levels of interest, awareness, and cognitive engagement, is a crucial antecedent to behavior change (Petty &

Cacioppo, 1986; Vezeau et al., 2015). However, scales that measure the concept of elaboration are lacking. This is important because an operationalization of elaboration would allow us to evaluate if different interpretation methods are effective in promoting elaboration and ultimately influencing visitors' behaviors. Only one research project has attempted to construct an elaboration scale, but measurement challenges presented themselves and ultimately rendered the scale incomplete (Vezeau et al., 2015). Therefore, this current research focuses on improving the measurement of elaboration first proposed by Vezeau et al. (2015) and examining if the scale has practical use in predicting a variety of related behaviors. In doing so, this research provides a better understanding of elaboration in the context of interpretation.

Theoretical framework

Interpretation generally has three desired outcomes; it can enhance experiences, impact attitudes, and change behavior (Ham, 2013). The elaboration likelihood model (ELM) is a useful theoretical framework for understanding the last two outcomes (e.g., impacting attitudes and changing behavior), which are related. The elaboration likelihood model is concerned with impacting attitudes, and attitude change can also lead to behavior change (Ajzen, 1991; Petty & Cacioppo, 1986). Collectively, this type of interpretation that tries to reinforce or change attitudes and behaviors is called persuasion.

According to ELM, there are two routes to persuasion: the central and the peripheral routes (Petty & Cacioppo, 1986; Figure 1). The central route is taken by people who are motivated and able to process a message and results in a logical, careful consideration, which is where the term "elaboration" comes from (Petty & Cacioppo., 1986). However, if people are unmotivated, unable, or unwilling to engage is such careful consideration and thoughtful processing, the peripheral route of persuasion may be more likely to impact attitudes (Petty &

Cacioppo., 1986). In the central route, the content of a message plays a major role in persuasion (Petty & Cacioppo, 1986). However, the peripheral route of persuasion relies on subtle and often subconscious cues. For instance, the number of arguments in a persuasive message, the authority from which the message comes from, and the conditions under which the message is presented are more important for the peripheral route to persuasion (Petty & Cacioppo, 1986). Although the routes are presented as a dichotomy, it is likely that people use both (in varying levels) to process a message (Petty, Wegener, & Fabrigar, 1997).

(INSERT FIGURE 1 ABOUT HERE)

Although persuasion can occur through either route, there are some notable differences. For instance, although peripheral routes to persuasion can be effective for a short period of time, attitude changes that result from this route tend to be less salient, less enduring, and are easily affected by future messages (Petty, McMichael, & Brannon, 1992). Attitude changes acquired through the central route of persuasion tend to be more salient, durable over time, indicative of behavior, and resistant to future messages due to higher levels of elaboration (Petty et al., 1992). For these reasons, the central route to persuasion is generally preferred (Petty et al., 1992).

Research by Vezeau et al. (2015) at Great Smoky Mountain National Park provided an early attempt at scale development in measuring elaboration. Vezeau et al. (2015) proposed the concept of elaboration as a quantifiable, multi-dimensional concept consisting of interest, awareness, and cognitive engagement as suggested by theory (Petty & Cacioppo, 1986). The results provided substantial evidence that elaboration can be quantified. In addition, the elaboration scale was highly predictive of behavioral intentions making it a useful framework for evaluating interpretation efforts. Removing the dichotomy of the ELM and replacing it with a

continuous variable creates a more realistic elaboration concept by changing the question from *if* elaboration occurred to *how much* elaboration occurred (Petty et al., 1997).

This current research is designed to construct a more theoretically complete elaboration scale by adapting concepts (e.g. interest, awareness, cognitive engagement) from Vezeau et al.'s (2015) research. In Vezeau et al.'s (2015) research, the awareness construct displayed variance issues and was dropped from the full model, leaving cognitive engagement and interest as the only factors of elaboration. Although still predictive of intended behaviors, elaboration as measured in the study was missing an important theoretical component (awareness) as originally conceptualized. This current research seeks to confirm the model originally proposed by Vezeau et al. (2015) and test its predictive validity.

Study site and context

To further explore the concept of elaboration and its impacts on behaviors, this research uses bear safety as a frame of reference. This includes the development of a bear safety elaboration scale, a bear safety behavioral intentions scale, and an evaluation of the relationship between bear safety elaboration and its impact on behavioral intentions. Bear safety behaviors are actions that visitors can adopt to increase their physical safety from bears while hiking.

This research was conducted in Yellowstone National Park (YNP). Yellowstone National Park is one of the most visited national parks in the US and sees over 4 million visitors annually (NPS, 2017b). Well-known for its geological uniqueness and numerous species of large, characteristic wildlife, there are also a multitude of recreation opportunities, including hiking. However, with millions of visitors and large, free-roaming wildlife, conflicts do occur. This includes conflicts with bears. Yellowstone National Park is one of the few places left in the contiguous US where both grizzly and black bears occur. Although both species can be a threat

to people, it is the grizzly bear that poses most risk (NPS, 2017c). Hiking in grizzly bear country should be done with special precautions that are unique when compared to hiking in areas where only black bears are present. For instance, while carrying and knowing how to use bear spray is recommended in areas where grizzly bears are present (NPS, 2015d), this is usually not recommended in areas where only black bears are present. In fact, in some areas where black bear and human interactions are common (like Yosemite National Park in the Sierra Nevada mountains of California), it is *illegal* to carry bear spray (NPS, 2015e). For this reason, the bear safety messaging at YNP focuses on behaviors more specific to grizzly bears. However, much of the bear safety behaviors overlap in regards to species of bear.

Of all the wildlife in YNP, the grizzly bear tends to be the species that people are most concerned about (Olliff & Caslick, 2003). There is good reason for this, as incidents with grizzly bears are more likely to result in human death than any other wildlife species in the park. Incidents with grizzly bears (defined as physical contact between a person and a bear) occur at a rate of about one per year in YNP, and happen almost exclusively in backcountry (undeveloped) areas, such as hiking trails (NPS, 2017c). Deaths from bear attacks are rare in YNP, with only three deaths occurring between 1963 and 2010 (NPS, 2017c). However, between 2011 and 2015, three visitors were killed by grizzly bears inside the park in separate incidents (NPS, 2017c). With the recent spike in deaths from bear incidents and growing numbers of visitors, this research focused on understanding how interpretation is influencing visitors' bear safety behaviors. This research is part of a broader project that examined how interpretation influences visitors' bear safety behaviors. This paper focuses only on scale construction and predictive validity.

Methods

Conceptualization and measurement

A questionnaire collected data from respondents. The portions of the questionnaire that pertain to this research involved two sections: an elaboration section and a bear safety behavioral intentions section.

Bear safety behaviors

Using information provided by YNP, including the YNP website, signs, brochures, maps, and other forms of communication, researchers identified six different bear safety behaviors of interest. Because it is often difficult to measure actual behaviors, this research conceptualized the measures as behavioral intentions, which are an antecedent to actual behavior (Ajzen, 1991). To measure behavioral intentions, hikers were asked, "How likely are you to do the following things while hiking in Yellowstone National Park?" The six items were: 1) make noise by clapping or shouting, 2) personally carry bear spray, 3) look for signs of bears, like scat and tracks, 4) hike in a group of three or more people, 5) carry bear spray in an accessible place, like a hip holster, and 6) run if you see a bear (item was reverse coded). Responses were measured on a 7-point Likert-type scale, where 1=highly unlikely, 2=unlikely, 3=slightly unlikely, 4=neither, 5=slightly likely, 6=likely, and 7=highly likely.

Elaboration

The conceptualization of elaboration on the questionnaire was divided into three different portions: interest, awareness, and cognitive engagement. In this research, we sought to reduce skewness and increase variation as recommended by Vezeau et al. (2015) using a variety of techniques. These included using extreme values/strong wording and unidirectional scaling (DeVellis, 2003; Klockars & Hancock, 1993; Munshi, 2014; Peterson & Wilson, 1992). All the

measures for interest, awareness, and cognitive engagement were conceptualized using information provided by YNP to visitors from a variety of communication sources (i.e., the YNP website, signs, brochures, maps, etc.)

Awareness

Awareness is defined in this research as a general, rather than specific, cognizance of different concepts relating to bear safety in YNP (Vezeau et al., 2015). This is similar to other research using awareness as a construct (Kollmuss & Agyeman, 2002; Vezeau, 2015). Previous research found that awareness is a different concept than knowledge, is predictive of behaviors, and has been used to evaluate a variety of programs (Musser & Malkus, 1994; Schultz 2000, 2001; Stern, Powell, & Adroin, 2008; Stone, Barnes, & Montgomery, 1995; Vezeau et al., 2015). To measure awareness, visitors were asked, "How aware are you of the following items?" Five different items were developed to measure awareness of bear safety. The items were: 1) ways to increase your safety while hiking in bear country, 2) techniques that can help you avoid negative encounters with bears, 3) how hiking in grizzly bear country is different than hiking in other areas, 4) resources you can use to keep you safe while hiking in bear country, and 5) things you can do to decrease your risk of a bear attack while hiking. Responses were recorded on a 5-point Likert-type scale, where 1=not at all aware, 2=somewhat aware, 3=very aware, 4=extremely aware, and 5=completely aware.

Interest

This study defines interest as wanting to learn about items related to bear safety (Vezeau et al., 2015). Interest in learning has previously been used in the evaluation of environmental programs and is associated with behavior change (Lück, 2015; Stern, Powell, Ardoin, 2008; Vezeau et al., 2015; Werner, 1999). To measure interest, visitors were asked, "How interested

are you in learning about the following items?" Six different items were developed to measure day hikers' interest in learning about bear safety. These items were: 1) staying safe while hiking in the presence of bears, 2) knowing how to act if you see a bear, 3) proper equipment while hiking in areas where bears may be present, 4) how to increase your alertness to bears in an area, 5) how to avoid bear encounters while hiking, and 6) how to interpret bear behaviors. Responses were recorded on a 5-point Likert-type scale, where 1=not at all interested, 2=somewhat interested, 3=very interested, 4=extremely interested, and 5=completely interested.

Cognitive engagement

In this study, cognitive engagement is defined as the amount of time someone spent thinking about aspects of bear safety, and is only the second study to measure this concept (Vezeau et al., 2015). Visitors were asked, "How much have you thought about the following items?" Six different items were developed to measure cognitive engagement for day hikers. These items were:1) appropriate behaviors while hiking in the presence of bears, 2) what hikers can do to stay safe from bears while hiking, 3) how to have an enjoyable experience while hiking in bear country, 4) the benefits of taking safety precautions while hiking in bear country, 5) encountering bears while hiking, and 6) how hikers can avoid bears while hiking. Responses were recorded on a 5-point Likert-type scale, where 1=not at all, 2=somewhat, 3=a moderate amount, 4=very much, and 5=a great deal.

Data collection

Day hikers (as opposed to overnight backpackers, or bicyclists on one trail) were of specific interest in this research because they have no point of mandatory contact and are likely less experienced than overnight backpackers. Additionally, the last three deaths from bears in YNP were all day hikers. Intercept survey techniques were used to collect data from day hikers

on two trails in YNP. The two trails were selected in conjunction with park managers and served as a sampling frame. Trained university researchers systematically sampled day hikers and asked them to participate in the research by completing the survey on a tablet. If groups of hikers were intercepted, the person with the most recent birthday (not date of birth) in the group was asked to participate in the research. Data collection represented all days of the week during daylight hours from July 1st to August 15th. Researchers intercepted 777 day hiker groups, in which 14 (1.8%) did not speak enough English to complete the survey. From the remaining 763 groups, 647 individuals agreed to participate in the survey (response rate=85%). Two variables were used to evaluate non-response bias: age and U.S. residency/citizenship. There were no significant differences ($p<0.05$) between respondents and non-respondents regarding these variables.

Analysis

SPSS and AMOS were used to perform statistical analyses. During data cleaning, attention was paid to univariate outliers, missing data, and skewness of variables. Three different approaches were used during the analysis. These include confirmatory factor analysis (CFA), principal axis factoring (PAF), and structural equation modeling (SEM). AMOS was used for all SEM and CFA procedures, and SPSS was used for all other procedures. Maximum likelihood (ML) estimation was used for all SEM and CFA procedures.

During data screening, it was found that most variables had one or two missing data points. To determine if there was a pattern to the missing data, Little's missing completely at random (MCAR) test was used. Results indicated that there was no pattern to the missing data ($\chi^2=566.79$, df=585, $p=0.698$). To be as conservative as possible, cases with missing data were deleted listwise instead of imputed. This left a final sample size of $n=600$.

Confirmatory factor analysis is a form of SEM used to test an *a priori* specified structure of the relationship among observed variables and latent variables (Kline, 2011). This research used CFA to examine a second-order model of elaboration using raw data, where interest, awareness, and cognitive engagement were first-order latent variables that are reflective of an underlying elaboration factor (Figure 2). Maximum likelihood estimation assumes a multivariate normal distribution of the data, and there were some indications that this assumption was violated (i.e., univariate skewness, Mardia's coefficient = 108.478, critical ratio=52.272). To correct for this, bootstrapping was applied to all CFA and SEM procedures, and bias-corrected confidence intervals (95%) were used when reporting significance (Byrne, 2001). Generally, standardized loadings of variables measuring a factor should be statistically significant and >.30, with values >0.60 considered "high" (Kline, 1994). Additionally, goodness-of-fit (GOF) statistics allow researchers to examine how well the data matches the specified model in CFA and SEM. In this research, we provide several GOF statistics for each model, including both relative and absolute fit measures.

Absolute fit statistics examine the relationship between the implied and hypothesized covariance matrices and include χ^2, the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). As is customary, the χ^2 statistic is reported for the model. In addition, the Bollen-Stine bootstrap χ^2 (BS_{boot}; a χ^2 test that accounts for the bootstrapping procedure) is reported. It is interpreted in the same way as the normal χ^2. However, larger samples make it more likely that χ^2 tests will be rejected. Therefore, other fit statistics are generally more relied upon for assessing model fit. RMSEA is a "badness of fit" index where values closer to 0 indicate a better fit (Kline, 2011, p. 205). RMSEA values less than 0.10 are considered acceptable, with RMSEA $\leq$ 0.05 indicative of an excellent fit (Brown &

Cudeck, 1993; Kline, 2011). With RMSEA, a *p*-close test along with the 90% confidence interval is provided. The *p*-close test evaluates whether the RMSEA has a high likelihood of actually being less than 0.05, with values of $p>0.05$ concluding that the model is "close fitting" (Kline, 2011). SRMR transforms the covariance matrices of the hypothesized and independence models into correlation matrices. The difference between these matrices is the mean absolute correlation residual, which is essentially what SRMR reflects (Kline, 2011). Generally, values of ≤ 0.08 are considered acceptable for SRMR, with values closer to 0 indicative of a better fit (Hu & Bentler, 1999).

Relative fit statistics (also called comparative fit statistics) examine how much the hypothesized model differs from an independence model (one where there is no relationship among variables). These fit statistics include the comparative fit index (CFI) and the Tucker-Lewis index (TLI). CFI compares the independence model to the hypothesize model (Kline, 2011). Values closer to 1 indicate a better fit, with values $\geq .90$ indicating an acceptable fit, and ≥ 0.95 indicative of an excellent fit (Hu & Bentler, 1998). TLI is fairly similar to CFI, except it compares the χ^2 value of the hypothesized model to the independence model, while also incorporating degrees of freedom (Kline, 2011). TLI is interpreted in a similar way to CFI. Invariance testing is used to further examine the validity of the elaboration scale (Byrne, 2001; Kline 2011).

The Rho coefficient (or Raykov's composite reliability) was used to determine the reliability of multidimensional measures for all models and was calculated as per Graham (2006) in AMOS. Rho has numerous advantages over Cronbach's alpha when evaluating scale reliability in CFA and SEM. Most important is the fact that Cronbach's alpha assumes that the items measuring a latent variable are tau-equivalent, or have equal loadings. Violating this

assumption tends to incorrectly estimate the actual reliability of items (Graham, 2006; Miller, 1995). Rho is interpreted in a similar fashion to Cronbach's alpha, where Rho>0.60 is considered acceptable (Gay, 1991).

Principal axis factoring was used to identify the underlying structure of the bear safety behavioral intentions. We used a PAF over a CFA because the items in the scale had never been developed before, and no explicit structure was determined *a priori*. Assumptions about the appropriateness of using PAF were checked using the Keiser-Meyer-Olkin (KMO) statistic (KMO>0.50) and Bartlett's test of sphericity ($p<0.05$). A scree plot was used to determine how many factors to maintain. Varimax rotation was applied to the PAF to help interpret the results. Along with face validity, loadings of >0.30 were used to determine the factor that each item belonged to (Kline, 1994). Reliability for the items that loaded onto the same factor was assessed using Cronbach's alpha, as Rho could not be calculated using exploratory factor analysis. A Cronbach's alpha $\geq$0.60 was considered acceptable (Gay, 1991). The PAF was conducted to inform the structure in the SEM model to keep the SEM in the "spirit" of a confirmatory, not exploratory, process.

The last step in analysis involved a SEM that merged both the elaboration scale and the bear safety behavioral intentions. This was done to ensure the predictive validity of the elaboration scale, which is in line with the theoretical concepts of the ELM (Petty & Cacioppo, 1986). Bootstrapping was also applied to the SEM procedures. Like the CFA, fit indices and factor loadings are reported. Lastly, standardized path coefficients are reported, along with their statistical significance (using bias-corrected confidence intervals [95%] to report significance), between elaboration and bear safety behavioral intentions.

Results

Sample characteristics

Overall, respondents were about evenly split regarding gender, with 47.5% being female and 52.5% being male. The mean age of respondents was 40.8 years. Over 91% of respondents reported being White, which is similar to other research conducted in national parks. Asians were the next largest group and consisted of about 6.4% of the sample, followed by people who reported being of more than one race (1.6%). People who identified as Hispanic or Latino made up 3.4% of the sample. In terms of education, the sample was highly educated, with 39.1% of respondents possessing a graduate degree and 40.4% possessing a Bachelor's degree. Over 90% of respondents had at least some college. Eighty-one percent of respondents were permanent residents or citizens of the United States. Forty-seven out of the fifty states in the US were represented, as was the District of Columbia. Respondents came from five of the seven continents on the globe (Antarctica and Africa were not represented in the sample). The most common non-US countries that respondents lived in were Canada (2.1%), France (2%), Germany (1.8%), Switzerland (1.7%), and the Netherlands (1.2%).

Measurement model for elaboration

Descriptive statistics and variable codes for the observed variables in the model, as well as Rho reliability for first-order factors, are provided in Table 1. Rho (0.92 to 0.95) indicated that the first-order factors were reliably measuring their underlying constructs. The second-order CFA provided ample evidence that the variables measured their intended first-order factors (e.g., interest, awareness, cognitive engagement) and that these first-order factors measured the concept of elaboration (Figure 2). The data had good fit to the model. Both χ^2 (χ^2 =331.041, *df*=116, p<0.001) and BS_{boot} (p=0.002) were significant, as was expected with a large sample

size. All other fit statistics indicated a good to excellent fit for the model (RMSEA=0.052, *p*-close=0.091; SRMR=0.0267; CFI=0.975; TLI=0.977), and all loadings were statistically significant ($p<0.01$) and above the generally accepted levels. Rho reliability for constructs measuring elaboration also supported that the items reliably measured the elaboration construct (Rho=0.68).

(INSERT TABLE 1 ABOUT HERE)

(INSERT FIGURE 2 ABOUT HERE)

Invariance testing. Invariance testing is used to examine how a scale functions across independent groups and is an additional validity check in scale development (Kline, 2011). For this process, the sample was randomly divided into two independent and roughly equal groups (group 1, $n=317$; group 2, $n=283$) (Kyle, Graefe, & Manning, 2005). In this research, two types of invariance testing are used: configural and metric invariance. Configural invariance ensures that the model structure is equivalent across multiple groups and is tested by simultaneously comparing the two groups in a multi-group CFA (Byrne, 2001; Vezeau et al., 2015). Results from the configural invariance test indicated that the structure of the model was the same between the two groups ($\chi^2=485.376$, $df=232$, $p<0.001$; BS_{boot}, $p=0.002$; RMSEA=0.043, *p*-close=0.988; SRMR=0.031; CFI=0.97; TLI=0.965). Metric invariance is a more rigorous validity check and examines the equality of unstandardized factor loadings across groups (Kline, 2011; Vezeau, 2015). This is done by comparing multiple models: one where factor loadings are unconstrained among the groups (reported above) and one where factor loadings are constrained to be equal among the groups (constrained model: $\chi^2=493.704$, $df=249$, $p<0.001$; BS_{boot}, $p=0.002$; RMSEA=0.041, *p*-close=0.999; SRMR=0.036; CFI=0.971; TLI=0.969). A Chi-square difference test indicated that there was no significant different between the two models (χ^2

difference= 8.328, *df*= 17, *p*=0.96). Further analysis showed that there was no significant difference ($p<0.05$) among any of the factor loadings between the two groups. In summary, the bear safety elaboration scale displayed both configural and metric invariance.

Principal axis factoring for bear safety behavioral intentions

The assumptions for using PAF were met (KMO=0.553 and Bartlett's test of sphericity $p<0.001$). Examination of the scree plot showed that only one factor could be identified from the data. No rotation could be applied since there was only one factor. Table 2 shows the results of the PAF as well as descriptive statistics for all bear safety behavioral intentions measures. Three of the bear safety behavioral intention variables loaded on the factor: "personally carry bear spray" (loading=0.938), "carry bear spray in an accessible place, like a hip holster" (loading=0.956), and "Look for signs of bears like scat and tracks" (loading=0.34). The last variable (e.g., Look for signs of bears, like scat and tracks") was removed from the factor due to face validity issues (i.e., the other two factors are clearly related to bear spray) and its comparatively low factor loading. Additional support for the two-item factor (e.g. "personally carry bear spray" and "carry bear spray in an accessible place, like a hip holster) came from the high Cronbach's alpha ($\alpha=0.96$). This factor was named "bear spray", and all other items were treated as stand-alone measures of bear safety behavioral intentions during further analysis.

(INSERT TABLE 2 ABOUT HERE)

Structural model of elaboration and bear safety behavioral intentions

Using the results from the CFA and the PAF, a SEM was designed to test the predictive validity of the elaboration construct on the bear safety behavioral intentions identified in the PAF (Figure 3). Fit statistics supported that there was a good to excellent fit between the model and the data. Like the CFA, both the χ^2 ($\chi^2=559.910$, $df=226$, $p<0.001$) and BS_{boot} ($p=0.002$) were

significant. All other fit statistics supported the model (RMSEA=0.050, *p*-close=0.531; SRMR=0.0413; CFI=0.967; TLI=0.963). Elaboration had a significant, positive effect on all bear safety behavioral intentions (Table 3). The largest effects were found in the latent bear spray factor and looking for signs of bears, like scat and tracks. A medium effect was found on making noise by clapping or shouting. Small to medium effects were found for hiking in a group of three or more people and running if you see a bear.

(INSERT FIGURE 3 ABOUT HERE)

(INSERT TABLE 3 ABOUT HERE)

Discussion

The purpose of this research was to develop an elaboration scale where all theorized constructs (e.g. interest, awareness, and cognitive engagement) were present, and to test the elaboration scale's predictive validity. In doing so, the research investigates the relationship between elaboration and behavioral intentions, and provides a way to evaluate the influence of future interpretation efforts.

The CFA and reliability of the bear safety elaboration measures indicated a good to excellent fit. Additionally, all three theorized constructs (e.g. interest, awareness, and cognitive engagement) measured the concept of elaboration. This was an improvement over Vezeau et al.'s (2015) model, in which awareness was not included in the model due to variance issues. The interest dimensions in the bear safety elaboration scale had a lower loading (0.37) when compared to other first-order factors. This indicates that, at least for bear safety elaboration, interest is likely a less important indicator of elaboration than either cognitive engagement or awareness. From an overarching theoretical view, this does not mean that interest is not as important as awareness or cognitive engagement to elaboration (Vezeau et al., 2015). Indeed,

Vezeau et al.'s (2015) model found both interest and cognitive engagement had relatively high factor loadings. Instead, it is likely that in this empirical case, interest was not as important to bear safety elaboration (Vezeau et al., 2015). Although the reasons for this are not clear, it may simply be that awareness and cognitive engagement are relatively more important for bear safety elaboration. Considering the results from the bear safety elaboration scale, the inclusion of all first–order elaboration factors (e.g. interest, awareness, and cognitive engagement) is likely a sounder way of measuring elaboration than previously done. At this nascent stage, any future research that develops scales for measuring elaboration in different contexts and populations will continue to help researchers understand the components of elaboration measurement.

The PAF of bear safety behavioral intentions only identified one factor (bear spray behavioral intentions). The results from this suggest that bear safety behaviors are mostly separate behaviors. For instance, hiking in a group of three or more people is a distinct behavior from making noise by clapping or shouting. This is likely useful to future research. For instance, theoretical frameworks, such as the theory of planned behavior (Ajzen, 1991), need to be applied separately to *each* type of bear safety behavior. This means that bear spray behaviors may have different influences (i.e. attitudes, subjective norms, perceived behavioral control) than hiking in a group of three or more people.

From both a theoretical and applied perspective, elaboration should be able to predict behavioral intentions (Ajzen, 1991; Ham, 2013; Petty & Cacioppo, 1986). Results indicated that elaboration significantly predicted all measured bear safety behavioral intentions. This provides further evidence that the elaboration construct, as measured by interest, awareness, and cognitive engagement, is conceptually valid. Additionally, although bear safety behaviors may have different influences, it appears that interpretation strategies based on raising levels of elaboration

can influence multiple, related behaviors, like sustainability (Vezeau et al., 2015) or, in this instance, bear safety. This has an important implication for interpretation programs. If the goal is to make a difference by impacting behaviors, then focusing on factual knowledge alone is unlikely to be successful (Schultz, 2011). Instead, these programs should focus on increasing interest, awareness, and cognitive engagement (e.g. elaboration) related to their topics.

Research needs to continue to develop elaboration scales in a variety of contexts to continue to refine our understanding of elaboration as a measured concept. Both this study and Vezeau et al.'s (2015) research were conducted in national parks in the US. Developing elaboration measures for populations outside of national parks and the US may be particularly insightful. Additionally, although elaboration influences behavioral intentions, it is yet to be revealed how it is doing so. Empirically modeling elaboration with other theories about behavior, like the theory of planned behavior (Ajzen, 1991), can help further understand the relationship between interpretation strategies and behaviors. Lastly, elaboration scales need to be used to assess the impact of different interpretation strategies, likely in a pre and post design. In these studies, close attention should be paid to the change not only of the second-order elaboration factor, but also among the first-order factors (e.g. interest, awareness, and cognitive engagement). Along with this, an assessment of the long-term effects of elaboration needs to be conducted.

Conclusion

This research provided further evidence of elaboration as a measured concept by constructing a more theoretically complete elaboration scale. In this research, higher levels of elaboration were found to have a positive impact on a variety of related behavioral intentions. The insights from this study indicate that when trying to impact attitudes or change behaviors

through interpretation, creating a strategy designed around the concept of elaboration can be highly effective. Specifically, creating strategies that raise interest, awareness, and cognitive engagement are likely to be useful. Additionally, the elaboration scale developed in this research can provide future opportunities to researchers that would further our understanding of *how* interpretation impacts behaviors.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Brown M.W., & Cudeck R. (1993). Alternative ways of assessing model fit. In: Bollen K.A., Long J.S., (Eds.). *Testing structural equation models*. Newbury Park, CA: Sage; 1993. pp. 136–162.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism*, *18*(7), 879–900.

Byrne, B. M. (2001). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming.* Mahwah, N.J.: Lawrence Erlbaum Associates.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

DeVellis, R. (2003). *Scale Development: Theory and Applications*. Thousand Oaks, CA: Sage Publications.

Gay, L. R. (1991). *Educational Evaluation and Measurement: Competencies for Analysis and Application.* New York: MacMillan Publishing Company.

Graham, J. M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and Psychological Measurement*, *66*(6), 930–944.

Ham, S. (2013). *Interpretation: Making a difference on purpose.* Golden, CO: Fulcrum Publishing.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3*, 424-453.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Kenrick, D. T., Neuberg, S. L., & Cialdini, R. B. (2002). *Social Psychology: Unraveling the Mystery (2nd Ed.)*. Boston: Allyn & Bacon.

Kline, P. (1994). *An Easy Guide to Factor Analysis*. New York, NY: Routledge.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, NY: The Guillford Press.

Klockars, A. J., & Hancock, G. R. (1993). Manipulations of evaluative ratings. *Psychological Reports*, *73*, 1059–1066.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research 8*(3), 239-260.

Kyle, G., Graefe, A., & Manning, R. (2005). Testing the dimensionality of place attachment in recreational settings. *Environment and Behavior*, *37*(2), 153–177.

Lück, M. (2015). Education on marine mammal tours - But what do tourists want to learn? *Ocean and Coastal Management*, *103*, 25–33.

Manning, R. (2003). Emerging principles for using information / education in wilderness management. *International Journal of Wilderness*, *9*(1), 20–27.

Manning, R. (2011). *Studies in outdoor recreation: Search and research for satisfaction* (3rd ed.). Corvallis, OR: Oregon State University Press.

Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modeling. *Structural Equation Modeling, 2*, 255-273.

Munshi, J. (2014). A method for constructing Likert scales. *SSRN Electronic Journal*, (April), 1–12.

Musser, L. M., & Diamond, K. E. (1999). The children's attitudes toward the environment scale for preschool children. *Journal of Environmental Education*, *30*(2), 23.

NPS. (2017a). *National Park Service Certifies 2015 Visitation at 307 Million: Reports Annual Top 10 Lists and Other Highlights* [Press release]. Retrieved from https://www.nps.gov/aboutus/news/release.htm?id=1784

NPS. (2017b). *Yellowstone National Park: Visitation statistics.* Retrieved from http://www.nps.gov/yell/planyourvisit/visitationstats.htm

NPS. (2017c). *Bear-inflicted human injuries and fatalities in Yellowstone*. Retrieved from http://www.nps.gov/yell/learn/nature/injuries.htm

NPS (2015d). *Using bear spray to deter an aggressive bear.* Retrieved from http://www.nps.gov/yell/learn/nature/bsdeter.htm

NPS (2015e). *Weapons/Firearms*. Retrieved from http://www.nps.gov/yose/planyourvisit/weapons.htm

Olliff, T., & Caslick, J. (2003). Wildlife – human conflicts in Yellowstone: When animals and people get too close. *Yellowstone Science*, *1*(18), 18–22.

Penteriani, V., Delgado, M. D. M., Pinchera, F., Naves, J., Fernández-Gil, A., Kojola, I., … López-Bao, J. V. (2016). Human behaviour can trigger large carnivore attacks in developed countries. *Scientific Reports*, *6*(1432), 20552.

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artifact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*, 19, 123-205.

Petty, R. E., McMichael, S., & Brannon, L. A. (1992). The elaboration likelihood model of persuasion: Applications in recreation and tourism. In M. J. Manfredo (Ed.), *Influencing Human Behavior: Theory and Applications in Recreation, Tourism, and Natural Resources Management* (pp. 77–101). Champaign, IL: Sagamore Publishing.

Petty, R. E., Wegener, D. T., & Fabrigar, L. R. (1997). Attitudes and attitude change. *Annual Review of Psychology*, *48*, 609–47.

Schultz, P. W. (2000). Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues*, *56*(3), 391–406.

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*(4), 327–339.

Schultz, P. W. (2011). Conservation means behavior. *Conservation Biology*, *25*(6), 1080–1083.

Stern, M. J., Powell, R. B., & Ardoin, N. M. (2008). What difference does it make? Assessing outcomes from participation in a residential environmental education program. *The Journal of Environmental Education*, *39*(4), 31–43.

Stone, G., Barnes, J. H., & Montgomery, C. (1995). Ecoscale: A scale for the measurement of environmentally responsible consumers. *Psychology and Marketing*, *12*(7), 595–612.

Vezeau, S. L., Powell, R. B., Stern, M. J., Moore, D. D., & Wright, B. A. (2015). Development and validation of two scales to measure elaboration and behaviors associated with stewardship in children. *Environmental Education Research*, (January), 1–22.

Werner, C.M. (1999). Psychological perspectives on sustainability. In E. Becker & T. Jahn (Eds.), *Sustainability and the Social Sciences: A Cross-disciplinary Approach to Integrating Environmental Considerations into Theoretical Reorientation* (pp. 223-242). New York: Zed Books.

Appendix A: Tables

Table 1: Descriptive statistics and reliability for elaboration measures

Component	Model code	Variable	Mean *(SD)*
Interest[3] Rho=0.95			--
	V1	Staying safe while hiking in the presence of bears.	3.4 *(1.13)*
	V2	Knowing how to act if you see a bear.	3.6 *(1.08)*
	V3	Proper equipment while hiking in areas where bears may be present.	3.4 *(1.12)*
	V4	How to increase your alertness to bears in an area.	3.5 *(1.06)*
	V5	How to avoid bear encounters while hiking.	3.5 *(1.13)*
	V6	How to interpret bear behaviors	3.8 *(1.08)*
Awareness[4] Rho=0.92			--
	V7	Things you can do to decrease your risk of a bear attack while hiking.	2.9 *(0.92)*
	V8	Resources you can use to keep you safe while hiking in bear country.	2.9 *(0.93)*
	V9	How hiking in grizzly bear country is different than hiking in other areas.	2.8 *(1.05)*
	V10	Techniques that can help you avoid negative encounters with bears.	2.8 *(0.92)*
	V11	Ways to increase your safety while hiking in bear country.	2.9 *(0.92)*
Cognitive engagement[5] Rho=0.93			--
	V12	How hikers can avoid bears while hiking.	3.6 *(1.03)*
	V13	Encountering bears while hiking.	3.8 *(1.03)*
	V14	The benefits of taking safety precautions while hiking in bear country.	3.9 *(0.93)*
	V15	How to have an enjoyable experience while hiking in bear country.	3.7 *(0.96)*
	V16	What hikers can do to stay safe from bears while hiking.	3.7 *(0.94)*
	V17	Appropriate behaviors while hiking in the presence of bears.	3.6 *(0.98)*

[3]Responses measured on a 5-point Likert-type scale where 1=not at all interested and 5=completely interested.
[4]Responses measured on a 5-point Likert-type scale where 1=not at all aware and 5=completely aware.
[5]Responses measured on a 5-point Likert-type scale where 1=not at all and 5=a great deal.

Table 2: Principal axis factoring for bear safety behavioral intentions[1]

Factor	Model code	Variable	Loading	Mean *(SD)*[2]
Bear spray α=0.96			--	--
	V18	Personally carry bear spray.	.938	5.4 *(2.14)*
	V19	Carry bear spray in an accessible place, like a hip holster.	.956	5.3 *(2.17)*
Single item measures[3]			--	--
	V20	Make noise by clapping or shouting.	--	5.3 *(1.75)*
	V21	Look for signs of bears, like scat and tracks.	--	5.6 *(1.48)*
	V22	Hike in a group of three or more people.	--	4.8 *(2.14)*
	V23	Run if you see a bear[4].	--	6.0 *(1.48)*

[1]KMO=0.553, Bartlett's test of sphericity $p<0.001$.
[2]Items were measured on a 7-point Likert-type scale where 1=highly unlikely and 7=highly likely.
[3]Items did not load on the single factor, and are treated as stand-alone measures.
[4]Item was reverse coded.

Table 3: Effect of elaboration on bear safety behavioral intentions[1]

Bear safety behavioral intention	Standardized path coefficient	Variance explained	Effect size[2]	*p*-value
Bear spray.	0.52	27.2%	Large	0.005
Make noise by clapping or shouting.	0.34	11.2%	Medium	0.006
Look for signs of bears, like scat and tracks.	0.49	24%	Medium-large	0.002
Hike in a group of three or more people.	0.15	2.1%	Small	0.003
Run if you see a bear[3].	0.19	3.7%	Small-medium	0.005

[1]See Figure 3 for full SEM.
[2]Based off of Cohen (1998).
[3]Item was reverse coded.

Appendix B: Figures

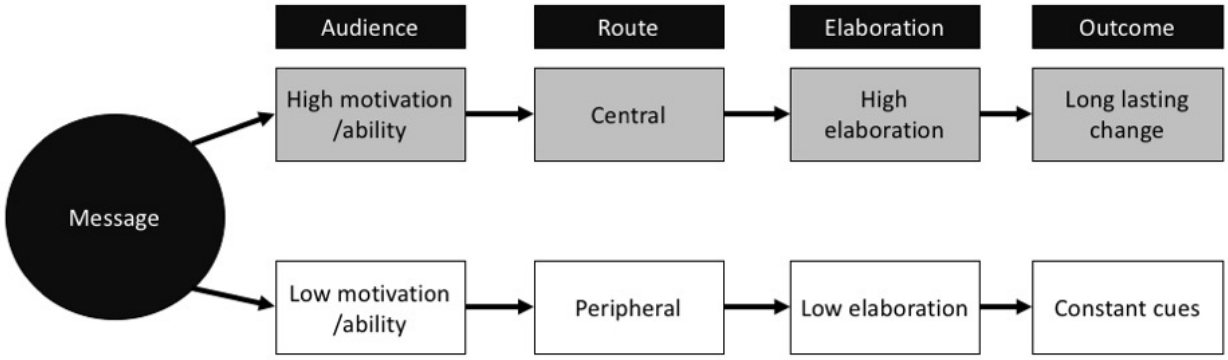

Figure 1: Elaboration likelihood model (adapted from Kenrick, Neuberg, & Cialdini, 2002; Petty & Cacioppo, 1986).

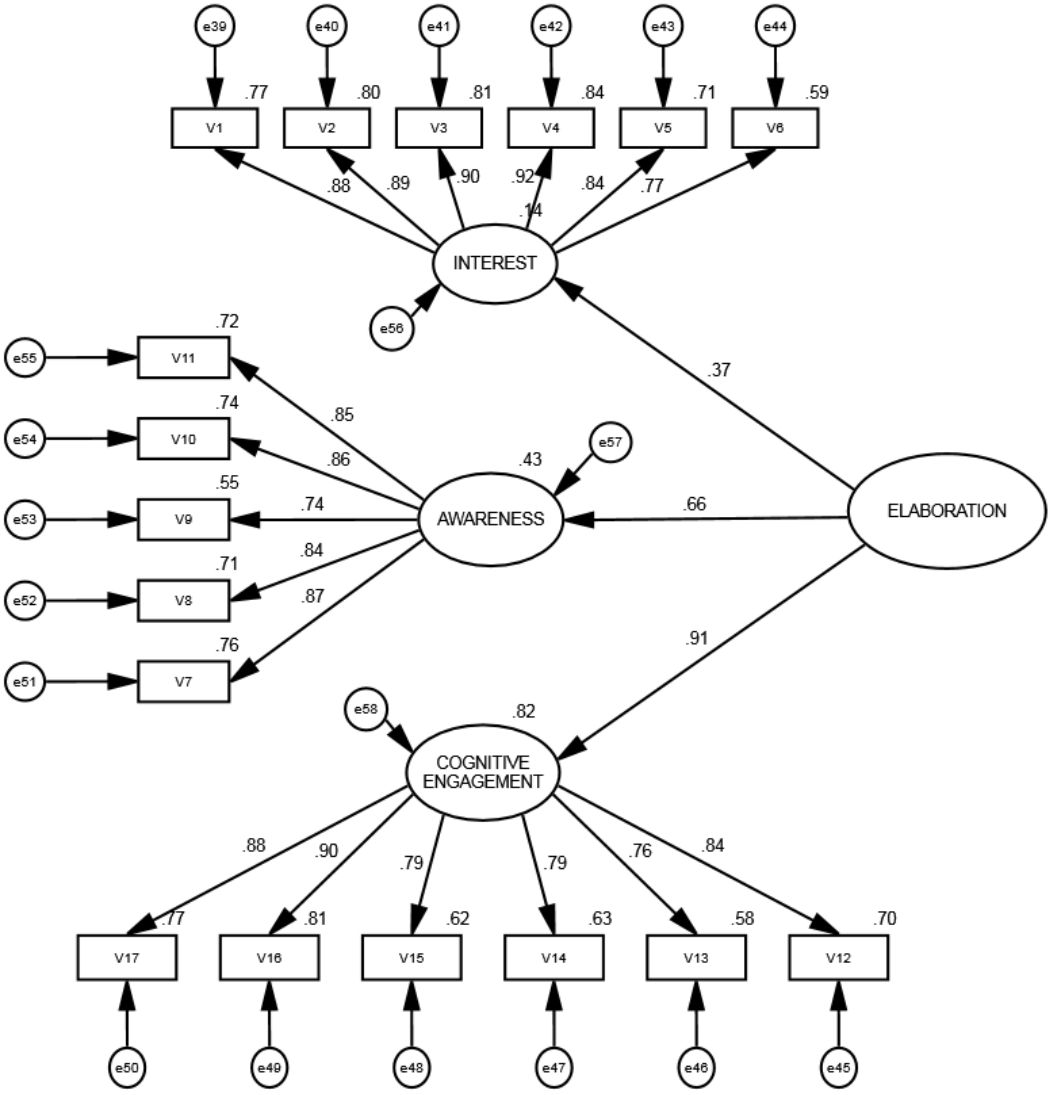

Figure 2: Second-order CFA of elaboration. All loadings are standardized and statistically significant (p<0.01). Fit statistics: χ^2 =331.041, df=116, p<0.001; BS_{boot}, p=0.002; RMSEA=0.052, p-close=0.091; SRMR=0.0267; CFI=0.975; TLI=0.977. See Table 1 for corresponding variable codes.

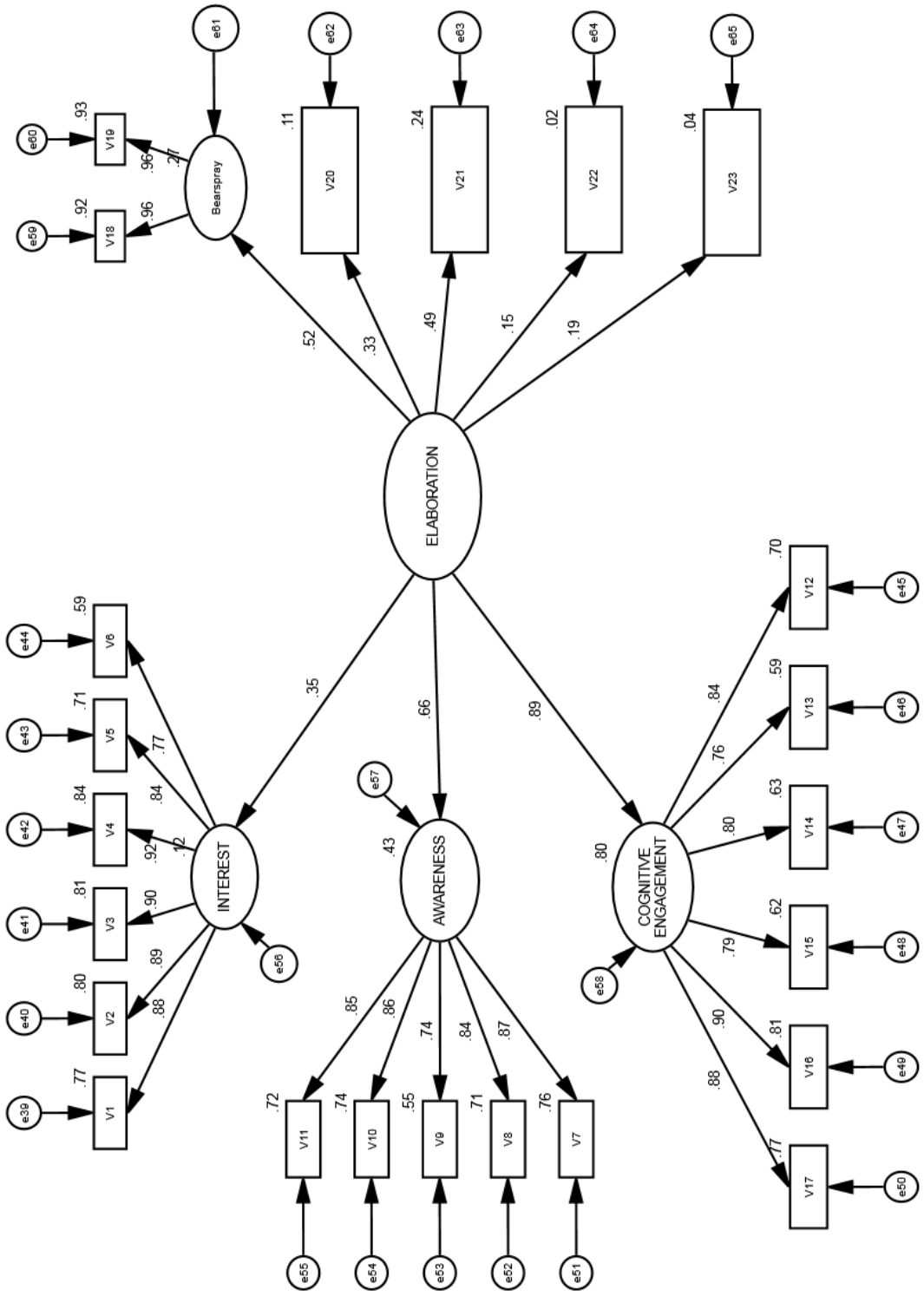

Figure 3: SEM of the relationship between elaboration and bear safety behaviors. Fit statistics: χ^2=331.041, *df*=116, p<0.001; BS_{boot}, p=0.002; RMSEA=0.050, *p*-close=0.531; SRMR=0.0413; CFI=0.967; TLI=0.963. All loadings and paths were statistically significant (p<0.01). See Tables 1 and 2 for corresponding variable codes.

CHAPTER III (Manuscript 2): An empirical model of elaboration's influence on the theory of planned behavior

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AN EMPIRICAL MODEL OF ELABORATION'S INFLUENCE ON THE THEORY OF PLANNED BEHAVIOR

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Abstract

This research empirically merges together two related theories: the elaboration likelihood model (Petty & Cacioppo, 1986) and the theory of planned behavior (Ajzen, 1991). A structural equation modeling approach was used to evaluate the relationship between the two theories and their collective impacts on behavioral intentions. The results suggest that an elaboration scale was able to predict the components of the theory of planned behavior (attitudes, subjective norms, and perceived behavior control), which in turn all predicted behavior intentions. Furthermore, results showed that the components of the theory of planned behavior partially meditated the relationship between elaboration and behavioral intentions, indicating that elaboration works mostly through the components of the theory of planned behavior to impact behavioral intentions. This study represents an improved understanding of the influence of communication techniques on visitor behaviors. Additionally, the discussion exemplifies how these techniques can be used to improve communications and evaluate communication strategies.

Introduction

Communication, such as informal education and interpretation, is an important management tool for protecting valuable resources, enhancing visitor experiences, reducing environmental impacts, and keeping visitors safe in park, recreation, and tourism management. This is particularly true for protected areas, like national parks. In these areas, both visitors and managers prefer indirect communication strategies to address management issues because they require fewer resources, can enhance visitor experiences, and may help to preserve some of the wilderness qualities associated with these areas (Manning, 2003; 2011). For all of these reasons, communication will continue to play a key role in visitor use management of park and protected areas.

In many cases, management issues in park and protected areas are inherently challenges with human behaviors (Manfredo, 2008). When this is the case, effective visitor communications should focus on impacting visitor attitudes and changing visitor behaviors through theory-driven approaches (Ham, 2013). However, many communication programs in park and protected areas are developed by using staff intuition or institutional formats (Hall, Ham, & Lackey, 2010). Although communication formed in this way may be occasionally successful in achieving management goals, communication strategies can be made more effective by drawing on theories that are rooted in social psychology (Ham, 2013; Teel, Dietsch, & Manfredo, 2015). Two theories that are useful in developing communication strategies in park and protected areas are the theory of planned behavior (Ajzen, 1991) and the elaboration likelihood model (Petty & Cacioppo, 1986).

The theory of planned behavior (TPB) (Ajzen, 1991) has been used to model human behavior in a variety of different research areas, including park, recreation, and tourism

management. This theory posits that human behavioral intentions are predicted by attitudes towards a behavior, subjective norms associated with the behavior, and perceived control in performing the behavior. Although this theory provides an understanding of *why* people intend to behave, it does not explain *how* to influence behavior.

While TPB was developing, other researchers focused on the *process* of attitude change. One of the leading theories to emerge was the elaboration likelihood model (ELM) (Petty & Cacioppo, 1986). ELM suggests that attitude change occurs by processing information through either a central or peripheral route, with the central route being indicative of resilient attitude change. Importantly, this change in attitudes may lead to an increase in appropriate behaviors. Although ELM has been used to construct and frame communication in a few park, recreation, and tourism settings, empirical evidence regarding the process of elaboration is only beginning to appear. This emerging research shows that higher levels of elaboration (defined as interest, awareness, and cognitive engagement) are indicative of the central route of processing and have a strong relationship with intended behaviors (Vezeau et al., 2015).

Juxtaposing TPB and ELM, TPB is descriptive and shows us where managers can most influence visitors' behavioral intentions. For instance, managers may find that perceived behavioral control has the largest impact on visit behaviors, and therefore messages should focus on content that targets this component of TPB. The elaboration likelihood model, on the other hand, shows us how to impact the TPB components by increasing the amount of thoughtful processing a person uses (Ham, 2013; Petty & Cacioppo, 1986), which in turn should impact behavioral intentions through the components of ELM (Ajzen, 1991; Brown, Ham, & Hughes, 2010; Ham, 2013). Although these two concepts are sometimes discussed together, this research seeks to empirically join these two theories. According to the theoretical foundations of ELM,

higher levels of elaboration should have an influence on the TPB antecedents of behavioral intentions. Situated within TPB, this could lead to desired behavior change. The purpose of this research is to empirically model the relationship between ELM and TPB. In doing so, it begins to unveil how communication strategies based on ELM affect visitor behavior according to TPB.

Conceptual background

The elaboration likelihood model

The elaboration likelihood model is one of the most widely-used communication theories (Teng, Khong, & Goh, 2014). In ELM, there are two routes to persuasion: the central and the peripheral routes (Petty & Cacioppo, 1986). The central route is taken by people who are motivated and able to process a message and results in a logical, careful processing of the information, which is where the term "elaboration" comes from (Petty & Cacioppo, 1986). However, if people are unmotivated, unable, or unwilling to engage in thoughtful processing, the peripheral route is taken (Petty & Cacioppo, 1986). Unlike the central route, where message content plays a major role in persuasion, the peripheral route relies on subtle and often subconscious cues (Petty & Cacioppo, 1986). Variables like the number of arguments presented and the authority of the sources are important for the peripheral route (Petty & Cacioppo, 1986). Although often presented as a dichotomy, people are likely use both central and peripheral routes (in varying levels) to process a message (Petty, Wegener, & Fabrigar, 1997).

Persuasion in the ELM is about changing attitudes towards a specific object. This change in attitude can occur through either the central or the peripheral route. However, there have been some notable differences between the two approaches. Attitude changes that result from the peripheral route tend to be "less accessible, persistent, and resistant to subsequent attacking messages..." (Petty, McMichael, & Brannon, 1992, p.82). In contrast, attitude changes from the

central routes tend "to be relatively accessible, persistent over time, predictive of behavior, and resistant to change…" (Petty et al. 1992, p. 81) due to higher levels of elaboration.

A large amount of the context in which ELM has been used in parks, recreation, and tourism comes from the field of environmental interpretation. Introduced originally as a useful theoretical framework by Petty et al. (1992), it was soon adopted by other professionals within the field (Ham and Krumpe, 1996). One of the more thorough uses of ELM in a national park setting was during a series of studies in Yosemite National Park regarding food storage and American black bears. Visitors were subjected to over 600 persuasion attempts, and although they indicated they were receiving the information about food storage, this higher level of knowledge did not result in higher compliance with food storage policies (Lackey & Ham, 2003). The authors leave the reader with a message in the final paragraph for future research needs: "…we need to better understand the link between message content and design, and visitors' processing of and compliance with those messages" (Lackey & Ham, 2003, p. 37). In other words, how do managers develop communication strategies that increase visitors' elaboration?

Brown et al. (2010) began to address the question above in research undertaken in Australia (see Ham et al., 2008 as well). This research was framed by both the ELM and TPB. In the research, they targeted salient beliefs, measured these beliefs between compliers and non-compliers, implemented a strategic communication strategy, and measured its effects in the form of observed action and salient beliefs after an exposure to a persuasion attempt. Although this provided further support that communication strategies framed by the ELM are successful in influencing visitor behaviors, the assumption was made that *any* change in beliefs or attitudes was caused by central route processing (Brown et al., 2010; Ham et al., 2008). This assumption

may not be true, as peripheral route processing can also cause short-term impacts to attitudes (and presumably beliefs) according to the ELM (Petty & Cacioppo, 1986). A better measure of effectiveness in the overall ELM theory may be looking at measurable levels of elaboration.

In Great Smoky Mountain National Park, Vezeau et al. (2015) developed a scale to measure the concept of elaboration, which they argued was a multi-dimensional concept consisting of interest, awareness, and cognitive engagement (Petty & Cacioppo, 1986; Vezeau et al., 2015). Developing indicators to measure each dimension of the construct, the research found evidence that elaboration can be measured (Vezeau et al., 2015). In addition, the elaboration scale was highly predictive of behavioral intentions making it a useful framework for communication. Lastly, by measuring elaboration as a continuous variable, it removes the "either/or" dichotomy of the peripheral or central route, and places elaboration on a continuum. A continuum of elaboration is more realistic and theoretically sound than a dichotomous perspective (Petty et al., 1997). Viewing elaboration on a spectrum changes the question from *if* elaboration was engaged to *how much* elaboration was engaged.

The theory of planned behavior

Perhaps no theory of human behavior has attracted as much attention as the theory of planned behavior (TPB) (Ajzen, 1991). An updated version of the earlier theory of reasoned action (Ajzen & Fishbein, 1980), TPB has proven to be useful in predicting behavioral intentions (an antecedent of actual behavior) (Madden, Ellen, & Ajzen, 1992). According to TPB, behavioral intentions can be predicted by attitudes towards performing a behavior, the subjective norms about performing a behavior, and a person's perceived behavior control regarding that behavior (Ajzen, 1991). Attitudes are a positive or negative evaluation based on a person's beliefs about the outcomes of performing a behavior (Ajzen, 1991; Ajzen & Driver, 1991). For

instance, someone may have positive attitudes about hiking because they believe it will reduce their stress. Subjective norms are social or group-level influences and often help establish how appropriate a behavior is in a setting (Teel et al., 2015). For example, although someone may desire to go hiking by him or herself, someone they care about (i.e., other hikers, their family, their kids, park rangers, etc.) would disapprove of the behavior. Perceived behavioral control is based on a person's belief that they are able to perform a certain behavior. An example of this would be where a person has positive attitudes towards going hunting and expresses favorable subjective norms, but they are not able to find a place to go hunting (due to location or access issues).

Early use of TPB in fields related to leisure sciences tried to predict participation in recreation activities using the TPB model (Ajzen & Driver, 1991). This research found the TPB model to be quite successful. Further research became more specific and applied. TPB has been applied successfully to hunting participation (Hrubes, Ajzen, & Daigle, 2001), use of bear canisters in Yosemite National Park (Martin & McCurdy, 2009), and deer hunting in Oregon (Shrestha et al., 2012) among others. Although not true in every study (see Shrestha et al., 2012), attitudes towards the behavior and subjective norms tend to be the best predictors of behavioral intentions (Ajzen, 1991; Petty, Cacioppo, & Goldman, 1981).

In summary, ELM allows us to understand how to *influence* the components of TPB (e.g. attitudes, subjective norms, and perceived behavioral control), which in turn are predictive of behavioral intentions and behaviors (Ajzen, 1991; Ham, 2013; Petty & Cacioppo, 1986). Recent research supports this notion that elaboration may impact all components of TPB, not just attitudes (Brown et al., 2010; Ham, 2013). Compared to ELM, TPB is more descriptive and shows us what factors contribute to a behavior and potential leverage areas where the behavior

can be influenced (Ham, 2013). One can imagine ELM flowing into TPB, where higher levels of elaboration connect with the components of TPB, guiding people towards a favorable action (Krosnick & Petty, 1995). To explore this conceptual relationship, one broad research question was developed for this study: What is the relationship among elaboration, the theory of planned behavior, and behavioral intentions? Recent research (Miller et al., under review, a; Vezeau et al., 2015) allows for an empirical approach to this question. Several propositions and related hypotheses are used as a framework to gain an in-depth understanding of the research question.

Proposition 1: The TPB measurement model is acceptable.

Proposition 2: The model that merges elaboration and TPB is acceptable.

Proposition 3: The TPB components (e.g., attitudes, subjective norms, and perceived behavior control) predict behavioral intentions.

H_1: There is a positive relationship between attitudes and behavioral intentions.

H_2: There is a positive relationship between subjective norms and behavioral intentions.

H_3: There is a positive relationship between perceived behavioral control and behavioral intentions.

Proposition 4: Elaboration has a positive effect on the components of TPB (e.g. attitudes, subjective norms, and perceived behavioral control).

H_4: There is a positive relationship between elaboration and attitudes.

H_5: There is a positive relationship between elaboration and subjective norms.

H_6: There is a positive relationship between elaboration and perceived behavioral control.

Proposition 5: The components of TPB mediate the relationship between elaboration and behavioral intentions.

H_7: There is a significant, positive indirect effect between elaboration and behavioral intentions.

H_8: There is a non-significant direct effect between elaboration and behavioral intentions.

Methods

Study site and context

The study site for this research was Yellowstone National Park (YNP). Yellowstone National Park sees over 4 million visitors annually, making it one of the most visited national parks in the U.S. (NPS, 2017a). Although YNP provides an assortment of recreational opportunities to visitors, it is also home to numerous large species of wildlife, including some which can be dangerous to people. With large, free-roaming wildlife and millions of visitors, conflicts are likely to present themselves. In particular, incidents between day hikers (as opposed to overnight backpackers) and grizzly bears appear to be occurring more frequently than in the past. For instance, between 1963 and 2010, three deaths from grizzly bears occurred in YNP (NPS, 2017b). However, between 2011 and 2015, three visitors were killed by bears inside the park (NPS, 2017b). Nearly all grizzly bear-visitor incidents occur in the backcountry, and these recent deaths are no exception (NPS, 2017b). Additionally, the three recent deaths all occurred to day hikers, not overnight backpackers. For this reason, this research focuses specifically on day hikers (referred to as hikers instead of day hikers from this point forward).

Most attacks from large carnivores in developed countries are a result of risk-enhancing human behaviors (Penteriani et al., 2016). Yellowstone National Park suggests several different

behaviors that hikers can adopt to reduce their risk while hiking, including hiking in a group of three or more people, carrying bear spray, making noise while hiking, knowing how to respond if hikers do see a bear, and being alert of bears in an area (NPS, 2017c). Best practices in TPB research suggest focusing on one *specific* behavior (Ham et al., 2008). Previous research has found that bear safety behaviors are not one single behavior, but a variety of different behaviors (Miller et al., under review, a). For this reason, the specific behavior of interest centers around bear spray.

Data collection

Hikers were systematically sampled by two university researchers on two different trails during daylight hours between July 1st and August 15th, 2016. The two trails were selected in consultation with YNP managers and served as a sampling frame. Sampling days were distributed to represent all days of the week. Overall, 777 groups of hikers were intercepted. From this, 14 (1.8%) did not speak enough English to complete the survey and were excluded from the study, leaving 763 eligible groups. Only one person from each group was selected to participate in the research. To make sure the participants were selected in a random fashion, the person with the most recent birthday (not date of birth) was asked to complete the survey. There were 647 hikers who agreed to participate in the study (85% response rate). Respondents completed the survey on a tablet device. A non-response bias check was completed using age and U.S. residency/citizenship. No significant difference ($p<0.05$) was found between respondents and non-respondents for the two variables.

Data instrument

A questionnaire was developed to gather information from respondents. Two sections of the questionnaire relate to this research and include an elaboration portion and a TPB portion.

The conceptualization of elaboration was developed from a variety of communication materials about bear safety from YNP (i.e., the YNP website, signs, brochures, maps, etc.).

Elaboration

Elaboration is conceptualized in this research as a second-order factor comprised of three first-order factors: interest, awareness, and cognitive engagement (see Miller et al., under review, a; Vezeau et al., 2015). Previous research validated the scale in this sample, and for a detailed analysis see Miller et al. (in review, a). Interest was measured by six different items on a 5-point Likert-type scale where 1=not at all interested and 5=completely interested. Respondents were asked, "How interested are you in learning about the following items?" Examples of measures include "Staying safe while hiking in the presence of bears" and "Avoiding bear encounters while hiking." Awareness was measure by five different items on a 5-point Likert-type scale where 1=not at all aware and 5=completely aware. Respondents were asked, "How aware are you of the following items?" Examples of measures include "Ways to increase your safety while hiking in bear country" and "How hiking in grizzly bear country is different than hiking in other areas." Cognitive engagement was measured by six different items on a 5-point Likert-type scale where 1=not at all and 5=a great deal. Respondents were asked, "How much have you thought about the following items?" Examples of measures include "Appropriate behaviors while hiking in the presence of bears" and "Encountering bears while hiking."

Theory of planned behavior constructs

In this research, TPB consists of four different constructs: attitudes, social norms, perceived behavioral control, and behavioral intentions. Multiple indicators were developed for each of these constructs. To reduce the amount of skewness in the variables, unidirectional scales

were used for attitudes, social norms, and perceived behavior control variables (DeVellis, 2003; Klockars & Hancock, 1993; Munshi, 2014; Peterson & Wilson, 1992).

Attitudes were assessed through three different variables using universal attitude measures: how pleasant, good, and favorable performing a behavior would be. These measures were guided by previous research and were adapted to fit the context of bear-spray behaviors (Ajzen & Driver, 1991; Hrubes et al., 2001; Shrestha et al., 2012). Respondents were presented with the statement, "For me, carrying bear spray while hiking in Yellowstone would be…" and answered on a unidirectional 5-point Likert-type scale (i.e., 1=not at all good, 2=somewhat good, 3=moderately good, 4=very good, 5=extremely good, etc.) for all three measures.

Subjective norms were evaluated by three different universal measures that were developed from previous research and adjusted to fit the current context (Ajzen & Driver, 1991; Hrubes et al., 2001; Shrestha et al., 2012). Respondents were presented with the question, "How true do you find the following statements?" The three statements were "People who I value think I should carry bear spray while hiking in Yellowstone", "People important to me would be carrying bear spray if they were hiking in Yellowstone", "Other visitors would support my decision to carry bear spray while hiking in Yellowstone." Responses were recorded on a unidirectional 5-point Likert-type scale where 1=not at all true, 2=slightly true, 3=moderately true, 4=very true, and 5=completely true.

Perceived behavioral control was assessed by three different universal measures developed from previous research and adjusted to be applicable to the current context (Ajzen & Driver, 1991; Hrubes et al., 2001; Shrestha et al., 2012). Respondents were presented with the question, "How true do you find the following statements?" The three statements were "If I wanted to, I could easily carry bear spray on my next hiking trip in Yellowstone", "The factors

that influence my decision to carry bear spray while hiking in Yellowstone are totally within my control", and "It is difficult to carry bear spray while hiking in Yellowstone." Responses were recorded on a unidirectional 5-point Likert-type scale where 1=not at all true, 2=slightly true, 3=moderately true, 4=very true, and 5=completely true. Responses to the last statement were reverse coded.

Bear spray behavioral intentions were measured by two different items. Respondents were asked, "How likely are you to do the following things while hiking in Yellowstone?" The two items that measure bear spray behavioral intentions were "Personally carry bear spray" and "Carry bear spray in an accessible place, like a hip holster." As this was a new behavior that had not been assessed prior to this study, a balanced 7-point Likert-type scale was used to record responses, where 1=highly unlikely, 2=unlikely, 3=slightly unlikely, 4=neither, 5=slightly likely, 6=likely, and 7=highly likely.

Analysis

Analyses were performed using SPSS and AMOS. Data cleaning commenced prior to analysis. Attention was paid to univariate outliers, skewness, and kurtosis of variables. Data cleaning found that several variables had missing data points. To determine if the there was a pattern to the missing data, Little's missing completely at random (MCAR) test was used. Little's MCAR indicated that there was no pattern to the missing data (χ^2=566.79, df=585, p=0.698). Listwise deletion was used to remove cases with missing variables. The final sample size for this research was n=600.

Two different approaches were used during the analysis. These include confirmatory factor analysis (CFA), and structural equation modeling (SEM) using maximum likelihood (ML) estimation. An assumption of ML estimation is that the data has a multivariate normal

distribution, which is often not true in a data set (Micerri, 1989). In this current data set, several of the TPB variables exhibited a negative skew in their distributions, and therefore the assumption of multivariate normality was likely violated. To correct for this, bootstrapping was applied in the CFA and SEM procedures to reduce the chance of a Type I error when testing for statistical significance (bias corrected confidence intervals, 95%) in the models (Byrne, 2001).

CFA was employed to assess the validity of the measurement of the concepts in the TPB (Proposition 1). CFA is a useful tool for evaluating theoretical relationships among variables that are identified *a priori.* From the CFA of the TPB components, a SEM was then conducted to evaluate the relationship between elaboration and TPB (Propositions 2 through 5).

Assessment of both the CFA and SEM was evaluated using a variety of fit statistics. These statistics allow researchers to evaluate how well the data matches the hypothesized model. Because there is no universal "best" fit statistic, several are provided (Kline, 2011). The fit statistics used to evaluate model fit in this research are χ^2, the Bollen-Stine bootstrap χ^2 (BS_{boot}; a χ^2 test that accounts for the bootstrapping procedure), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the Tucker-Lewis index (TLI). Both the normal χ^2 test and the BS_{boot} test should not be statistically significant (p>0.05). However, both tests are likely to be rejected with the larger sample sizes that CFA and SEM require. Therefore, other fit statistics are generally more relied upon to evaluate model fit. RMSEA should have a value $\leq$0.10, with values $\leq$0.05 indicative of an excellent fit (Browne & Cudeck, 1993; Kline, 2011). The RMSEA statistic also has an associated *p*-close test, which is a one-sided hypothesis test that RMSEA is realistically less than 0.05. If *p*-close>0.05, the model has a close fit (Kline, 2011). SRMR values of $\leq$0.08 are considered acceptable, with values closer to 0 indicating a better fit (Hu & Bentler, 1999).

For both CFI and TLI, values ≥0.90 indicate an acceptable fit, with values ≥0.95 indicative of an excellent fit (Hu & Bentler, 1998). Additional assessment of the models was made from factor loadings, where statistically significant loadings >0.30 were considered sufficient, and loadings >0.60 were considered high (Kline, 1994).

To check the reliability among variables measuring a single concept, the rho coefficient (Raykov's composite reliability) was used. When evaluating scale reliability in CFA and SEM, Rho has a distinct advantage over Cronbach's alpha. Cronbach's alpha assumes that the items measuring a construct have equal loadings, or are tau-equivalent. This assumption is almost always violated and leads to a poorer estimate of the actual reliability (Graham, 2006; Miller, 1995). Rho was calculated in AMOS according to Graham (2006) and can be interpreted in a similar fashion to Cronbach's alpha, where Rho>0.60 is considered acceptable (Gay, 1991).

Results

Sample characteristics

The profile of the respondents was fairly similar to previous research in national parks. International visitors (not from the USA) made up about 19% of the sample, with the top five countries of origin being Canada (2.1%), France (2%), Germany (1.8%), Switzerland (1.7%), and the Netherlands (1.7%). Gender distributions were nearly even, with 47.5% of respondents reporting that they were female. The vast majority (91%) of respondents were White, with the next largest group being Asian (6.4%). Only 3.4% identified as Hispanic or Latino. Respondents were also highly educated, with over 90% of the sample saying that had at least some college. Just over 40% of respondents had at least a Bachelor's degree, and just under 40% had a graduate degree. The average age of respondents was 40.8 years.

Measurement model of the theory of planned behavior

Descriptive statistics and variable codes for the variables used in the TPB CFA can be found in Table 1. The CFA of the TPB components provided evidence that there was a strong fit between the data and the model (Figure 1). Although the χ^2 was significant (χ^2=48.607, *df*=29, *p*<0.013), all other fit statistics indicated an excellent fit (BS_{boot}, *p*=0.190; RMSEA=0.034, *p*-close=0.954; SRMR=0.020; CFI=0.996; TLI=0.993). Additionally, all factor loadings were statistically significant (*p*<0.01) and above the 0.30 threshold, with most loadings >0.60. Rho reliabilities for each concept were also above the 0.60 threshold, and ranged from 0.65 to 0.96 (see Table 1 for all Rho coefficients). Collectively, this evidence supports Proposition 1 (The TPB measurement model is acceptable).

(INSERT TABLE 1 ABOUT HERE)

(INSERT FIGURE 1 ABOUT HERE)

The role of elaboration and the theory of planned behavior in predicting bear spray behavioral intentions

A full model that examined the relationship between elaboration, behavioral intentions, and TPB was built to test the remaining propositions and their associated hypotheses (Figure 2). The fit statistics indicated that there was an excellent fit between the data and the model (RMSEA=0.041, *p*-close=1.00; SRMR=0.038; CFI=0.975; TLI=0.972), although both χ^2 tests were significant (χ^2 =670.66, *df*=337, *p*<0.001; BS_{boot}, *p*=0.002). Overall, the model explained 64.7% of the variance in bear spray behavioral intentions. This evidence supports Proposition 2 (The model that merges elaboration and TPB is acceptable).

(INSERT FIGURE 2 ABOUT HERE)

The model also provided evidence in support of Proposition 3 (The TPB components [e.g., attitudes, subjective norms, and perceived behavior control] predict behavioral intentions),

including the associated hypotheses, H_1, H_2, and H_3 (H_1: There is a positive relationship between attitudes and behavioral intentions; H_2: There is a positive relationship between subjective norms and behavioral intentions; H_3: There is a positive relationship between perceived behavioral control and behavioral intentions). Table 2 outlines this evidence. All components of TPB (e.g. attitudes, subjective norms, perceived behavioral control) had a significant effect ($p<0.05$) on bear spray behavioral intentions. Attitudes and subjective norms appeared to have the strongest effect (0.34 and 0.33, respectively), and perceived behavioral control had the weakest effect (0.14).

(INSERT TABLE 2 ABOUT HERE)

Evidence was also provided by the model to support Proposition 4 (Elaboration has a positive effect on the components of TPB [e.g. attitudes, subjective norms, and perceived behavioral control]), including all the associated hypotheses (e.g. H_4 [there is a positive relationship between elaboration and attitudes], H_5 [there is a positive relationship between elaboration and subjective norms], and H_6 [there is a positive relationship between elaboration and perceived behavioral control]). Table 3 outlines this evidence. Elaboration had a significant, positive effect on attitudes, perceived behavioral control, and subjective norms. The effect of elaboration on all the components of TPB (e.g. attitudes, subjective norms, perceived behavioral control) was similar and medium-large in magnitude (Cohen, 1998).

(INSERT TABLE 3 ABOUT HERE)

Partial support was found for Proposition 5 (The components of TPB mediate the relationship between elaboration and behavioral intentions). H_7 (There is a significant indirect between elaboration and behavioral intentions) was confirmed and showed that there was a significant, positive, medium indirect effect (0.36) on bear spray behavioral intentions from

elaboration. However, the model did not support H_8 (There is an non-significant direct effect between elaboration and behavioral intentions) as there was still a statistically significant, positive, direct effect on bear spray behavioral intentions from elaboration (Table 4). However, this effect (0.13) was small. Collectively, this indicates that the components of TPB (e.g. attitudes, subjective norms, and perceived behavioral control) are partially mediating the relationship between elaboration and bear spray behavioral intentions.

(INSERT TABLE 4 ABOUT HERE)

Discussion

The goal of this research was to empirically model the relationship between elaboration and the theory of planned behavior to better understand persuasive communication. Bear safety elaboration and bear spray behavioral intentions were used as a frame for this research. Overall, the research was successful in merging together ELM and TPB in a single empirical model and explained over 64% of the variation in bear spray behavioral intentions. These results have several important theoretical contributions and management implications.

The bulk of the theoretical contributions of this research can be found from the results of Propositions 2 through 5. This research demonstrates that the concept of elaboration has a direct influence on all the components of TPB, as well as a direct effect on behavioral intentions. Additionally, elaboration has an indirect effect on behavioral intentions through the components of TPB. This indirect effect was also larger in comparison to the direct effect of elaboration and behavioral intentions (0.36 and 0.13, respectively). In line with previous theoretical development and research (Ham, 2013; Petty & Cacioppo, 1986), this exemplifies the *process* of change in that elaboration not only has the potential to directly impact the components of TPB, but also operates mostly *through* the components of TPB to affect behavioral intentions, and thus

behavioral intentions. These results further add to the validity of the concept of elaboration as measured by interest, awareness, and cognitive engagement. We encourage other researchers to continue to adapt the elaboration concept (Miller et al., under review, a) to meet their own needs and context to provide further insights.

This research also has important implications for managers who need to develop effective communication strategies to influence day hikers' bear spray behaviors. First, TPB revealed that attitudes, subjective norms, and perceived behavioral control all have an impact on bear spray behavioral intentions. However, the most influential components are attitudes and subjective norms, and targeting these components through interpretive messaging will likely result in more change in visitor bear spray behaviors. This is similar to many other TPB studies, where perceived behavioral control has a low impact when attitudes and subjective norms have a higher impact on behaviors (Armitage & Conner, 2001). Second, results show that bear safety elaboration can affect *all* components of TPB in relation to bear spray behavior. In addition to this, and specific to YNP, because the elaboration items were developed using YNP communication resources, we can reasonably say that communication in YNP is effective in influencing the TPB components of bear spray behavior. However, the influence of elaboration on attitudes, subjective norms, and perceived behavioral control appears to be fairly similar. Increasing messages that target attitudes and subjective norms (so that elaboration would, in theory, have higher path loadings to them when compared to perceived behavioral control) may produce even more positive behavior change, as these two components of TPB have a relatively larger impact than perceived behavioral control in influencing bear spray behavioral intentions.

Beyond communication designed to influence bear spray behaviors, this research provides insights for managers who want to use communication to help address a variety of

behaviors. Even with a relatively thorough understanding of TPB from a science perspective, it still reveals insights and strategies for communication when trying to influence behaviors. Additionally, TPB can be easy to use for professionals with limited social science research skills or resources, and excellent handbooks have been developed specifically for park and protected area management (see Ham et al., 2009 for more information and guidance). However, TPB is limited in its scope, as it only deals with rational behaviors. For instance, in situations where behaviors are largely driven by emotions, TPB is likely to be less useful.

As exemplified in this research as well as Vezeau et al.'s (2015), designing communication strategies that increase interest, awareness, and cognitive engagement (collectively called elaboration) is a useful framework for developing communication materials designed to impact attitudes and influence behaviors (Ham, 2013). To increase the amount of elaboration that people use to process a message, they must be motivated (Petty & Cacioppo, 1986). In parks, tourism, and recreation settings, motivation is usually increased by providing relevant messages to visitors. Although there are some guidelines for exactly what relevancy means in communication (see Ham, 2013 for more information), it is clear that more research needs to be conducted on how to increase elaboration likelihood in parks, tourism, and recreation settings. Additionally, not all visitors are likely to find the same types of messages motivating. Although some research has started to explore this area (Miller, et al., under review, b), future research needs to be conducted to understand how and where to implement communication strategies to diverse groups of people. Collectively, the insights from both ELM and TPB are a reminder that influencing people's behavior is generally not a knowledge-driven process (Schultz, 2011). In other words, people do not always do what they *know* is right; they do what they *care* about.

A last useful insight about this research is how it can be applied to other contexts to evaluate communication programs. For communication programs, like Leave No Trace for instance, an elaboration/TPB model, like the one in Figure 2, can be developed. From this, a general evaluation can be derived to assess how effective a communication program is at influencing a behavior. This would be done by evaluating the relationships between the TPB components and behavioral intentions, and then evaluating the influence of elaboration on the components of TPB. For instance, if a behavior appears to be driven solely by subjective norms, but elaboration is only affecting attitudes, then there is a mismatch that is apparent between current communication efforts and the drivers of a behavior. Insights such as these would provide useful evaluations for managers and further refine elaboration measures and theory. Additionally, elaboration scales can be used as standalone evaluations of communication programs, preferably after it has been established that the elaboration scale developed affects a specific behavior (or behaviors) (Miller et al., under review, a). This would likely be accomplished in a quasi-experimental design, where elaboration scores are measured before and after a communication event. This same design can be used to evaluate the lasting impacts of elaboration, as higher levels of elaboration should lead to long-lasting behavior change (Petty & Cacioppo, 1986).

There were some notable limitations in this research. For instance, there is some room for improvement upon the variables that measure the components of TPB in this research. Specifically, the variable PBC_3 (It is difficult to carry bear spray while hiking in Yellowstone) had a comparatively low factor loading (0.35). Although still sufficient, removing PBC_3 and adding an additional variable measuring perceived behavioral control may improve the model as well as the Rho reliability score for perceived behavioral control. Additionally, we used global

measures of attitudes, subjective norms, and perceived behavioral control instead of expectancy-value measures (Fishbein & Ajzen, 1975) to reduce participant burden in this research. Using an expectancy-value measure of the concepts related to TPB may provide further insights and refine measurement. In particular, the salient beliefs that drive attitudes, subjective norms, and perceived behavior control would be revealed. The choice of using universal measurements may have also contributed to the statistically significant effect of elaboration on bear spray behavioral intentions in H_4 and the resulting partial support of the hypothesis. Future researchers may wish to further explore the reasons for the significant direct effect of elaboration on bear spray behavioral intentions in H_8, including the inclusion of additional components of TPB, such as personal norms (Ajzen, 1991; Brown et al., 2010).

Conclusion

This research merged together two major theories - the theory of planned behavior and the elaboration likelihood model – that are often used in communication strategies in park, recreation, and tourism settings to better understand how communication affects visitor behavior. The results and insights from this study advance research on communication by further exploring the relationship between TPB, ELM, and their influence on people's behaviors. Results indicate that effect of elaboration moves mostly through the TPB components (e.g. attitudes, subjective norms, and perceived behavioral control) to impact behaviors. The relationship between elaboration and TPB detailed in this study provides unique insights and new directions for research involving communication in park, tourism, and recreation management. Additionally, results from this study can provide guidance to managers regarding communication strategies that are likely to be most effective on influencing visitor bear spray behaviors.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Ajzen, I., & Driver, B. L. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior. *Leisure Sciences*, *13*, 185–204.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewood Cliffs, N.J.: Prentice-Hall.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471–499.

Briñol, P., Petty, R. E., & Wheeler, S. C. (2006). Discrepancies between explicit and implicit self-concepts: Consequences for information processing. *Journal of Personality and Social Psychology*, *91*(1), 154–170.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism*, *18*(7), 879–900.

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), *Testing Structural Equation Models* (pp. 136–162). Newbury Park, CA: Sage.

Byrne, B. M. (2001). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming.* Mahwah, N.J.: Lawrence Erlbaum Associates.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

DeVellis, R. (2003). *Scale Development: Theory and Applications*. Thousand Oaks, CA: Sage Publications.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Gay, L. R. (1991). *Educational Evaluation and Measurement: Competencies for Analysis and Application.* New York: MacMillan Publishing Company.

Graham, J. M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and Psychological Measurement*, *66*(6), 930–944.

Hall, T. E., Ham, S. H., & Lackey, B. K. (2010). Comparative evaluation of the attention capture and holding power of novel signs aimed at park visitors. *Journal of Interpretation Research*, *15*(1), 15–36.

Ham, S. (2013). *Interpretation: Making a difference on purpose.* Golden, CO: Fulcrum Publishing.

Ham, S. H., Brown, T. J., Curtis, J., Weiler, B., Hughes, M., & Poll, M. (2009). *Promoting Persuasion in Protected Areas: A Guide for Managers Who Want to Use Strategic Communication to Influence Visitor Behaviour* (1st ed.). Gold Coast, Queensland: Sustainable Tourism Cooperative Research Centre.

Ham, S. H., & Krumpe, E. E. (1996). Identifying audiences and messages for nonformal environmental education - A theoretical framework for interpreters. *Journal of Interpretation Research*, *1*(1), 11–24.

Ham, S. H., Weiler, B., Hughes, M., Brown, T., Curtis, J., & Poll, M. (2008). *Asking Visitors to Help: Research to Guide Strategic Communication for Protected Area Management*. Gold Coast, Queensland: Cooperative Research Center for Sustainable Tourism.

Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the theory of planned behavior. *Leisure Sciences*, *23*(3), 165–178.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3*, 424-453.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Kline, P. (1994). *An Easy Guide to Factor Analysis*. New York, NY: Routledge.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, N.Y.: The Guilford Press.

Klockars, A. J., & Hancock, G. R. (1993). Manipulations of evaluative ratings. *Psychological Reports*, *73*, 1059–1066.

Krosnick, J. A., and Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty and J. A. Krosnick, et al. (Ed.), *Attitude Strength: Antecedents and Consequences*. (pp. 1–24). Mahwah, NJ, USA: Lawrence Erlbaum Associates, Inc.

Lackey, B. K., & Ham, S. H. (2003). Assessment of communication focused on human-black bear conflict at Yosemite National Park. *Journal of Interpretation Research*, *8*(3), 25–40.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, *18*(1), 3–9.

Manfredo, M. J. (2008). *Who Cares About Wildlife? Social Science Concepts for Exploring Human-Wildlife Relationships and Conservation Issues*. New York: Spring Science & Business Media, LLC.

Manning, R. (2003). Emerging principles for using information / education in wilderness management. *International Journal of Wilderness*, *9*(1), 20–27.

Manning, R. (2011). *Studies in Outdoor Recreation: Search and Research for Satisfaction* (3rd ed.). Corvallis, OR: Oregon State University Press.

Martin, S. R., & McCurdy, K. (2009). Wilderness food storage in Yosemite: Using the theory of planned behavior to understand backpacker canister use. *Human Dimensions of Wildlife*, *14*(3), 206–218.

Micerri, T. (1989). The unicorn, the normal curve, and other improbable creatures. *Psychological Bulletin, 105*, 156–166.

Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modeling. *Structural Equation Modeling, 2*, 255-273.

Miller, Z.D., Freimund, W., Metcalf, E., Nickerson, N., Dalenberg, D., Powell, R.B. (Under review, a). Measuring elaboration and evaluating its influence on behaviors. *Environmental Education Research.*

Miller, Z.D., Freimund, W., Metcalf, E., Nickerson, N., Dalenberg, D., Powell, R.B. (Under review, b). Targeting your audience: Wildlife value orientations and the relevance of messages about bear safety. *Human Dimensions of Wildlife.*

Munshi, J. (2014). A method for constructing Likert scales. *SSRN Electronic Journal*, (April), 1–12.

NPS. (2017a). *Yellowstone National Park: Visitation statistics.* Retrieved from http://www.nps.gov/yell/planyourvisit/visitationstats.htm

NPS. (2017b). *Bear-inflicted human injuries and fatalities in Yellowstone*. Retrieved from http://www.nps.gov/yell/learn/nature/injuries.htm

NPS. (2017c). *Bear safety. Yellowstone National Park.* Retrieved from https://www.nps.gov/yell/planyourvisit/bearsafety.htm

Penteriani, V., Delgado, M. D. M., Pinchera, F., Naves, J., Fernández-Gil, A., Kojola, I., … López-Bao, J. V. (2016). Human behaviour can trigger large carnivore attacks in developed countries. *Scientific Reports*, *6*(1432), 20552.

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artifact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71.

Petty, R. E., Cacioppo, J. T., & Goldman, R. (1981). Personal involvement as a determinant of argument-based persuasion. *Journal of Personality and Social Psychology*, *41*(5), 847–855.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*. (Vol.19, pp. 123- 205). San Diego, CA: Academic Press.

Petty, R. E., McMichael, S., & Brannon, L. A. (1992). The elaboration likelihood model of persuasion: Applications in recreation and tourism. In M. J. Manfredo (Ed.), *Influencing Human Behavior: Theory and applications in recreation, tourism, and natural resources management* (pp. 77–101). Champaign, IL: Sagamore Publishing.

Petty, R. E., Wegener, D. T., & Fabrigar, L. R. (1997). Attitudes and attitude change. *Annual Review of Psychology*, *48*, 609–47.

Schultz, P. W. (2011). Conservation means behavior. *Conservation Biology*, *25*(6), 1080–1083.

Shrestha, S. K., Burns, R. C., Pierskalla, C. D., & Selin, S. (2012). Predicting deer hunting intentions using the theory of planned behavior: A survey of Oregon big game hunters. *Human Dimensions of Wildlife*, *17*, 129–140.

Teel, T. L., Dietsch, A. M., & Manfredo, M. J. (2015). A (social) psychology approach in conservation. In N. J. Bennett & R. Roth (Eds.), *The Conservation Social Sciences: What?, How?, and Why*. Vancouver, B.C.: Canadian Wildlife Federation and Institute for Resources, Environment and Sustainability.

Teng, S., Khong, K. W., & Goh, W. W. (2014). Conceptualizing persuasive messages using ELM in social media. *Journal of Internet Commerce*, *13*(1), 65–87.

Vezeau, S. L., Powell, R. B., Stern, M. J., Moore, D. D., & Wright, B. A. (2015). Development and validation of two scales to measure elaboration and behaviors associated with stewardship in children. *Environmental Education Research*, (January), 1–22.

Appendix A: Tables

Table 1: Descriptive statistics and reliability for theory of planned behavior measures.

Component	Variable code	Variable	Mean *(SD)*
Attitudes[1] Rho=0.92			--
	ATT_1	Not at all pleasant to extremely pleasant[2].	3.7 *(1.27)*
	ATT_2	Not at all favorable to extremely favorable[3].	4.0 *(1.16)*
	ATT_3	Not at all good to extremely good[4].	4.1 *(1.11)*
Subjective norms[5] Rho=0.81			--
	SN_1	People who I value think I should carry bear spray while hiking in Yellowstone.	4.0 *(1.22)*
	SN_2	People important to me would be carrying bear spray if they were hiking in Yellowstone.	3.9 *(1.25)*
	SN_3	Other visitors would support my decisions to carry bear spray while hiking in Yellowstone.	3.9 *(1.16)*
Perceived behavioral control[5] Rho=0.65			--
	PBC_1	If I wanted to, I could easily carry bear spray on my next hiking trip in Yellowstone.	4.5 *(0.87)*
	PBC_2	The factors that influence my decision to carry bear spray while hiking in Yellowstone are totally within my control.	4.4 *(0.90)*
	PBC_3[6]	It is difficult to carry bear spray while hiking in Yellowstone.	4.7 *(0.69)*
Bear spray behavior[7] Rho=0.96			--
	BSP_1	Personally carry bear spray.	5.4 *(2.14)*
	BSP_2	Carry bear spray in an accessible place, like a hip holster.	5.3 *(2.17)*

[1]Responses to the statement, "For me, carrying bear spray while hiking in Yellowstone would be…"
[2]1=not at all pleasant, 5=extremely pleasant.
[3]1=not at all favorable, 5=extremely favorable.
[4]1=not at all good, 5=extremely good.
[5]1=not at all true, 5=completely true.
[6]Item reverse coded.
[7]1=highly unlikely, 7=highly likely.

Table 2: Effect of attitudes, subjective norms, and perceived behavioral control on bear spray behavioral intentions[1]

TPB component	Standardized path coefficient	Effect size[2]	*p*-value
Attitudes	0.34	Medium	0.002
Subjective norms	0.33	Medium	0.006
Perceived behavioral control	0.14	Small	0.012

[1]See Figure 2 for full SEM.
[2]Based off of Cohen (1998).

Table 3: Effect of elaboration on attitudes, subjective norms, and perceived behavioral control[1]

TPB component	Standardized path coefficient	Effect size[2]	*p*-value
Attitudes	0.43	Medium-Large	0.005
Subjective norms	0.46	Medium-Large	0.003
Perceived behavioral control	0.46	Medium-Large	0.002

[1]See Figure 2 for full SEM.
[2]Based off of Cohen (1998).

Table 4: Effect of elaboration on bear safety behavioral intentions[1]

	Standardized effect	Effect size	*p*-value
Direct effect	0.13	Small	0.004
Indirect effect	0.36	Medium	0.003

[1]See Figure 2 for full SEM.
[2]Based off of Cohen (1998).

Appendix B: Figures

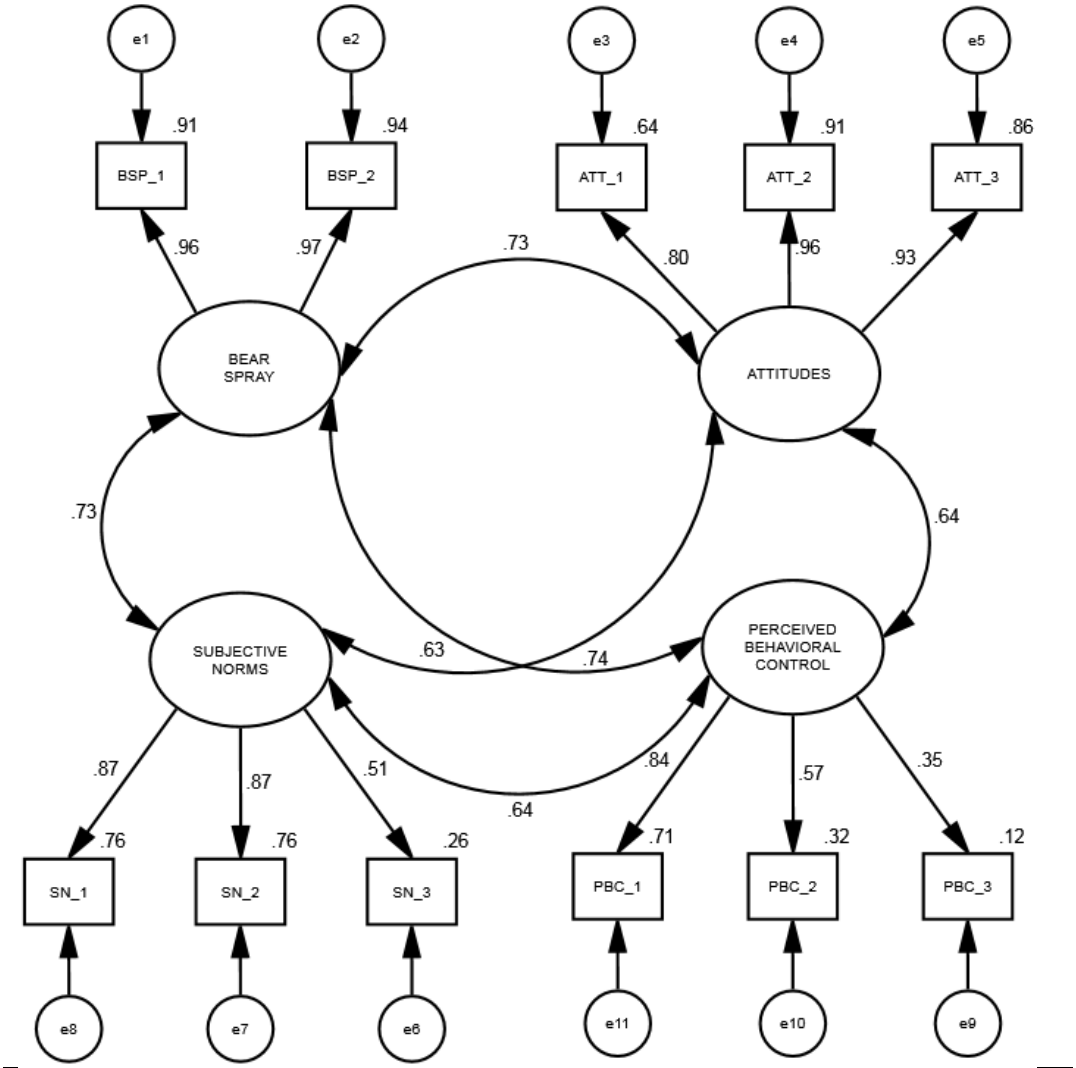

Figure 1: CFA of theory of planned behavior measures. All loadings are standardized and statistically significant (p<0.01). Fit statistics: χ^2=78.023, df=38, p<0.001; BS_{boot}, p=0.064; RMSEA=0.042, p-close=0.834; SRMR=0.0247; CFI=0.991; TLI=0.988. See Table 1 for corresponding variable codes.

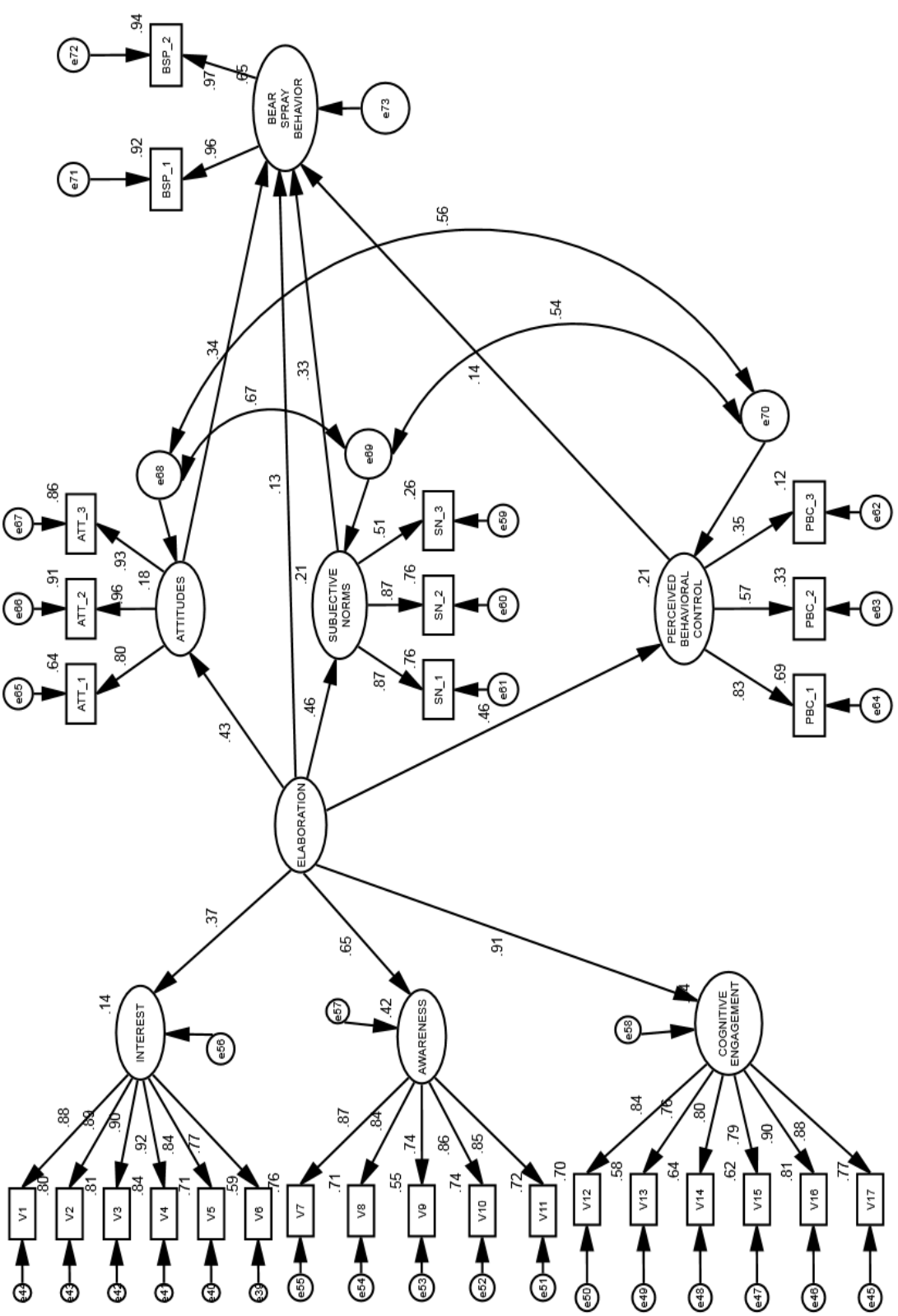

Figure 2: The relationship between elaboration and the theory of planned behavior. Fit statistics: χ^2=670.66, df=337, p<0.001; BS_{boot}, p=0.002; RMSEA=0.041, p-close=1.00; SRMR=0.038; CFI=0.975; TLI=0.972. All loadings and paths were statistically significant (p<0.01). See Table 1 for corresponding variable codes.

CHAPTER IV (Manuscript 3): Targeting your audience: Wildlife value orientations and the relevance of messages about bear safety

Intended journal: *Human Dimensions of Wildlife*

TARGETING YOUR AUDIENCE: WILDLIFE VALUE ORIENTATIONS AND THE RELEVANCE OF MESSAGES ABOUT BEAR SAFETY

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Abstract

This research uses the concept of wildlife value orientations to understand how to increase the motivation of people to process information about wildlife in the context of the elaboration likelihood model (Petty & Cacioppo, 1986). After wildlife value orientation typologies were identified using confirmatory factor analysis and cluster analysis, a series of ANOVAs were used to examine how important different types of messages were to the typology segments. The results indicated that wildlife value orientations may be useful in framing communications about wildlife-related issues. In general, people with more mutualistic orientations found more ecologically-framed messages more important. This research represents the application of wildlife value orientations to a communication theory like the elaboration likelihood model. Additionally, it is one of the few examples where wildlife value orientations are applied to a population of national park visitors.

Introduction

Dealing with human-wildlife interactions is a particularly salient issue for many managers of park and protected areas. Some of these interactions can be a serious issue for visitor safety, and many of these dangerous interactions are a result of inappropriate human behaviors (DiSteffano, 2005; Penteriani et al., 2016; Woodroffe & Ginsberg, 1998). One tool managers use to address inappropriate or unsafe human-wildlife interactions is communication. Communication is often used in park and protected area management because it does not require as many resources, is often more appropriate in wildland settings, is preferred by visitors, and can be highly effective at influencing visitor behaviors when designed appropriately (Brown, Ham, & Hughes, 2010; Ham, 2013; Manning, 2003; 2011). Using well-established communication theories, instead of institutional formats or staff intuition, can help make communications more effective in influencing visitor behaviors (Hall, Ham & Lackey, 2010).

One theory that has been a valuable framework for helping to improve communication designed to influence visitor behaviors is the elaboration likelihood model (ELM) (Petty & Cacioppo, 1986). The goal of strategies developed using the ELM is to increase the amount of thoughtful processing, or elaboration, that people engage in. Higher levels of elaboration are predictive of favorable behavior change that is long-lasting (Petty, McMichael, & Brannon, 1992). A crucial prerequisite to elaboration is that people are motivated to process the information (Petty & Cacioppo, 1986). This is particularly important in non-captive audiences, such as visitors to park and protected areas. Visitors are often bombarded by many different messages, but if they do not view these messages as relevant, they are unlikely to be motivated to process them (Ham, 2013; Lackey & Ham, 2003; Petty & Cacioppo, 1986). Therefore,

developing messages that are relevant to visitors is a critical part of increasing the effectiveness of communication strategies.

However, visitors to park and protected areas have a wide range of beliefs and interests regarding any number of subjects. Communication theory recognizes that visitor characteristics, like these beliefs and interests, play an important part in the process of persuasion (Hall et al., 2010; Ham, 2013). When it comes to addressing human-wildlife interactions through communication, wildlife value orientations are a useful way to understand differences among visitors (Fulton, Manfredo, & Lipscomb, 1996; Teel & Manfredo, 2009; Teel et al., 2010). One way that WVOs can be used to address human-wildlife conflict is through targeted communications. In terms of the ELM, it is likely that visitors with different WVOs will find different types of messages about wildlife relevant (Bright, Manfredo, & Fulton, 2000; Hermann, Voß, & Menzel, 2013). However, few studies have explicitly investigated this. Increasing the relevancy of wildlife-safety messages to visitors is likely to lead to more elaboration, and thus more favorable outcomes (Ham, 2013; Petty & Cacioppo, 1986).

To further explore the relationship between WVOs and message relevancy, a study was conducted in Yellowstone National Park (YNP). Yellowstone National Park is located in one of two main areas in the contiguous US that is home to a substantial population of grizzly bears (*Ursus arctos)*. Safe hiking in grizzly bear country is best done by adopting several specific behaviors (NPS, 2017a), and YNP has developed numerous communications intended to increase visitors' bear safety behavior compliance. However, recent research has found that compliance with bear safety is fairly low (NPS, 2017b). Additionally, there has also been a spike in deaths from grizzly attacks in YNP. For instance, between 1963 and 2010, three deaths from grizzly bears occurred in the park. However, between 2011 and 2015, in separate incidents, three

visitors were killed by grizzly bears in YNP (NPS, 2017c). The purpose of this research is to explore the relevancy of different bear safety messages to visitors of different WVO typologies. Within the context of the ELM, messages that are more relevant should increase the adoption of bear safety behaviors while hiking. A single research question was developed for this study to explore these concepts:

R_1: How do different messages about bear safety vary in their level of relevance among WVO typologies?

Conceptual framework

Wildlife value orientations

Value orientations are a part of the cognitive hierarchy, which is sometimes referred to as the value-attitude-behavior hierarchy (Homer & Kahle, 1988; Kluckholn, 1951). This theory is conceptualized as a hierarchy of reciprocal cognitions, where one level influences the next, that guide behavior (Teel & Manfredo, 2009). From the bottom to the top of the hierarchy, the levels are values, value orientations, beliefs, attitudes, behavioral intentions, and actual behavior. Values tend to be few, abstract, widely shared by individuals in a culture, stable across situations, and relatively resistant to change (Fulton et al., 1996; Rokeach, 1973). Beliefs relate to a specific domain, like national parks or wildlife. Patterns of beliefs, both in direction and strength, comprise a value orientation. Attitudes are a positive or negative evaluation of a subject or object based upon a person's beliefs about the outcome of the attitude subject (Ajzen, 1991). Behavioral intentions are a close antecedent to actual behaviors (Ajzen, 1991).

Wildlife value orientations were originally developed by Fulton, Manfredo, and Lipscomb (1996). Since Fulton et al.'s (1996) original article, WVOs have resulted in an abundance of research. Hunters, wildlife viewers, and general outdoor recreationists were shown

to express different WVOs (Hrubes, Ajzen, & Daigle, 2001). WVOs have also been useful in predicting what kind of recreational activities someone participates in (Fulton et al., 1996). WVOs can influence an individual's support, attitudes, and intentions for wildlife related management actions (Bright et al., 2000; Manfredo et al., 1999), and more severe responses to wildlife are associated with people who have a utilitarian value orientation (Manfredo, Teel, & Bright, 2003; Perry-Hill et al., 2014). WVOs are also valuable for understanding human relationships with wildlife in a global context (Manfredo & Dayer, 2004).

It is also worth noting that WVOs in the U.S. are gradually shifting away from the idea that wildlife exists for human use and enjoyment (Manfredo et al., 2003). Part of the reason this shift may be occurring is due to the rise of post-materialist values in the U.S., which in turn is driven by increasing urbanization (Inglehart, 1997; Manfredo et al., 2003). Areas with higher incomes, higher levels of education, and urban areas were associated with shifts away from the "traditional" modern values and utilitarian WVOs (Manfredo et al., 2003). This shift may also be apparent in other countries as they begin to urbanize and develop (Miller et al., 2016).

Recent research has refined and improved the measurement and terminology associated with WVOs, including the incorporation of qualitative research (Deruiter & Donnelly, 2002; Jacobs, Vaske, Sijtsma, 2014; Manfredo, Teel, & Henry, 2009; Teel & Manfredo, 2009). According to the refined WVO research there are two value orientations: mutualism and domination. Mutualism is measured by two different belief dimensions: social affiliation and caring. Domination is also measured by two different belief dimensions: appropriate use and hunting. These two different WVOs (mutualism and domination) can be used to further segment groups of people into four discreet typologies: traditionalists (high domination, low mutualism), pluralists (high domination, high mutualism), mutualists (high mutualism, low domination), and

distanced (low mutualism, low domination). Proportions of the four typologies also vary from state to state (Teel & Manfredo, 2009).

The mutualism-domination WVOs spurred new research in human dimensions of wildlife. In the U.S., WVO typologies showed significant differences and levels of agreement regarding a variety of topics related to hunting, logging, private property rights, and predator management (Teel & Manfredo, 2009). International research was also conducted under this WVOs framework. In Germany, WVOs were predictive of support for reintroduction of bison and the migration of wolves (Heremann, Voß, & Menzel, 2013). Additionally, WVOs were also predictive of support for lethal control of agriculturally harmful wildlife species, like geese and deer, in the Netherlands (Sijtsma, Vaske, & Jacobs, 2012). The refined WVO measures appear to be theoretically and empirically robust instruments for understanding the relationship and behaviors between humans and wildlife.

Understanding WVOs can also help with protected area management (Teel et al., 2010). WVOs can be used in park and protected areas to address human-wildlife conflict through targeted messaging. Audience characteristics play an important role in persuasive communication (Hall et al., 2010), and WVOs can help understand differences in an audience regarding wildlife. It is likely that visitors with different WVOs will find different types of "why" messages relevant. Because of this, messages should be crafted to address the different types of relationships visitors have with wildlife (Hermann et al., 2013). This may have multiple benefits, including the incorporation of different perspectives and greater success in persuasion (Hermann et al., 2013).

Elaboration likelihood model

The ELM has been one of the most widely used theories for developing communication materials (Teng, Khong, & Goh, 2014). The ELM is specifically about persuasion, which is the process of influencing people's attitudes, and thus behaviors (Ajzen, 1991; Ham, 2013; Petty & Cacioppo, 1986). The ELM states there are two routes to persuasion: the peripheral and the central route. To take the central route to persuasion, people need to be motivated and able to process a message (Petty & Cacioppo, 1986). In communication, motivation usually comes from the relevance of the message (Ham, 2013). Central route processing leads to a logical, thoughtful consideration of the information, which is where the term "elaboration" is derived from (Petty & Cacioppo, 1986). People take the peripheral route to persuasion when they are unmotivated or unable to process a message. In the peripheral route, people rely on cues that have nothing to do with the merits of the information. This can include things like the number of arguments in a message and the conditions under which the message is presented (Petty & Cacioppo, 1986).

There are some important differences in the outcomes between peripheral and central route processing. For instance, attitude changes from the peripheral route are less salient, persistent, and durable (Petty et al., 1992). In contrast, attitude changes from the central route tend to be more salient, persistent, durable, and predictive of behaviors due to higher levels of elaboration (Petty et al., 1992). Comparing the outcomes of the two routes, the central route to persuasion is generally preferred over the peripheral route (Petty et al., 1992).

However, research in social psychology suggests that most decisions people make are based on peripheral route processes, and not the elaborative, central route processing that is more favored (Bargh & Chartrand, 1999; Petty et al., 1992). The reason for this is that people have a

limited capacity in their ability to centrally process information and reserve their cognitive processing capacity for situations where it would be most important (Bargh & Chartrand, 1999; Gilbert, Pelham, & Krull, 1988). In this sense, the importance of a message is similar to relevance in the ELM, which motivates people to use central route processing (Ham, 2013; Petty & Cacioppo, 1986).

Research supports that message importance can interrupt the common-place peripheral route processing and guide people towards central route processing. For instance, when people see many different messages to choose from, such as at a national park, people first scan a message for its importance *before* further pursuing it (Pratkanis & Greenwald, 1993). Similar concepts, like preference matching, can be found in online marketing research, where elaboration likelihood is higher if information is more appealing to an individual (Tam & Ho, 2005). In this current research, importance is used as a proxy for understanding relevancy in the context of the ELM. Regardless of how relevancy is operationalized, it is usually considered the "why" portion of the message, as opposed to the "what" portion of the message. For instance, most bear safety messages in YNP say that bears are dangerous (why) and describe behaviors people can adopt (what). The importance of messages to an audience should not be overlooked, as it is a prerequisite for elaboration to occur. Within the framework of the ELM, important messages would be viewed as more relevant. This increased relevance would promote higher levels of elaboration to occur, which in turn would have a positive impact on behaviors. Overall, more relevant messages are more likely to impact visitor behaviors.

Methods

Sample

Day hikers were systematically sampled on two different trails during daylight hours between July 1st and August 15th. Managers at YNP helped select two trails that served as a sampling frame. Data collection was distributed to represent all days of the week. In total, 777 groups of hikers were contacted to participate in the research. Fourteen (1.8%) did not speak English and were removed from the study. If a group of more than one person was intercepted, only one person was selected from the group to participate. To prevent self-selection, the person with the most recent birthday (not date of birth) was asked to complete the survey. Out of 763 eligible groups, 647 individuals agreed to participate (response rate=85%). Two questions were used to evaluate for a non-response bias: age and U.S. residency/citizenship. There were no significant differences ($p<0.05$) between respondents and non-respondents for the two variables.

Data instrument

A survey-based questionnaire collected data via an electronic tablet. Due to institutional limitations on the types of questions that can be asked to visitors, an abbreviated version of WVO measures was developed. Of most importance, questions about killing or hunting animals were excluded from the survey due to their potential controversy. Due to these exclusions, the WVO measures are designed to measure only mutualism and domination, and not their underlying constructs (e.g. appropriate use, hunting, social affiliation, caring; see Teel & Manfredo, 2009). Respondents were asked, "In general, how much do you disagree or agree with the following statement." All responses were measured on a 7-point Likert-type scale, where 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=neither, 5=slightly agree, 6=agree, and 7=strongly agree. Six different items measured a mutualist WVO, all of which were adapted

from previous research (Larson, Whiting, & Green, 2011; Teel & Manfredo, 2009; Vaske et al., 2001). They are "We should strive for a world where humans and wildlife can live side by side without fear", "I feel a strong emotional bond with animals", "Wildlife has value, whether people are present or not", "Wildlife are like my family and I want to protect them", "I view all living things as part of one big family", and "Wildlife has as much right to exist as people." Five different items are used to measure a domination WVO. These include "The needs of humans should take priority over wildlife protection", "Wildlife is on earth primarily for people's benefit", "Humans should manage wildlife populations so that humans benefit", "Wildlife is important because of what it can contribute to the pleasure and welfare of humans", and "Wildlife is only valuable if people benefit."

Eight different messages were evaluated in this research for their level of importance, which serves as a proxy for message relevancy in the framework of ELM (Ham, 2013; Petty & Cacioppo, 1986; Tam & Ho, 2005). Respondents were presented with the statement, "Please rate the following statements according to how important they are to you." Responses were recorded on a 5-point Likert-type scale, where 1=not at all important, 2=slightly important, 3=moderately important, 4=very important, 5=extremely important. Five of the messages were from existing YNP communication materials. These include the messages "Even though the animals of Yellowstone seem tame they are still wild", "In 2011 and 2015, in separate incidents, three visitors were killed by bears inside the park", "All wildlife, especially bears, can be dangerous", "Bear spray has been proven to be highly successful at stopping aggressive behavior in bears", and "There is no guarantee of your safety in bear country." Three of the messages were developed by researchers and include "You are entering a place that is home to many bears. It is your responsibility to know how to behave", "Taking safety precautions while hiking helps keep

Yellowstone's bears healthy, safe, and wild", and "Hiking in places where grizzly bears live, like Yellowstone, is different than hiking in other places. Know how to act!" Messages were selected and developed to appeal to both mutualist and domination WVOs.

Analysis

Data screening revealed that some of the variables had one or two missing data points. Results from a Little's missing completely at random (MCAR) test indicated there was no pattern to the missing data (χ^2=96.051, df=155, p=1.000). Cases with missing data were deleted listwise instead of imputed to be as conservative as possible. This left a final sample size of n=630.

The internal consistency and structure of the WVO measures were examined using a confirmatory factor analysis (CFA) and Rho reliability analysis. CFA allows researcher to determine if the hypothesized structure of the variables provides a good fit to the data. The assessment of this fit is evaluated using several different fit statistics. During data screening, it was revealed that several variables were skewed. This indicated that the assumption of multivariate normality, a requirement for using maximum likelihood (ML) estimation in CFA, was likely violated. To correct for this, we applied bootstrapping to the CFA procedure and used bias-corrected confidence intervals (95%) to report significance. In this research, χ^2, the Bollen-Stine bootstrap χ^2 (BS_{boot}; a χ^2 test that accounts for the bootstrapping procedure), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) are used to assess model fit. Although it is customary to report χ^2 fit statistics (including BS_{boot} where appropriate), large sample sizes often result in a statistically significant p-value. Due to this, other fit statistics are generally more relied upon. For the RMSEA, values should be $\leq$0.10, with values $\leq$0.05

considered to be indicative of an excellent fit (Browne & Cudeck, 1993; Kline, 2011). A *p*-close test is also provided for RMSEA, which tests the likelihood that RMSEA is realistically less than 0.05. A *p*-close value of >0.05 is considered a close fit (Kline, 2011). SRMR values should be ≤0.08, and fit becomes increasing better as values approach 0. Both the CFI and TLI should have values ≥0.90, with values ≥0.95 indicating an excellent fit (Hu & Bentler, 1998). In addition, all factor loadings should be statistically significant and >0.30, with loadings >0.60 considered high (Kline, 1994).

Rho coefficient (Raykov's composite reliability) was used to assess the internal consistency of the items measuring a concept. Although Cronbach's alpha is more frequently used, Rho has a significant advantage over it. Cronbach's alpha assumes that all items measuring a concept are tau-equivalent, or have equal factor loadings, which is almost never the case. When this assumption of tau-equivalency is violated, Cronbach's alpha does not properly estimate scale reliability (Graham, 2006; Miller, 1995). Rho is interpreted in a similar way to Cronbach's alpha, where values ≥0.60 are considered acceptable (Gay, 1991). Graham's (2006) guidance for calculating Rho in AMOS was used.

Results from the CFA were used to create a mean index for both WVO dimensions (e.g. mutualism and domination). This process followed Teel and Manfredo's (2009) method of segmenting groups, where the median score in each composite WVO (e.g. domination and mutualism) served as a cutoff point between high and low scores. For domination, high was defined as a score ≥3.0. For mutualism, high was defined as a score of ≥ 6.0. Crosstabs were then used to simultaneously evaluate scores for WVO and segment the groups. Respondents were segmented into four groups based on whether they scored high or low on each of the WVOs.

This resulted in a high-high, high-low, low-high, and low-low grouping. These groups were labeled per previous research and theory (Teel & Manfredo, 2009).

Results

Sample characteristics

The gender of respondents was about evenly split, with 53.2% identifying as male and 46.8% as female. The average age was 40.7 years. The clear majority (over 91%) of respondents reported being White, with the next largest group being Asian (6.2% of the sample). Only 3.4% of respondents said they identified as Hispanic or Latino. Respondents in the sample had high levels of educational attainment, with over 90% stating they had at least some college. About 40% of respondents said they had a graduate degree as their highest level of educational attainment, with another 40% stating they had a Bachelor's degree as their highest level of educational attainment. Respondents represented all continents except Antarctica and Africa, and about 18% said they were not permanent residents or citizens of the US. The most common countries of origin for international visitors were Canada (2.5%), France (2.1%), Germany (1.9%) Switzerland (1.3%), and the Netherlands (1.1%). Of the 82% of respondents who were permanent citizens or residents of the US, 47 of the 50 states were represented, as was Washington, DC.

Wildlife value orientations

Table 1 provides variable codes and descriptive statistics for WVO measures. In CFA, variables need to have sufficient variance to be modeled. One variable (V3, "Wildlife has value, whether people are present or not") had a relatively low standard deviation (0.65) and was excluded from the analysis. The CFA model provided some evidence that the data fit the model, but some of the fit indices, although still acceptable, were borderline (χ^2 =149.278, *df*=34,

p<0.001; BS_{boot}, p=0.002; RMSEA=0.073, p-close=0.001; SRMR=0.069; CFI=0.93; TLI=0.90), and the p-close test for the RMSEA was significant. To improve the model, modification indices were used in an iterative process to construct a model that the data fits better. In total, two additional variables (V6, "Wildlife has as much right to exist as people", and V10, "Wildlife is important because of what it can contribute to the pleasure and welfare of humans) were removed after consulting with the modification indices, which indicated that the two variables cross-loaded on the opposing dimension (e.g. mutualism or domination). This final model (Figure 1) indicated that there was a good fit between the data and the model. Although the χ^2 test was significant (χ^2=33.320, df=10, p=0.022), all other fit statistics supported the model (BS_{boot}, p=0.072; RMSEA=0.035, p-close=0.903; SRMR=0.0312; CFI=0.99; TLI=0.98). Additionally, all factor loadings were statistically significant (p<0.01) and over the threshold of 0.30, with most above 0.60. Rho reliability also indicated that the items were reliably measuring their respective dimensions and were above the 0.60 threshold (see Table 1).

(INSERT FIGURE 1 ABOUT HERE)

(INSERT TABLE 1 ABOUT HERE)

Using the results of the CFA, groups were segmented using their scores on both WVO dimensions. A one-way ANOVA was conducted to make sure the groups made logical sense based off previous research and were named accordingly (Miller et al., 2014; Teel & Manfredo, 2009). Results supported that the process was successful in segmenting respondents in a similar fashion to previous WVO studies (Table 2).

(INSERT TABLE 2 ABOUT HERE)

Level of importance of messages about bear safety among WVO typologies

A series of ANOVAs showed that there were significant differences ($p<0.05$) in the level of importance of messages about bear safety among the WVO typologies for every message tested (Table 3). However, the effect size was rather weak for all tests (Cohen, 1998), and the η^2 ranged from 0.03 to 0.05. The post-hoc analyses provided further insight into the differences among the typologies. In seven out of the eight messages, mutualists and traditionalists were significantly different. In all of these instances, mutualists found the messages presented as more important than traditionalists. Distanced respondents were more like traditionalists, showing no significant difference with them on seven of the eight messages. Pluralists fell somewhat in the middle, often differing from only one other group (in five of eight of the messages). Pluralists were most similar to mutualists (no significant difference between the groups for any messages) and most different when compared to traditionalists (differing on seven of the eight messages). In general, mutualists had rated messages higher than other groups. This is particularly true when compared to traditionalists, who rated messages lower than other groups in almost every instance.

(INSERT TABLE 3 ABOUT HERE)

For most messages that were explicitly designed to appeal to more mutualistic values (e.g., "You are entering a place that is home to many bears. It's your responsibility to know how to act", "Taking safety precautions while hiking helps keep Yellowstone's bears healthy, safe, and wild."), pluralists and mutualists rated them as more important when compared to traditionalists. Distanced respondents were not different from any groups for these messages. A similar pattern can be found in some less explicit appeals to mutualistic WVOs (e.g. "Even though the animals of Yellowstone seem tame, they are still wild", "There is no guarantee of your safety in bear country"). The one message that appealed specifically to more human-

centered, traditionalist WVOs (e.g. “In 2011 and 2015, in separate incidents, three visitors were killed by bears inside the park”) was also the only message where mutualists and traditionalists were not different in their rating of importance, although there were some other differences among the groups.

Discussion

This research was designed to explore how different messages about bear safety vary in their level of relevance among WVO typologies. Message importance was used as a proxy to understand relevance in the context of the ELM. The results indicate that people with different WVOs perceive messages about bear safety significantly different in their level of importance. This was true for all the messages in this study. Within the framework of the ELM, messages that an audience views as more important will increase people’s levels of motivation for processing a message through the central route. The product of central route processing is a higher level of elaboration, which would impact attitudes and lead to behavior change (Ajzen, 1991; Petty & Cacioppo, 1986). Ultimately, results from this research suggest that designing messages that are more important to a specific audience is likely to lead to communication strategies that are more effective at impacting behaviors.

Post-hoc analyses revealed why some of the messages may be more or less important to different WVO typologies. Messages that appeal to an audiences’ stronger WVO were generally considered more important. For instance, messages with a more mutualistic value-framing (Teel et al., 2015) were found to be more important to visitors with higher levels of mutualism WVOs. The results from this confirm past suggestions that WVOs are related to the types of information that people seek out or pay attention to (Bright et al., 2000; Hermann et al., 2013). This is similar to the concept of “preference matching” (Tam & Ho, 2005), where information that is more

appealing to people is provided in an effort to increase their levels of elaboration. Collectively, framing communications about wildlife to match people's WVOs would make communications more effective in influencing behaviors (Ham, 2013; Petty & Cacioppo, 1986).

For park and protected area managers and other wildlife professionals, messages about wildlife that are crafted with knowledge of an audiences' WVOs can be useful in increasing the elaboration likelihood of an audience, and thus impacting behaviors. For instance, in dealing with populations who tend to be more like mutualists, messages can be constructed that appeal to the mutualism WVO. Several examples of value-framing (Teel et al., 2015) using WVOs as a framework are provided in Figure 2 below. In matching people's WVOs with messaging, it is likely that the target audience will find the message more important, pay more attention to it, and be more motivated to thoughtfully process the message (Bright et al., 2000; Petty & Cacioppo, 1986). As indicated previously, the outcomes of this thoughtful processing, or elaboration, can impact attitudes and change behaviors when applied appropriately (Ajzen, 1991; Ham, 2013; Petty & Cacioppo, 1986). Even when the audience represents a diversity of WVOs, understanding differing perspectives can help to decrease the distance between opposing views (Hermann et al., 2013). Using WVOs to frame communications can lead to better outcomes when dealing with human-wildlife conflict.

(INSERT FIGURE 2 ABOUT HERE)

Although much research has been done with WVOs in other areas, little research has been conducted with this concept in national parks. Compared to other recent studies in the US (Teel & Manfredo, 2009), these national park visitors appeared to have higher mutualism WVOs (mean=5.7) and lower domination WVOs (mean=3.0). Even the traditionalist typology (which generally has the lowest mean mutualism score) had a mutualism mean score that was above the

neutral point (4) in the scale (mean=4.7). Given the demographic characteristics of national park visitors, this is not terribly surprising. Previous research has linked higher levels of educational attainment (among other post-materialist values), which was substantially present in this sample, as drivers of WVOs that are more mutualistic (Manfredo et al., 2003). Additionally, one of the most common reasons people visit national parks is to view wildlife (Manfredo, 2008), and wildlife viewing has also been associated with mutualism WVOs (Hrubes et al., 2001). Given all of this, it is likely that national park visitors are generally skewed more towards mutualism WVOs than domination ones. In YNP, messages that focus on mutualistic value-framing with bear safety may be one way to increase the relevancy of messages to day hikers. From this increased relevancy, visitors may be more inclined to engage in favorable behaviors (Ham, 2013; Petty & Cacioppo, 1986).

There are some notable limitations to this research. For instance, the process of segmenting out typologies using WVOs is not a standardized process. The differences in the segmentation process from study to study can lead to results that may be more difficult to compare. Nonetheless, most segmentations, including this one, result in typologies that follow the conceptual framework of WVOs. Additionally, this research used a reduced version of the WVO measures. One reason for this was institutional limitations, in that controversial questions (such as those relating to the hunting, killing, or harming of wildlife) could not be used. A second reason was that this research was part of a broader project, and using the full scale would have resulted in an unnecessary burden to visitors. Another limitation to this research is that the effect sizes were quite weak. There are several reasons why this might be apparent. First, there was a relatively high level of mutualism and low level of domination WVOs in all typologies. The higher levels of similarities among WVO typologies could have reduced the effect size on

message importance. Second, message importance scores were negatively skewed, indicating that the scales may have had a ceiling effect in place. Increasing the variance of the scales (see DeVellis, 2003; Klockars & Hancock, 1993; Munshi, 2014; Peterson & Wilson, 1992) or using a ranking measure (likely in conjunction with fewer messages) may increase the ability to detect a more meaningful effect. Lastly, dramatic types of messages that may be viewed as controversial were avoided in this research due to institutional barriers. Messages that are more explicit and dramatic in their appeals to mutualism or domination WVOs may also result in greater effect sizes. Overall, however, the authors believe that this research is a good preliminary step towards better understanding how WVOs can be used in constructing communication strategies.

Future research should continue to explore how to create effective communication strategies using WVOs. Part of this will be overcoming some of the limitations detailed previously. Specifically, developing a robust scale for WVOs that is both abbreviated, non-controversial, and consistent in multiple protected areas will be important. Other efforts should try to apply WVOs to concepts found in communication. For instance, what message types (i.e., perspective taking, anecdotes, humor, etc.) are most effective in reaching different types of WVOs (Hall et al., 2010)? An additional line of research can be found in how messaging using a particular WVO appeal influences an audience's level of elaboration, or thoughtful processing of a communication strategy (Miller et al., in review). This would be a further look at whether framing communication strategies using WVOs can make an impact on people's behaviors. As future research continues to build, communication strategies can be tailored to specific audiences and achieve greater success.

Conclusion

WVOs have been useful for understanding the relationship between people and wildlife, and understanding human-wildlife relationships can help achieve success in park and protected area management (Teel et al., 2010). One way that WVOs can help is through developing effective communication strategies that recognize that messages about wildlife will differ in their level of importance to visitors. WVOs can be a useful way to increase the importance of messages to visitors. By matching messages about wildlife to an audience's WVO, it is likely that the audience will find the information to be more important and become motivated to thoughtfully process the message. This thoughtful processing, called elaboration, can lead to better outcomes. By using this theoretical approach to communication with visitors, communication becomes more likely to achieve management goals.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Bargh, J.A., & Chartrand, T.L. (1999). The unbearable automaticity of being. *American Psychologist*, *54*(7), 462–479.

Bright, A. D., Manfredo, M. J., & Fulton, D. C. (2000). Segmenting the public: An application of value orientations to wildlife planning in Colorado. *Wildlife Society Bulletin, 28*(1), 218–226.

Browne, M. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), *Testing Structural Equation Models* (pp. 136–162). Newbury Park, CA: Sage.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism*, *18*(7), 879–900.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Deruiter, D. S. & Donnelly, M. P. (2002). A qualitative approach to measuring determinants of wildlife value orientations. *Human Dimensions of Wildlife*, *7*, 251–271.

DeVellis, R. (2003). *Scale Development: Theory and Applications*. Thousand Oaks, CA: Sage Publications.

DiStefano, E. (2005). Human–Wildlife Conflict Worldwide: Collection of Case Studies, Analysis of Management Strategies and Good Practices. Rome: SARD Initiative Report.

Fulton, D. C., Manfredo, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife*, *1*(2), 24–47.

Gay, L. R. (1991). *Educational Evaluation and Measurement: Competencies for Analysis and Application.* New York: MacMillan Publishing Company.

Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1988). On cognitive busyness: When person perceivers meet persons perceived. *Journal of Personality and Social Psychology*, *54*(5), 733–740.

Graham, J. M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and Psychological Measurement*, *66*(6), 930–944.

Hall, T. E., Ham, S. H., & Lackey, B. K. (2010). Comparative evaluation of the attention capture and holding power of novel signs aimed at park visitors. *Journal of Interpretation Research*, *15*(1), 15–36.

Ham, S. (2013). *Interpretation: Making a difference on purpose.* Golden, CO: Fulcrum Publishing.

Hermann, N., Voß, C., & Menzel, S. (2013). Wildlife value orientations as predicting factors in support of reintroducing bison and of wolves migrating to Germany. *Journal for Nature Conservation*, *21*(3), 125–132.

Homer, P. M. & Kahle, L. R. (1988). A structural equation test of the value–attitude–behavior hierarchy. *Journal of Personality Social Psychology, 54*(4). 638–646.

Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the theory of planned behavior. *Leisure Sciences*, *23*(3), 165–178.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3*, 424-453.

Inglehart, R. (1997). *Modernization and postmodernization*. Princeton, NJ: Princeton University Press.

Jacobs, M. H., Vaske, J. J., & Sijtsma, M. T. J. (2014). Predictive potential of wildlife value orientations for acceptability of management interventions. *Journal for Nature Conservation*, *22*(4), 377–383.

Kline, P. (1994). *An Easy Guide to Factor Analysis*. New York, NY: Routledge.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, N.Y.: The Guilford Press.

Klockars, A. J., & Hancock, G. R. (1993). Manipulations of evaluative ratings. *Psychological Reports*, *73*, 1059–1066.

Kluckholn, C. (1951). Values and value orientations in the theory of action. In T. Parsons and E.A. Shils (Eds.), *Towards a General Theory of Action* (pp 388-433). Cambridge, MA: Harvard University Press.

Lackey, B. K., & Ham, S. H. (2003). Assessment of communication focused on human-black bear conflict at Yosemite National Park. *Journal of Interpretation Research*, *8*(3), 25–40.

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment*, *16*(1), 67–86.

Lück, M. (2015). Education on marine mammal tours - But what do tourists want to learn? *Ocean and Coastal Management*, *103*, 25–33.

Manfredo, M. J. (2008). *Who Cares About Wildlife? Social Science Concepts for Exploring Human-Wildlife Relationships and Conservation Issues*. New York: Spring Science & Business Media, LLC.

Manfredo, M. J., & Dayer, A.A. (2004). Concepts for exploring the social aspects of human–wildlife conflict in a global context. *Human Dimensions of Wildlife*, *9*(4), 1–20.

Manfredo, M. J., Pierce, C. L., Fulton, D., Pate, J., & Gill, B. R. (1999). Public acceptance of wildlife trapping in Colorado. *Wildlife Society Bulletin, 27*(2), 499–508.

Manfredo, M., Teel, T., & Bright, A. (2003). Why are public values toward wildlife changing? *Human Dimensions of Wildlife*, *8*(4), 287–306.

Manfredo, M. J., Teel, T. L., & Henry, K. L. (2009). Linking society and environment: A multilevel model of shifting wildlife value orientations in the Western United States. *Social Science Quarterly*, *90*(2), 407–427.

Manning, R. (2003). Emerging principles for using information / education in wilderness management. *International Journal of Wilderness*, *9*(1), 20–27.

Manning, R. (2011). *Studies in Outdoor Recreation: Search and Research for Satisfaction* (3rd ed.). Corvallis, OR: Oregon State University Press.

Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modeling. *Structural Equation Modeling, 2*, 255-273.

Miller, Z. D., Hallo, J. C., Sharp, J. L., Powell, R. B., & Lanham, J. D. (2014). Birding by Ear: A Study of Recreational Specialization and Soundscape Preference. *Human Dimensions of Wildlife*, *19*(6), 498–511.

Miller, Z. D., Quigley, C., Hallo, J. C., Dogbey, J., Che, S. M., & Seno, S. K. (2016). Investigating wildlife and grazing perspectives of Kenyan university students. *Journal for Nature Conservation*, *32*, 44–52.

Munshi, J. (2014). A method for constructing Likert scales. *SSRN Electronic Journal*, (April), 1–12.

NPS. (2017a). *Bear safety.* Retrieved from https://www.nps.gov/yell/planyourvisit/bearsafety.htm

NPS. (2017b). *"A bear doesn't care" campaign*. Retrieved from https://www.nps.gov/yell/planyourvisit/abeardoesntcare.htm

NPS. (2017c). *Bear-inflicted human injuries and fatalities in Yellowstone*. Retrieved from http://www.nps.gov/yell/learn/nature/injuries.htm

Penteriani, V., Delgado, M. D. M., Pinchera, F., Naves, J., Fernández-Gil, A., Kojola, I., … López-Bao, J. V. (2016). Human behaviour can trigger large carnivore attacks in developed countries. *Scientific Reports*, *6*(1432), 20552.

Perry-hill, R., Smith, J. W., Reimer, A. C., Mase, A. S. D., Mullendore, N. E., Mulvaney, K. K., & Prokopy, L. S. (2014). The influence of basic beliefs and object-specific attitudes on behavioural intentions towards a rare and little-know amphibian. *Wildlife Research*, *41*, 287–299.

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artifact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*, 19, 123- 205.

Petty, R. E., McMichael, S., & Brannon, L. A. (1992). The elaboration likelihood model of persuasion: Applications in recreation and tourism. In M. J. Manfredo (Ed.), *Influencing Human Behavior: Theory and applications in recreation, tourism, and natural resources management* (pp. 77–101). Champaign, IL: Sagamore Publishing.

Pratkanis, A. R., & Greenwald, A. G. (1993). Consumer involvement, message attention, and the persistence of persuasive impact in a message-dense environment. *Psychology and Marketing*, *10*(August 1993), 321–332.

Rokeach, M. (1973). *The Nature of Human Values*. New York: The Free Press.

Sijtsma, M. T. J., Vaske, J. J., & Jacobs, M. H. (2012). Acceptability of lethal control of wildlife that damage agriculture in the Netherlands. *Society & Natural Resources*, *25*(12), 1308–1323.

Tam, K. Y., & Ho, S. Y. (2005). Web personalization as a persuasion strategy: An elaboration likelihood model perspective. *Information Systems Research*, *16*(3), 271–291.

Teel, T. L., Dietsch, A. M., & Manfredo, M. J. (2015). A (social) psychology approach in conservation. In N. J. Bennett & R. Roth (Eds.), *The Conservation Social Sciences: What?, How?, and Why* (pp. 21–25).

Teel, T. L., & Manfredo, M. J. (2009). Understanding the diversity of public interests in wildlife conservation. *Conservation Biology*, *24*(1), 128–139.

Teel, T. L., Manfredo, M. J., Jensen, F. S., Buijs, A. E., Fischer, A., Riepe, C., … Jacobs, M. H. (2010). Understanding the cognitive basis for human-wildlife relationships as a key to successful protected-area management. *International Journal of Sociology*, *40*(3), 104–123.

Teng, S., Khong, K. W., & Goh, W. W. (2014). Conceptualizing persuasive messages using ELM in social media. *Journal of Internet Commerce*, *13*(1), 65–87.

Vaske, J., Donnelly, M. P., Williams, D. R., & Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about National Forest management. *Society & Natural Resources*, *14*(9), 761–776.

Woodroffe, R., and J.R. Ginsberg. (1998). Edge effects and the extinction of populations inside protected areas. *Science, 280*: 2126–28.

Appendix A: Tables

Table 1: Descriptive statistics[1] and reliability for wildlife value orientations measures.

Dimension	Variable code	Variable	Mean *(SD)*
Mutualism Rho=0.76			5.7 *(1.09)*
	V1	We should strive for a world where humans and wildlife can live side by side without fear.	5.9 *(1.56)*
	V2	I feel a strong emotional bond with animals.	5.6 *(1.35)*
	V4	Wildlife are like my family and I want to protect them.	5.7 *(1.39)*
	V5	I view all living things as part of one big family.	5.6 (*1.44)*
Domination Rho=0.74			3.0 (*1.28)*
	V7	The needs of humans should take priority over wildlife protection.	3.7 *(1.81)*
	V8	Wildlife is on earth primarily for people's benefit.	3.0 *(1.98)*
	V9	Humans should manage wildlife populations so that humans benefit.	3.5 *(1.87)*
	V11	Wildlife is only valuable if it produces human benefits.	1.8 *(1.18)*
Items removed from CFA			--
	V3[2]	Wildlife has value, whether people are present or not.	6.7 *(0.65)*
	V6[2]	Wildlife has as much right to exist as people.	6.4 (*1.00)*
	V10[3]	Wildlife is important because of what it can contribute to the pleasure and welfare of humans.	4.4 *(1.92)*

[1]Items measured on a 7-point Likert-type scale, where 1=strongly disagree and 7=strongly agree.
[2]Items originally measure mutualism dimension.
[3]Item originally measured domination dimension.

Table 2: Mean comparison of wildlife value orientation dimensions among typologies

Dimension	Mutualists *n*=185	Traditionalists *n*=172	Pluralists *n*=146	Distanced *n*=127	*p*-value
Mutualism	6.5[a]	4.7[b]	6.4[a]	4.9[b]	<0.001
Domination	1.9[a]	4.0[b]	4.1[b]	2.0[a]	<0.001

Note. Means with different superscript letters in the same row are significantly different ($p<0.05$) using Bonferonni post-hoc tests.

Table 3: Mean comparisons of message importance among wildlife value orientation typologies[1].

Message	WVO typology				*p*-value	Effect size
	Mutualist	Traditionalist	Pluralist	Distanced		
Even though the animals of Yellowstone seem tame, they are still wild.	4.7^{a}	4.4^{b}	4.6^{a}	4.6^{ab}	<0.001	0.03
In 2011 and 2015, in separate incidents, three visitors were killed by bears inside the park.	3.9^{ac}	3.8^{ad}	4.2^{c}	3.6^{bd}	<0.001	0.04
All wildlife, especially bears, can be dangerous.	4.6^{ac}	4.4^{bd}	4.6^{bc}	4.4^{d}	0.001	0.03
Bear spray has been proven to be highly successful at stopping aggressive behavior in bears.	4.3^{a}	4.1^{b}	4.5^{a}	4.1^{b}	<0.001	0.04
There is no guarantee of your safety in bear country.	4.6^{a}	4.2^{b}	4.5^{a}	4.2^{b}	<0.001	0.05
You are entering a place that is home to many bears. It is your responsibility to know how to behave.	4.8^{a}	4.5^{b}	4.7^{ac}	4.6^{bc}	<0.001	0.05
Taking safety precautions while hiking helps keep Yellowstone's bears healthy, safe, and wild.	4.8^{a}	4.4^{b}	4.6^{ac}	4.5^{bc}	<0.001	0.05
Hiking in places where grizzly bears live, like Yellowstone, is different than hiking in other places. Know how to act!	4.7^{a}	4.4^{b}	4.7^{a}	4.5^{ab}	<0.001	0.03

Note. Means with different superscript letters in the same row are significantly different ($p<0.05$) using Bonferonni post-hoc tests.
[1]Items were measured on a 5-point Likert-type scale where 1=not at all important and 5=extremely important.

Appendix B: Figures

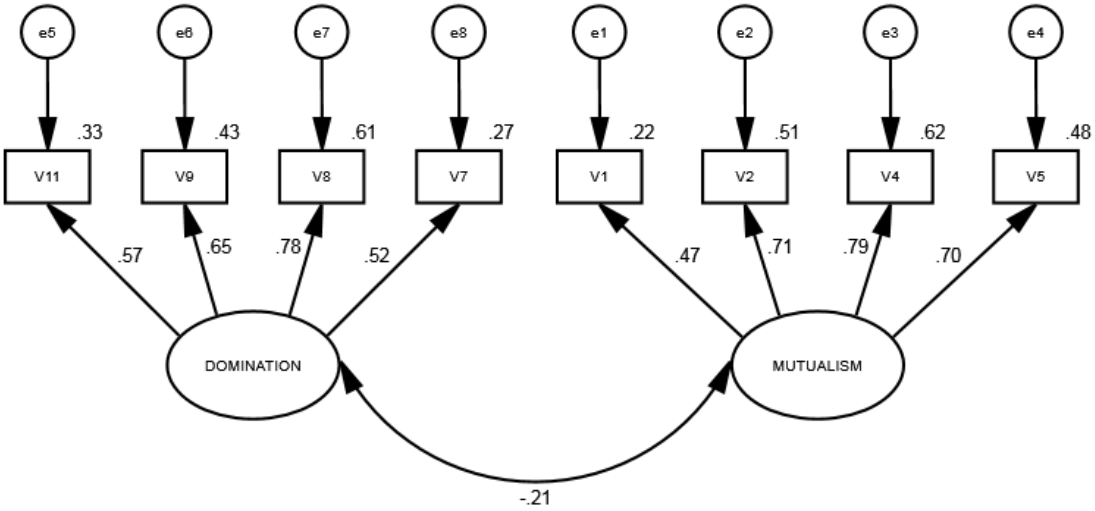

Figure 1: CFA of wildlife value orientation measures. All loadings are standardized and statistically significant (p<0.01). Fit statistics: χ^2=33.320, df=10, p=0.022; BS_{boot}, p=0.072; RMSEA=0.035, p-close=0.903; SRMR=0.0312; CFI=0.99; TLI=0.98. See Table 1 for corresponding variable codes.

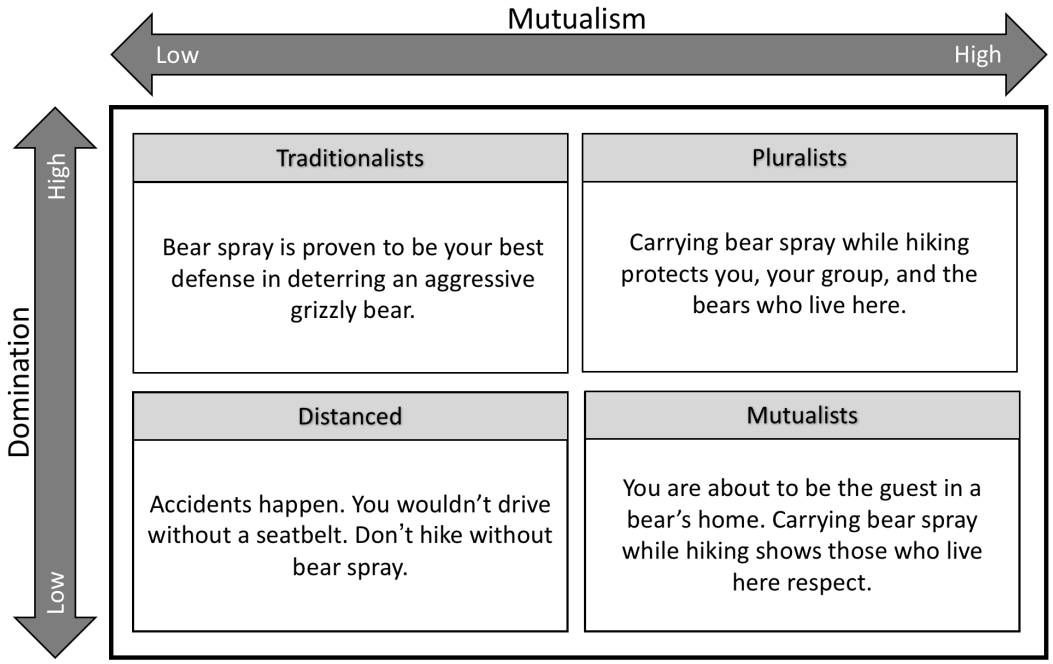

Figure 2: Examples of value-framed (Teel et al., 2015) messages about bear spray designed to increase relevance using wildlife value orientation typologies.

CHAPTER V

Summary

Since their beginnings, our national parks have been places where people come to experience the wildness of the United States' public lands. In Yellowstone National Park, free-roaming megafauna has always been a large part of this experience, and it has also been central to the management challenges. As record-breaking visitation has continued for the past several years, human-wildlife conflict seems to have become a flashpoint that demonstrates the effects of high levels of visitation and a visiting public with limited understandings of how to interact with wildlife. All signs seem to suggest that the future of YNP likely involves even higher visitation and stretched park resources to handle the increasing challenges. Yellowstone National Park is not alone in these challenges. Other parks, such as Glacier, Grand Teton, Grand Canyon, and Yosemite National Parks are dealing with similar issues of high visitation and limited managerial capacities. In all of these situations, park managers need effective and efficient tools to help address the challenges of protected area management in a complex and uncertain second century of national parks. Theory-driven communication strategies can act as a leverage point for park managers to help address a variety of visitor driven management issues (McCool et al., 2014). By organizing communication strategies around theoretical concepts, the success or failure of a strategy can be assessed in a consistent fashion. These assessments will enable refinement of strategies and increase return on the investment of limited resources into communication.

The following section is designed to revisit the original purpose of this research described in Chapter I. In doing so, it summarizes and concludes the findings from the three articles and makes recommendations to YNP managers. Additionally, this section provides recommendations for future research.

Theoretical implications

Confirming an elaboration scale in a different context than originally constructed.

Previous research by Vezeau et al. (2015) developed the first conceptualization of elaboration as a measured concept defined by interest, awareness, and cognitive engagement. In that research, they used stewardship as a concept to operationalize their measures of elaboration. Although the study had its shortcomings (the final model dropped awareness due to variance issues and was thus incomplete), it demonstrated that the concept showed construct validity, predictive validity, and reliability. The researchers further encouraged others to pick up where they left off and adapt and improve their proposed model. This current research achieved just that. The elaboration scale developed around the concept of bear safety demonstrated not only construct validity, predictive validity, and reliability, but it was also theoretically complete in that it measured all three concepts specified by Vezeau et al. (2015). Additionally, the bear safety elaboration scale could predict a variety of different bear safety behavioral intentions, as was found in previous research (Vezeau et al., 2015) and suggested by theory (Petty & Cacioppo, 1986). These results add further support to the concept of elaboration as consisting of interest, awareness, and cognitive engagement.

Linking together two related theories (ELM and TPB) in protected area management in a novel way to understand the process of attitude change

The bulk of the second manuscript (Chapter III) was focused on merging together the elaboration scale and the theory of planned behavior (TPB). Ultimately, this merger was successful and provided a variety of insights about the relationship between the elaboration concept and how it influences behavioral intentions. The first insight was that elaboration, as measured by interest, awareness, and cognitive engagement, has the *potential* to impact all the

antecedents of behavioral intentions according to TPB. In my personal view, I think of this in a way similar to TPB; sometimes it will have an effect on all the components and sometimes it will not. It ultimately depends on the content of the information that people are elaborating on. For instance, if there were no messages that targeted behavioral beliefs/attitudes, then elaboration may not influence the attitude component of TPB. However, the results from this research demonstrate that elaboration can indeed affect all the components of TPB, and not just attitudes. This supports not only the original concept of attitude change (Petty & Cacioppo, 1981; 1986), but also the Ham (2013) concept of the relationship between TPB and the elaboration likelihood model (ELM).

An additional finding from the merging of these two theories is that the concept of elaboration is mostly operating *through* the TPB components to impact behavioral intentions. Although this is not terribly surprising as both theories are based off "rational actor" ideas about human behaviors (Ajzen, 1991; Petty & Cacioppo, 1981), it does add further support to the concept of elaboration as measured in this study. For instance, if elaboration ended up having a larger direct effect than indirect effect on behavioral intentions, it would have casted some doubt on the validity of the elaboration scale. However, the balance of the remaining direct effect of elaboration on behavioral intentions (after the effect was partially mediated by the TPB components) indicates that TPB is not wholly mediating this effect. It seems likely to me that this may be due to some measurement error from the TPB model. For instance, the normative referents used in the social norms component of this research may not have been sufficient. Maybe day hikers do not care if other visitors want them to carry bear spray, so much as their families, friends, or other members of their hiking group. This could also be extended to other facets of perceived behavior control. Additionally, a missing component (like personal norms,

see Brown, Ham, & Hughes, 2010) from the model that also affects behavioral intentions in the rational actor framework may be able to explain the balance of the direct effect of elaboration on behavioral intentions. A last possibility, though one I view as unlikely due to theoretical reasoning, is that elaboration does indeed have a direct effect on behavioral intentions even after moving through other rational actor variables.

Describing wildlife value orientations in a national park context

Previous research using WVOs was limited in a national park context. The results of this research, specifically the third manuscript (Chapter IV) showed that although visitors expressed both mutualistic and domination WVOs, visitors edged more towards mutualistic and less towards domination WVOs. Reflecting on previous research conducted on WVOs, this result should have been more anticipated. Previous research has shown that post-materialist values (things like high levels of education, income, and urbanization) tend to drive mutualistic WVOs (Manfredo et al., 2003; Inglehart, 1997). One of the more notable findings was that even the traditionalist typology (who are supposed to be the most "extreme" in terms of domination WVOs) had relatively high levels of mutualism WVOs. The mean score for mutualism WVOs for the traditionalist typology was over the center point of the scale (mean=4.7). This was in fact *higher* than the neutral point for domination. Collectively, these results indicate that national park visitors are much more mutualistic in their WVOs than other populations that have been previously studied. An alternative explanation would be that the WVO measures did a poor job in detecting differences in visitors. Although there may be some truth to this, many of the measures were derived from previous research that has been validated in numerous populations.

Advancing the idea of relevancy in messaging to a diverse population of visitors

The third manuscript (Chapter IV) demonstrated that day hikers viewed different messages about bear safety with varying levels of importance based on their WVOs. However, the effect size was relatively weak in all the omnibus tests. This was likely due to a relatively high level of mutualism WVOs and relatively low level of domination WVOs across all typologies. Additionally, a "ceiling effect" may have been in place, as the responses for level of importance were negatively skewed for all messages tested. Even with the weak effect size, the pattern was fairly consistent, and there were differences among the groups for every message tested. This confirmed previous assumptions that people with different WVOs tend to pay attention to different types of information (Bright, Manfredo, & Fulton, 2000). In an ELM context, capturing people's attention by providing them with relevant messages increases their elaboration likelihood (Petty & Cacioppo, 1986). Although WVOs are often described as being useful for framing communications (for instance, Hermann, Voß, & Menzel, 2013), this study is one of the first to actually test this concept using a theoretical understanding of communication. The results of this likely extrapolate to a variety of different contexts where values are used to frame communications. For instance, trying to communicate with national park visitors about fee increases in national parks may best be framed based on their park value orientations (Borrie, Freimund, & Davenport, 2002).

The conceptual model revisited

Figure 1 below provides an additional perspective on how this research all fits together. This is the conceptual model first displayed in Chapter I. In this model, we see that framing messages based on people's WVOs is likely to increase the amount of a message's relevance. This increased relevance in turn increases people's elaboration likelihood. Evidence from the

third manuscript (Chapter IV) supports this theoretical relationship. This increased amount of elaboration has the potential to impact the components of TPB, including attitudes, perceived behavioral control, and subjective norms. The process of this is that elaboration, working through TPB, ultimately impacts behavioral intentions. The second manuscript (Chapter III) demonstrates these relationships. Ultimately, the results of this dissertation supported the conceptual model presented in Figure 1.

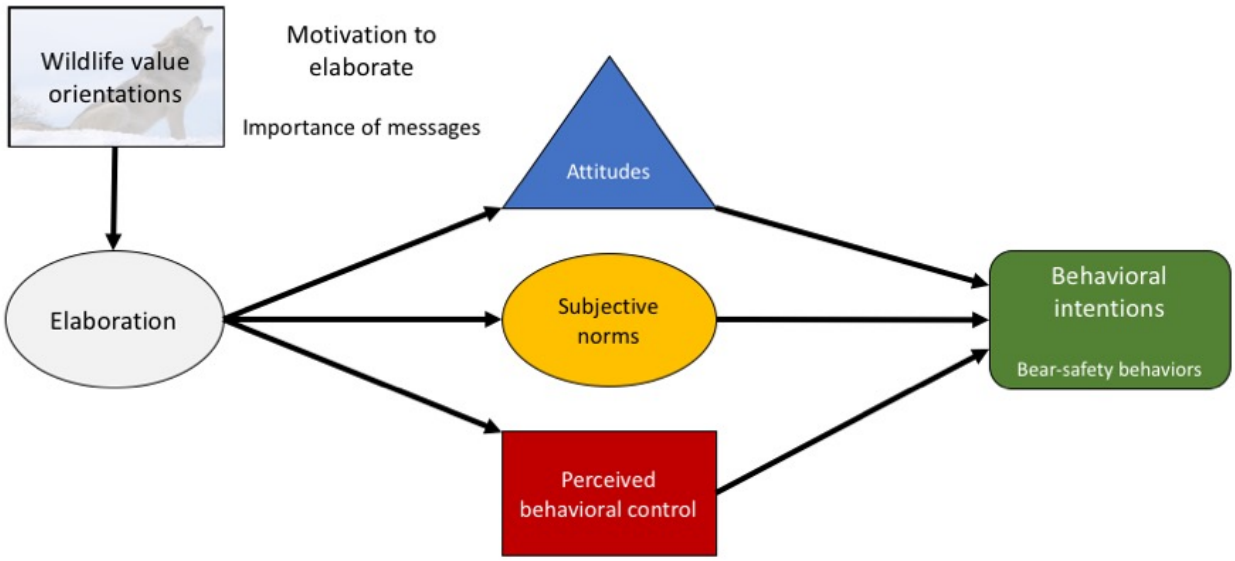

Figure 1: Conceptual model of theoretical framework

For decades, the three theories used in this research have generally been applied separately with success. Although TPB and ELM have always had a close relationship, most researchers focused on either one or the other during their inquiries. Only recently were the two theories explicitly merged together as an organizing concept for communications from scientists in more applied fields (Brown, Ham, & Hughes, 2010; Ham, 2013). This dissertation research takes this conceptual relationship one step further and empirically merges together TPB (the *why*) and ELM (the *how*) through SEM to better understand persuasive communication. WVOs are conceptually merged with the model in this research by evaluating how relevancy of messages can be increased through values-framing (Teel et al., 2015). Without these three

theories working together, we would not be able to focus on this subject with the depth displayed in this research. This conclusion demonstrates that we should take it upon ourselves to continually improve our metrics as they apply to individual concepts while also creatively exploring how some concepts that we have traditionally studied discreetly can be mutually beneficial to one another. In some cases, modeling approaches, such as SEM, provide numerous opportunities for us to ask deeper and more comprehensive questions.

Managerial recommendations

This section details and outlines managerial recommendations derived from the results of this research. These recommendations apply to bear safety as well as communication more broadly. Although these recommendations are intended for YNP managers, managers from other national parks may also find use in them. Although recommendations have been made in each of the manuscripts presented previously, this section presents further details to these strategies.

Use the elaboration tool for evaluating and developing communication strategies

The bear safety elaboration scale developed in this research can be used as a standalone tool to assess a variety of different communication strategies related to bear safety. This would likely be done in a pre-post (or similar) design. These communication strategies are not limited to bear spray, as the elaboration tool has been shown to impact a variety of bear safety behaviors as demonstrated by the first manuscript (Chapter II). Additionally, when constructing future communication strategies across a broad range of topics (not just bear safety) that are trying to change visitor behaviors, YNP managers should focus on creating messages that increase visitors' interest, awareness, and cognitive engagement (collectively known as elaboration). Previous research shows us that factual knowledge alone is generally not a driver of behavior change (Schultz, 2011). Although knowledge is still important, this research, as well as previous

research (Vezeau et al., 2015), has demonstrated that communication strategies that increase elaboration (e.g. interest, awareness, and cognitive engagement) are highly effective in influencing visitor behaviors.

Incorporate messages about bear spray behavior based off the TPB model.

The TPB model in the second manuscript (Chapter III) indicates that attitudes, subjective norms, and perceived behavioral control are all significant predictors of bear spray behaviors. Although targeting any of the underlying beliefs associated with these constructs may be effective, the most effective and efficient route to change is likely through attitudes and subjective norms. Because targeting attitudes and subjective norms is likely to have the largest impacts on behaviors, we refer to subjective norms and attitudes as "leverage points" for influencing visitor bear spray behaviors.

To impact attitudes, messages should target their underlying beliefs. Attitudes are based off behavioral beliefs. Behavioral beliefs are what people think will happen if they perform a behavior. For instance, people may have positive attitudes towards bear spray behaviors because they believe that carrying bear spray while hiking will keep them safe if they encounter a bear. In contrast, people may have less positive attitudes about bear spray behaviors because they believe that a firearm is more effective at deterring an aggressive bear.

Subjective norms are determined from normative beliefs. Normative beliefs are based off who will care (or not care) if someone performs a behavior. This is similar to peer/social pressure. For instance, someone may have positive subjective norms about carrying bear spray because their mother (or some other important person or group) would want them to carry bear spray while hiking. The TPB model found that both social norms and attitudes were roughly the

same in their level of impact, indicating that it is important to try to make an impact on both components.

Results from this research also showed that bear safety behaviors are not one behavior, but a multitude of different behaviors. From this, we can confidently say that each bear safety behavior (e.g. hiking in a group of three or more people, making noise by clapping or shouting, etc.) is likely under the influence of different components in TPB when compared to bear spray behaviors. For instance, hiking in a group of three or more people may be most influenced by perceived behavioral control in that if hikers cannot find other people to hike with, they are not able to engage this behavior. Communication strategies need to be aware of this when trying to influence visitor behaviors. Further research would need to be conducted to reveal the TPB components associated with each of these behaviors.

Embrace the mutualistic relationship day hikers have with wildlife

Most day hikers in YNP expressed relatively high levels of mutualistic wildlife value orientations (WVOs). This means that they view their relationships with wildlife in more "ecocentric" terms, and that most day hikers are likely motivated to protect wildlife, believe that wildlife has rights, and find that wildlife has intrinsic value. YNP managers should embrace these perspectives and leverage them to create more interesting communications. Research shows that people need *reasons* to act. In addition to telling them what to do (i.e. carry bear spray), messages should also focus on why people need to do it. This includes not only the previously mentioned components of TPB, but also more value-laden reasons. Focusing on mutualistic value-framing for communication strategies is likely to draw the attention of most day hikers (Petty & Cacioppo, 1986; Teel et al., 2015). This increased attention to messages is likely to foster higher levels of elaboration, which in turn should impact visitor behaviors (Ajzen,

1991; Petty & Cacioppo, 1986). Even park visitors who do not express high levels of mutualistic WVOs, understanding different perspectives can help to decrease the distance between opposing views (Hermann et al., 2013).

Future research

This research helped further develop a previous scale for elaboration. In addition, it is some of the first research to merge together theories like ELM, TPB, and WVO. It is hoped that this research will contribute back to the greater social science community and inspire researchers to evaluate how the concepts presented in this dissertation can be improved and applied. Researchers should consider several specific avenues.

Continued development of elaboration scales

Both this study and Vezeau et al.'s (2015) study provide evidence that the elaboration scales are useful for understanding how communication can impact people's behaviors. Future research should continue to develop our understanding of elaboration in regards to other behaviors of interest to conservation social science. This could include things like low impact/Leave No Trace techniques, non-bear related wildlife issues, and sustainability. Developing these scales would provide a more in-depth understanding of how interest, awareness, and cognitive engagement contribute to elaboration across multiple populations and in regards to multiple issues. It may be that for some issues, interest, awareness, and cognitive engagement may be more or less related to elaboration. Additionally, both this research and Vezeau et al.'s occurred in national parks. Future research should also focus on developing elaboration scales in non-national park populations.

Effect of elaboration on belief structures in TPB

This research provides evidence that elaboration has the potential to affect the components of TPB (e.g., attitudes, subjective norms, perceived behavioral control), and that the effect of elaboration on behavioral intentions is partially (mostly) mediated by the components of TPB. Future research should explore if there is are differences in salient beliefs among those with different levels of elaboration. For instance, researchers could assess the types of belief structures that are changes by their communication strategies in those with higher levels of elaboration and those with lower levels of elaboration. This would provide a deeper understanding of the process of elaboration in relation to TPB, as well as provide further evidence that measured elaboration is theoretically congruent with the concept of elaboration. Additionally, this would provide valuable information for managers about what types of messages are influencing visitors as well as the types of messages that are missing from communications or need to be focused on more.

Evaluating elaboration change

Communication attempts that motivate people to process messages should lead to higher levels of elaboration (Petty & Cacioppo, 1986). In turn, elaboration influences behaviors. Managers and applied researchers could use the elaboration scale to evaluate how effective *specific* communication events are. For instance, in a pre-post design, researchers could evaluate levels of elaboration between two different groups (i.e., general park visitors, and park visitors that had attended a wildlife safety talk). Additionally, although it may be less useful due to population inference issues, an experimental design using a psychology lab may also provide evidence of a change in levels of elaboration from communication resources such as signs and brochures. This type of information would be most useful to managers, but could also provide

some evidence that measured elaboration acts in the same way as the broader theoretical concept of elaboration.

The lasting effect of elaboration

Petty and Cacioppo (1986) state that higher levels of elaboration should lead to long-lasting changes in attitudes and behaviors. Future research using elaboration scales should evaluate the impact of elaboration over a longer period of time. For instance, if a communication program influences a population, does this effect continue to last? From a theoretical standpoint, if measured elaboration has a lasting impact on attitudes and/or behavioral intentions, this would further support that the elaboration scales are congruent with the elaboration concept. If measured elaboration does have a lasting impact, this would provide further impetus for managers to create communication strategies designed to raise interest, awareness, and cognitive engagement.

A better understanding of motivation in ELM

For elaboration likelihood to be increased, we need to be able to interrupt the heuristic decision making processes by increasing the motivation of people to process information. In this research, increasing motivation was viewed as matching visitors with messages they found important based on their wildlife value orientations. However, this is not the only way to increase visitors' motivation. Ham (2013) details many ways to increase the relevancy of messages, including Knockan theory, universal concepts, and incorporating personal language. No matter the technique, motivation is increased by connecting the messages a product is delivering to the things people care most about (Ham, 2013). Future research should continue to explore ways that communication can increase people's motivation to process information.

Better wildlife value orientations measures for national park visitors

The reason we measure something is to be able to detect differences in a population. Although the WVO measures in this research ultimately succeeded in accomplishing this, the differences among the typologies were not as different as in other studies. This is likely due to the population (and not the measures themselves) that visits national parks for two reasons. First, the relatively high level of education expressed by national park visitors has been found to be one of the indicators of more mutualistic WVOs (Manfredo et al., 2003). Second, WVO measures have been used and validated in numerous studies. Nonetheless, future research in national parks using WVO measures may wish to change the scale options to reduce skewing and increase variance in the responses. For instance, using extreme values and eliminating one side of the scale may help researchers to detect more meaningful differences in a population.

A second option would be to use a different value orientation concept, such as the biocentric-anthropocentric scale (Vaske & Donnelly, 1999) that may be better at detecting differences among this population. However, refinement is likely needed in the biocentric-anthropocentric concepts. For instance, although many researchers have used the terms ecocentric and biocentric interchangeably, other researchers have suggested that the two terms may reflect different concepts (Quigley et al., 2014). Future research would need to explore this issue.

Additional TPB-ELM models

The evidence in this research suggests that the effect of elaboration on behavioral intentions is mostly mediated by the components of TPB. Future research should continue to merge these two theories together in using structural equation modeling. From a theoretical perspective, this would allow us to explore the relationships in different populations, and provide

further evidence for or refinement of the relationships between the two concepts. For instance, do the TPB components ever fully mediate the relationship between elaboration and behavioral intentions? Conversely, is there a situation where the TPB components show *no* mediation effect between elaboration and behavioral intentions? Future researchers could also explore the effect of adding additional components, like personal norms (Brown et al., 2010). Applied researchers and managers would also benefit from these models, as they would be able to assess their communication strategies and their effects on the components of TPB.

Additional insights

This section is designed to provide the primary author an opportunity to reflect on the learning process that this dissertation provided. This section may present the committee with an opportunity to better understand the thinking and approach of the author. Additionally, it may provide future graduate students and other researchers with insight about their own process.

Scale measurement

One of the most useful things I learned from this dissertation had to do with the measurement of variables. In protected area management, it seems like everything we measure is skewed in one way or another. Additionally, transforming these variables reduces our ability to interpret them, which is crucial in an applied field that must make their research understandable for managers. This means we are constantly violating assumptions (i.e. a normal distribution) of some statistical tests, like ANOVAs and especially maximum likelihood estimation (MLE) in structural equation modeling (SEM)/confirmatory factor analysis (CFA). Additionally, if our data is skewed, we may be missing out on the ability to detect meaningful difference in a population. Using guidance from one of my preliminary exam questions, I substantially reformatted the scales I used in this survey to increase the amount of variance in the data (see the

Appendix for the data instrument). Although a small skew was still present in some variables, I believe that the reformatting of many of the scales was tremendously successful in normalizing the distribution and increasing the variance for many different variables. The success of this has convinced me to use similar techniques for reducing skew and increasing variance whenever it is appropriate.

Correcting for non-normality in SEM/CFA using maximum likelihood estimation

As stated above, much of the data in our field is skewed and presents an issue for some statistical models. This includes MLE that is often used in SEM/CFA. To address the issue of non-normality in SEM/CFA/MLE, two different approaches are generally used: bootstrapping and Satorra-Bentler corrections. Bootstrapping assumes that the sample reflects the broader population and corrects the standard errors used in significance testing for factor and path loadings to reduce the chance of making a Type I error. Satorra-Bentler corrects the χ^2 value based on the amount of kurtosis in the data set, and thus adjusts many other fit statistics that are related to the χ^2 value. Most software programs only contain one or the other, but some contain both. Even if the program does contain both, researchers must make a choice about what type of correction they are going to use. One (bootstrapping) does not improve fit statistics, but does reduce the chance of a Type I error for any significance testing not related to fit statistics. The other (Satorra-Bentler) improves fit statistics, but does not make any adjustments to standard errors, thus increasing the probability of making a Type I error. To me, the bootstrapping procedure appears to be a more conservative approach. However, researchers should be aware that there are ways to address non-normality in SEM/CFA/MLE. An additional insight related to this is that very few articles using SEM/CFA/MLE state that they used either bootstrapping or

Satorra-Bentler when they likely should have been. We need to focus on making these corrections explicit in our research to increase the validity of our work.

Specific behaviors and the theory of planned behavior

In my original dissertation proposal, the behavior of interest (which is what the TPB measures was based off) was "general" bear safety behaviors. This would be a composite of bear safety behaviors, and would assume that there is a strong relationship among all the different bear safety behaviors (i.e. carrying bear spray, hiking in a group of three or more, running if you see a bear, etc.). During my oral examinations, one faculty member raised suspicions about this assumption. Upon some reflection, I agreed with that committee member and made changes to the data instrument so that it focused more heavily on one specific bear safety behavior (bear spray). In retrospect, this was a wise suggestion. The bear safety behaviors were ultimately unrelated, and my previous approach would have been less useful and likely less successful as well. The lesson learned here is that for TPB, you *must* focus on a *specific* behavior.

Final thoughts

As many park and protected areas around the world balance managerial capacity, resource protection, and visitor experience, communication remains a vital, light-handed tool for helping address a diversity of issues related to visitor use. This research demonstrates that theory-driven approaches to communication can be effective in influencing visitor behaviors. Specifically, communications that increase people's level of elaboration (defined as interest, awareness, and cognitive engagement) have the potential to impact the antecedents of behavioral intentions (attitudes, subjective norms, and perceived behavioral control). Collectively, the findings from this research provide meaningful implications for both the advancement of science and management in communication and protected area management.

References

Ablett, P. G., & Dyer, P. K. (2009). Heritage and hermeneutics: Towards a broader interpretation of interpretation. *Current Issues in Tourism*, *12*(3), 209–233.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Ajzen, I., & Driver, B. L. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior. *Leisure Sciences*, *13*, 185–204.

Ajzen, I. & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior.* Englewood Cliffs, N.J.: Prentice-Hall.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471–499.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, *54*(7), 462–479.

Borrie, W. T., Freimund, W. A., & Davenport, M. A. (2002). Winter visitors to Yellowstone National Park: Their value orientations and support for management actions. *Research in Human Ecology*, *9*(2), 41–48.

Boyle, S. A., & Samson, F. B. (1985). Effects of nonconsumptive recreation on wildlife: A review. *Wildlife Society Bulletin*, *13*(2), 110–116.

Bright, A. D., Manfredo, M. J., & Fulton, D. C. (2000). Segmenting the public: An application of value orientations to wildlife planning in Colorado. *Wildlife Society Bulletin, 28*(1), 218–226.

Briñol, P., Petty, R. E., & Wheeler, S. C. (2006). Discrepancies between explicit and implicit self-concepts: Consequences for information processing. *Journal of Personality and Social Psychology*, *91*(1), 154–170.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism*, *18*(7), 879–900.

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.), *Testing Structural Equation Models* (pp. 136–162). Newbury Park, CA: Sage.

Bryan, T. (2008). *The Geysers of Yellowstone*. Boulder: University Press of Colorado.

Byrne, B. M. (2001). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming.* Mahwah, N.J.: Lawrence Erlbaum Associates.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Deruiter, D. S., & Donnelly, M. P. (2002). A qualitative approach to measuring determinants of wildlife value orientations. *Human Dimensions of Wildlife*, *7*, 251–271.

DeVellis, R. (2003). *Scale Development: Theory and Applications*. Thousand Oaks, CA: Sage Publications.

DiStefano, E. (2005). *Human–Wildlife Conflict Worldwide: Collection of Case Studies, Analysis of Management Strategies and Good Practices.* Rome: SARD Initiative Report.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Fox, H. E., Christian, C., Nordby, J. C., Pergams, O. R. W., Peterson, G. D., & Pyke, C. R. (2006). Perceived barriers to integrating social science and conservation. *Conservation Biology*, *20*(6), 1817–1820.

Fulton, D. C., Manfredo, M. J., & Lipscomb, J. (1996). Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife*, *1*(2), 24–47.

Gay, L. R. (1991). *Educational Evaluation and Measurement: Competencies for Analysis and Application.* New York: MacMillan Publishing Company.

Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1988). On cognitive busyness: When person perceivers meet persons perceived. *Journal of Personality and Social Psychology*, *54*(5), 733–740.

Graham, J. M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and Psychological Measurement*, *66*(6), 930–944.

Gunther, K. A., Haroldson, M. A., Frey, K., Cain, S. L., Copeland, J., & Schwartz, C. C. (2004). Grizzly bear – human conflicts in the Greater Yellowstone ecosystem, 1992 – 2000. *Ursus*, *15*(1), 10–22.

Hall, T. E., Ham, S. H., & Lackey, B. K. (2010). Comparative evaluation of the attention capture and holding power of novel signs aimed at park visitors. *Journal of Interpretation Research*, *15*(1), 15–36.

Ham, S. (2013). *Interpretation: Making a difference on purpose.* Golden, CO: Fulcrum Publishing.

Ham, S. H., Brown, T. J., Curtis, J., Weiler, B., Hughes, M., & Poll, M. (2009). *Promoting Persuasion in Protected Areas: A Guide for Managers Who Want to Use Strategic*

Communication to Influence Visitor Behaviour (1st ed.). Gold Coast, Queensland: Sustainable Tourism Cooperative Research Centre.

Ham, S. H., & Krumpe, E. E. (1996). Identifying audiences and messages for nonformal environmental education - A theoretical framework for interpreters. *Journal of Interpretation Research*, *1*(1), 11–24.

Ham, S. H., Weiler, B., Hughes, M., Brown, T., Curtis, J., & Poll, M. (2008). *Asking Visitors to Help: Research to Guide Strategic Communication for Protected Area Management*. Gold Coast, Queensland: Cooperative Research Center for Sustainable Tourism.

Hermann, N., Voß, C., & Menzel, S. (2013). Wildlife value orientations as predicting factors in support of reintroducing bison and of wolves migrating to Germany. *Journal for Nature Conservation*, *21*(3), 125–132.

Herrero, S., & Higgins, A. (1995). Field use of capsicum spray as a bear deterrent. *Ursus*, *10,* (September), 533–537.

Homer, P. M. & L. R. Kahle. (1988). A structural equation test of the value–attitude–behavior hierarchy. *Journal of Personality Social Psychology, 54*(4). 638–646.

Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the theory of planned behavior. *Leisure Sciences*, *23*(January 2015), 165–178.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3*, 424-453.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Inglehart, R. (1997). Modernization and postmodernization. Princeton, NJ: Princeton University Press.

Jacobs, M. H., Vaske, J. J., & Sijtsma, M. T. J. (2014). Predictive potential of wildlife value orientations for acceptability of management interventions. *Journal for Nature Conservation*, *22*(4), 377–383.

Kenrick, D. T., Neuberg, S. L., & Cialdini, R. B. (2002). *Social Psychology: Unraveling the mystery (2nd Ed.)*. Boston: Allyn & Bacon.

Kline, P. (1994). *An Easy Guide to Factor Analysis*. New York, NY: Routledge.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, NY: The Guillford Press.

Klockars, A. J., & Hancock, G. R. (1993). Manipulations of evaluative ratings. *Psychological Reports*, *73*, 1059–1066.

Kluckholn, C. (1951). Values and value orientations in the theory of action. In *Towards a general theory of action,* (Eds.) T. Parsons and E.A. Shils, 388-433. Cambridge, MA: Harvard University Press.

Kollmuss, A., and Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research 8*(3), 239-260.

Krosnick, J. A., and Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty and J. A. Krosnick, et al. (Eds.), *Attitude strength: Antecedents and consequences*. (pp. 1–24). Mahwah, NJ, USA: Lawrence Erlbaum Associates, Inc.

Kuhn, T. S. (1970). The nature and necessity of scientific revolutions. In *The Structure of Scientific Revolutions* (Vol. 2). Chicago: The University of Chicago.

Kyle, G., Graefe, A., & Manning, R. (2005). Testing the dimensionality of place attachment in recreational settings. *Environment and Behavior*, *37*(2), 153–177.

Lackey, B. K., & Ham, S. H. (2003). Assessment of communication focused on human-black bear conflict at Yosemite National Park. *Journal of Interpretation Research*, *8*(3), 25–40.

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment*, *16*(1), 67–86.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, *18*(1), 3–9.

Manfredo, M. J. (2008). *Who Cares About Wildlife? Social Science Concepts for Exploring Human-Wildlife Relationships and Conservation Issues*. New York: Spring Science & Business Media, LLC.

Manfredo, M. J., & Dayer, A.A. (2004). Concepts for exploring the social aspects of human–wildlife conflict in a global context. *Human Dimensions of Wildlife*, *9*(4), 1–20.

Manfredo, M. J., Pierce, C. L., Fulton, D., Pate, J., & Gill, B. R. (1999). Public acceptance of wildlife trapping in Colorado. *Wildlife Society Bulletin, 27*(2), 499–508.

Manfredo, M., Teel, T., & Bright, A. (2003). Why are public values toward wildlife changing? *Human Dimensions of Wildlife*, *8*(4), 287–306.

Manfredo, M. J., Teel, T. L., & Henry, K. L. (2009). Linking society and environment: A multilevel model of shifting wildlife value orientations in the Western United States. *Social Science Quarterly*, *90*(2), 407–427.

Manfredo, M.J., Teel, T., & Zinn, H. (2009). Understanding global values toward wildlife. In *Wildlife and Society: The Science of Human Dimensions,* M.J. Manfredo, J. Vaske, P.J. Brown, D. Decker, and E. Duke, (Eds.), 31-43. Washington, D.C.: Island Press.

Manning, R. (2003). Emerging principles for using information / education in wilderness management. *International Journal of Wilderness*, *9*(1), 20–27.

Manning, R. (2011). *Studies in outdoor recreation: Search and research for satisfaction* (3rd ed.). Corvallis, OR: Oregon State University Press.

Markegard, S. (2014). *Understanding the nature of the interactions between visitors and mountain goats (*Oreamnos americanus*) on the Hidden Lake trail, Glacier National Park.* (Unpublished master thesis). The University of Montana, Missoula, MT, USA.

Martin, S. R., & McCurdy, K. (2009). Wilderness food storage in Yosemite: Using the theory of planned behavior to understand backpacker canister use. *Human Dimensions of Wildlife*, *14*(3), 206–218.

Micerri, T. (1989). The unicorn, the normal curve, and other improbable creatures. *Psychological Bulletin, 105*, 156–166.

Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modeling. *Structural Equation Modeling, 2*, 255-273.

Miller, Z. D., Quigley, C., Hallo, J. C., Dogbey, J., Che, S. M., & Seno, S. K. (2016). Investigating wildlife and grazing perspectives of Kenyan university students. *Journal for Nature Conservation*, *32*, 44–52.

Montag, J. M., Patterson, M. E., & Freimund, W. a. (2005). The wolf viewing experience in the Lamar Valley of Yellowstone National Park. *Human Dimensions of Wildlife*, *10*(4), 273–284.

Munshi, J. (2014). A method for constructing Likert scales. *SSRN Electronic Journal*, (April), 1–12.

Musser, L. M., & Diamond, K. E. (1999). The children's attitudes toward the environment scale for preschool children. *Journal of Environmental Education*, *30*(2), 23.

NPS. (2017a). *National Park Service Certifies 2015 Visitation at 307 Million: Reports Annual Top 10 Lists and Other Highlights* [Press release]. Retrieved from https://www.nps.gov/aboutus/news/release.htm?id=1784

NPS. (2017b). *2016 – A Year of Records* [Press release]. Retrieved from https://www.nps.gov/yell/learn/news/17002.htm

NPS. (2017c). *Yellowstone National Park: Wilderness*. Retrieved from http://www.nps.gov/yell/learn/nature/wilderness.htm

NPS. (2017d). *Bear-inflicted human injuries and fatalities in Yellowstone*. Retrieved from http://www.nps.gov/yell/learn/nature/injuries.htm

NPS (2017e). *Using bear spray to deter an aggressive bear.* Retrieved from https://www.nps.gov/yell/learn/nature/bearspray.htm

NPS (2017f). *Weapons/Firearms*. Retrieved from http://www.nps.gov/yose/planyourvisit/weapons.htm

NPS (2017g). *Reducing your risk of a bear encounter.* Retrieved from http://www.nps.gov/yell/learn/nature/reducing_risks.htm

NPS (2017h). *Reacting to a bear encounter.* Retrieved from http://www.nps.gov/yell/learn/nature/bearreact.htm

Olliff, T., & Caslick, J. (2003). Wildlife – human conflicts in Yellowstone: When animals and people get too close. *Yellowstone Science*, *1*(18), 18–22.

Pate, J., Manfredo, M. J., Bright, A. D., & Tischbein, G. (1996). Coloradans' attitudes toward reintroducing the gray wolf into Colorado. *Wildlife Society Bulletin*, *24*(3), 421–428.

Penteriani, V., Delgado, M. D. M., Pinchera, F., Naves, J., Fernández-Gil, A., Kojola, I., … López-Bao, J. V. (2016). Human behaviour can trigger large carnivore attacks in developed countries. *Scientific Reports*, *6*(1432), 20552.

Perry-hill, R., Smith, J. W., Reimer, A. C., Mase, A. S. D., Mullendore, N. E., Mulvaney, K. K., & Prokopy, L. S. (2014). The influence of basic beliefs and object-specific attitudes on behavioural intentions towards a rare and little-know amphibian. *Wildlife Research*, *41*, 287–299.

Peterson, R. A., & Wilson, W. R. (1992). Measuring customer satisfaction: Fact and artifact. *Journal of the Academy of Marketing Science*, *20*(1), 61–71.

Petty, R. E., & Cacioppo, J. T. (1979). Issue involvement can increase or decrease persuasion by enhancing message-relevant cognitive responses. *Journal of Personality and Social Psychology*, *37*(10), 1915–1926.

Petty, R. E., Cacioppo, J. T., & Goldman, R. (1981). Personal involvement as a determinant of argument-based persuasion. *Journal of Personality and Social Psychology*, *41*(5), 847–855.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology*. (Vol.19, pp. 123- 205). San Diego, CA: Academic Press.

Petty, R. E., McMichael, S., & Brannon, L. A. (1992). The elaboration likelihood model of persuasion: Applications in recreation and tourism. In M. J. Manfredo (Ed.), *Influencing*

Human Behavior: Theory and Applications in Recreation, Tourism, and Natural Resources Management (pp. 77–101). Champaign, IL: Sagamore Publising.

Petty, R. E., Wegener, D. T., & Fabrigar, L. R. (1997). Attitudes and attitude change. *Annual Review of Psychology*, *48*, 609–47.

Ponterotto, J. G. (2005). Qualitative research in counseling psychology: A primer on research paradigms and philosophy of Science. *Journal of Counseling Psychology*, *52*(2), 126–136.

Popper, K. (1968). *Conjectures and refutations*. New York: Harper & Row.

Pratkanis, A.R., and Greenwald, A.G. (1993). Consumer involvement, message attention, and persistence of persuasive impact in a message-dense environment. *Psychology and Marketing, 10*(4), 321-332.

Reigner, N., Gordon, L., Nagata, R., Service, N. P., & Bright, A. (2009). Improving the efficacy of visitor education in Haleakalā National Park using the theory of planned behavior. *Journal of Interpretation Research*, *14*(2), 21–45.

Rokeach, M. (1973). *The Nature of Human Values*. New York: The Free Press.

Runte, A. (2010). *National Parks: The American Experience*. Lanham, MD: Taylor Trade Publishing.

Schultz, P. W. (2000). Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues*, *56*(3), 391–406.

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*(4), 327–339.

Schultz, P. W. (2011). Conservation means behavior. *Conservation Biology*, *25*(6), 1080–1083.

Shrestha, S. K., Burns, R. C., Pierskalla, C. D., & Selin, S. (2012). Predicting deer hunting intentions using the theory of planned behavior: A survey of Oregon big game hunters. *Human Dimensions of Wildlife*, *17*, 129–140.

Sijtsma, M. T. J., Vaske, J. J., & Jacobs, M. H. (2012). Acceptability of lethal control of wildlife that damage agriculture in the Netherlands. *Society & Natural Resources*, *25*(12), 1308–1323.

Stern, M. J., Powell, R. B., & Ardoin, N. M. (2008). What difference does it make? Assessing outcomes from participation in a residential environmental education program. *The Journal of Environmental Education*, *39*(21), 31–43.

Stone, G., Barnes, J. H., & Montgomery, C. (1995). Ecoscale: A scale for the measurement of environmentally responsible consumers. *Psychology and Marketing*, *12*(7), 595–612.

Tam, K. Y., & Ho, S. Y. (2005). Web personalization as a persuasion strategy: An elaboration likelihood model perspective. *Information Systems Research*, *16*(3), 271–291.

Teel, T. L., Dietsch, A. M., & Manfredo, M. J. (2015). A (social) psychology approach in conservation. In N. J. Bennett & R. Roth (Eds.), *The Conservation Social Sciences: What?, How? and Why*. Vancouver, B.C.: Canadian Wildlife Federation and Institute for Resources, Environment and Sustainability.

Teel, T. L., & Manfredo, M. J. (2009). Understanding the diversity of public interests in wildlife conservation. *Conservation Biology*, *24*(1), 128–139.

Teel, T. L., Manfredo, M. J., Jensen, F. S., Buijs, A. E., Fischer, A., Riepe, C., … Jacobs, M. H. (2010). Understanding the cognitive basis for human-wildlife relationships as a key to successful protected-area management. *International Journal of Sociology*, *40*(3), 104–123.

Teng, S., Khong, K. W., & Goh, W. W. (2014). Conceptualizing Persuasive Messages Using ELM in Social Media. *Journal of Internet Commerce*, *13*(1), 65–87.

U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. (2011). *2011 National Survey of Fishing, Hunting, and Wildlife-associated Recreation.* Washington, DC: Authors.

Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society & Natural Resources*, *12*(6), 523–537.

Vaske, J., Donnelly, M. P., Williams, D. R., & Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about National Forest management. *Society & Natural Resources*, *14*(9), 761–776.

Vezeau, S. (2014). *Investigating the influence of interpretation on children's national park stewardship behaviors using the elaboration likelihood model*. (Doctoral dissertation). Clemson University, Clemson, SC, USA.

Vezeau, S. L., Powell, R. B., Stern, M. J., Moore, D. D., & Wright, B. A. (2015). Development and validation of two scales to measure elaboration and behaviors associated with stewardship in children. *Environmental Education Research*, (January), 1–22.

Werner, C.M. (1999). Psychological perspectives on sustainability. In E. Becker & T. Jahn (Eds.), *Sustainability and the Social Sciences: A Cross-disciplinary Approach to Integrating Environmental Considerations into Theoretical Reorientation* (pp. 223-242). New York: Zed Books.

Whittaker, D., Vaske, J. J., & Manfredo, M. J. (2006). Specificity and the cognitive hierarchy: Value orientations and the acceptability of urban wildlife management actions. *Society & Natural Resources*, *19*(6), 515–530.

Willcox, A. S., Giuliano, W. M., & Monroe, M. C. (2012). Predicting cattle rancher wildlife management activities: An application of the theory of planned behavior. *Human Dimensions of Wildlife*, *17*(February 2015), 159–173.

Woodroffe, R., and J.R. Ginsberg. (1998). Edge effects and the extinction of populations inside protected areas. *Science, 280*: 2126–28.

APPENDICES

Appendix A: Survey Instrument

NOTE: *For the purposes of this review and submission the justifications for each question or section of questions is highlighted in a shaded text box above each question. These text boxes will not be printed on the final version of the surveys. The Topic Areas noted are consistent with the currently approved pool questions for the NPS Programmatic Review Process (1024-0224). The questions that are variations are denoted as such. Any questions that are outside the general scope of the programmatic review process have been carefully discussed and generally approved by the NPS Information Collection Review Coordinator with understanding that that those questions will require further review and consideration by OMB before full determination and approval can be granted.*

OMB Control Number: 1024-0224

Yellowstone National Park Visitor-Bear Survey

Thank you for agreeing to help Yellowstone National Park!
Your input is important to park management. Response to this request is voluntary. While you are not required to respond, your cooperation is needed to make the survey results comprehensive, accurate, and timely. This survey is sponsored by the National Park Service and the information will be used to understand visitor use and perceptions of bear safety at Yellowstone National Park.

PAPERWORK REDUCTION ACT STATEMENT: The National Park Service is authorized by 16 U.S.C. 1a-7 to collect this information. This information will be used by park managers to understand visitors' bear safety behaviors at Yellowstone National Park. Responses to this request are voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number and expiration date.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to: Tami Blackford, Yellowstone National Park; P.O. Box 158; Yellowstone National Park, WY 82190; tami_blackford@nps.gov (email).

1. Have you visited Yellowstone National Park before this trip?

   ☐ Yes ☐ No

   If **YES**, approximately how many times have you visited in the last 12 months?

   Number of prior visits: _____

2. How experienced are you with hiking in grizzly bear country?

Not at all experienced	Slightly experienced	Moderately experienced	Very experienced	Extremely experienced
1	2	3	4	5

We would like to know about some different aspects regarding bear safety while hiking.

3. How interested are you in learning about the following items? (please select one response per item)

Item	Not at all interested	Somewhat interested	Very interested	Extremely interested	Completely interested
Staying safe while hiking in the presence of bears.	1	2	3	4	5
Knowing how to act if you see a bear.	1	2	3	4	5
Proper equipment while hiking in areas where bears may be present.	1	2	3	4	5
How to avoid bear encounters while hiking.	1	2	3	4	5
How to interpret bear behaviors.	1	2	3	4	5
How to increase your alertness to bears in an area.	1	2	3	4	5

4. How aware are you of the following items?

Item	Not at all aware	Somewhat aware	Very aware	Extremely aware	Completely aware
Ways to increase your safety while hiking in bear country.	1	2	3	4	5
Techniques that can help you avoid negative encounters with bears.	1	2	3	4	5
Resources you can use to help keep you safe while hiking in bear country.	1	2	3	4	5
Things you can do to decrease your risk of a bear attack while hiking.	1	2	3	4	5
How hiking in grizzly bear country is different than hiking in other areas.	1	2	3	4	5

5. How much have you thought about the following items?

Item	Not at all	Somewhat	A moderate amount	Very Much	A great deal
Appropriate behaviors while hiking in the presence of bears.	1	2	3	4	5
What hikers can do to stay safe from bears while hiking.	1	2	3	4	5
How to have an enjoyable experience while hiking in bear country.	1	2	3	4	5
The benefits of taking safety precautions while hiking in bear country.	1	2	3	4	5
Encountering bears while hiking.	1	2	3	4	5
How hikers can avoid bears while hiking.	1	2	3	4	5

6. How likely are you to do the following things while hiking in Yellowstone National Park?

	Highly unlikely	Unlikely	Slightly unlikely	Neither	Slightly likely	Likely	Highly likely
Make noise by clapping or shouting.	1	2	3	4	5	6	7
Personally carry bear spray.	1	2	3	4	5	6	7
Look for signs of bears, like scat and tracks.	1	2	3	4	5	6	7
Hike in a group of three or more people.	1	2	3	4	5	6	7
Carry bear spray in an accessible place, like a hip holster.	1	2	3	4	5	6	7
Run if you see a bear.	1	2	3	4	5	6	7

The next questions are about carrying bear-spray while hiking in Yellowstone. Please answer them to the best of your ability.

7. Please rate the following statement: “For me, carrying bear spray while hiking in Yellowstone would be…”

Not at all pleasant	Somewhat pleasant	Moderately pleasant	Very pleasant	Extremely pleasant
1	2	3	4	5

Not at all favorable	Somewhat favorable	Moderately favorable	Very favorable	Extremely favorable
1	2	3	4	5

Not at all good	Somewhat good	Moderately good	Very good	Extremely good
1	2	3	4	5

8. How true do you find the following statements?

Statement	Not at all true	Slightly true	Moderately true	Very true	Completely true
People who I value think I should carry bear spray while hiking in Yellowstone.	1	2	3	4	5
People important to me would be carrying bear spray if they were hiking in Yellowstone.	1	2	3	4	5
Other visitors support my decision to carry bear spray while hiking in Yellowstone.	1	2	3	4	5

9. How true do you find the following statements?

Statement	Not at all true	Slightly true	Moderately true	Very true	Completely true
If I wanted to, I could easily carry bear spray on my next hiking trip in Yellowstone.	1	2	3	4	5
The factors that influence my decision to carry bear spray while hiking in Yellowstone are totally within my control.	1	2	3	4	5
It is difficult to carry bear spray while hiking in Yellowstone.	1	2	3	4	5

10. In general, how much do you disagree or agree with the following statements?

Statement	Strongly disagree	Disagree	Slightly disagree	Neither	Slightly agree	Agree	Strongly agree
We should strive for a world where humans and wildlife can live side by side without fear.	1	2	3	4	5	6	7
I feel a strong emotional bond with animals.	1	2	3	4	5	6	7
Wildlife has value, whether people are present or not.	1	2	3	4	5	6	7
Wildlife are like my family and I want to protect them.	1	2	3	4	5	6	7
The needs of humans should take priority over wildlife protection.	1	2	3	4	5	6	7
I view all living things as part of one big family.	1	2	3	4	5	6	7
Wildlife has as much right to exist as people.	1	2	3	4	5	6	7
Wildlife is on earth primarily for people's benefit.	1	2	3	4	5	6	7
Humans should manage wildlife populations so that humans benefit.	1	2	3	4	5	6	7
Wildlife is important because of what it can contribute to the pleasure and welfare of humans.	1	2	3	4	5	6	7
Wildlife is only valuable if it produces human benefits.	1	2	3	4	5	6	7

11. Please rate the following statements according to how **important** they are to you.

Statement	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Even though the animals of Yellowstone seem tame they are still wild.	1	2	3	4	5
In 2011 and 2015, in separate incidents, three visitors were killed by bears inside the park.	1	2	3	4	5
All wildlife, especially bears, can be dangerous.	1	2	3	4	5
Bear spray is proven to be highly successful at stopping aggressive behavior in bears.	1	2	3	4	5
There is no guarantee of your safety in bear country.	1	2	3	4	5
You are entering a place that is home to many bears. It is your responsibility to know how to behave.	1	2	3	4	5
Taking safety precautions while hiking helps keep Yellowstone's bears healthy, safe, and wild.	1	2	3	4	5
Hiking in places where grizzly bears live, like Yellowstone, is different than hiking in other places. Know how to act!	1	2	3	4	5

12. Are you carrying bear spray on this hike?
    □ No
    □ Yes
    Why or why not?

13. Are you a permanent resident or citizen of the United States?
    □ No - What is your country of origin? _____
    □ Yes - What is your zip code and state of residence?
    State_____
    Zip code _____

14. In what year were you born?

    _____

15. What is your gender? Please mark one.
    ☐ Male ☐ Female

16. Please indicate your highest level of education completed. (select one)
    □ Some high school
    □ High school diploma/GED
    □ Some college
    □ Bachelor's degree
    ☐ Graduate degree

17. For you only, are you Hispanic or Latino?
    ☐ No ☐ Yes

18. What is your race? Please mark one or more.
    ☐ American Indian or Alaska Native
    □ Asian
    □ Black or African-American
    ☐ White
    ☐ Native Hawaiian or other Pacific Islander

Introductory script

Hello. My name is _____(name) and I am working for the University of Montana in cooperation with Yellowstone National Park. We are doing a survey for the park managers of visitors hiking on the trail today. Would you be willing to answer some questions? The questions I would like you to answer will only take about **10 minutes** to complete. All of your answers are voluntary and you will remain completely anonymous.

(Note the following question will be used to determine if the respondent is a day hiker)

- Are you hiking for the day or overnight?

Thank you.

Non-response bias questions

1. Are you a permanent resident or citizen of the United States?

☐ No ☐ Yes

2. In what year were you born?

_____

If completely refused to answer any questions, please mark the box below:
☐