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# Merging elaboration and the theory of planned behavior to understand bear spray behavior of day hikers in Yellowstone National Park

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**Abstract**
This research empirically merges together two related theories: the elaboration likelihood model and the theory of planned behavior. A structural equation modeling approach is used to evaluate the relationship between the two theories and their collective impacts on behavioral intentions. The results suggest elaboration predicts 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 in sustainable tourism settings. Additionally, the discussion exemplifies how these techniques can be used to improve communications and evaluate communication strategies.

**Keywords** Parks · Protected areas · Communication · Behavior · Wildlife · Elaboration

## 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 tourism settings. 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 sustainable tourism to park and protected areas.

In many cases, challenges with sustainable tourism in park and protected areas are inherently challenges with human behaviors (Brown et al. 2010; 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 aimed at influencing visitor behaviors are developed by using staff intuition or institutional formats (Hall et al. 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 et al. 2015). Two theories that are useful in developing communication strategies in sustainable tourism settings are the theory of planned behavior (Ajzen 1991) and the elaboration likelihood model (Petty and 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 (Miller 2017). This theory posits that human

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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 (Miller et al. 2018a).

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 and 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 sustainable tourism settings (Brown et al. 2010; Ham et al. 2008), 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 (Miller et al., 2018; 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 visitor behaviors, and therefore messages should focus on content that targets this component of TPB. ELM, 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 and Cacioppo 1986), which in turn should impact behavioral intentions through the components of ELM (Ajzen 1991; Brown et al. 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 (e.g., attitudes, subjective norms, and perceived behavioral control). 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 a sustainable tourism setting. 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 et al. 2014). In ELM, there are two routes to persuasion: the central and the peripheral routes (Petty and Cacioppo 1986). The central route is taken by people who are motivated and able to process a message and results in a logical, careful consideration of the information, which is where the term "elaboration" comes from (Petty and Cacioppo 1986). However, if people are unmotivated, unable, or unwilling to engage in thoughtful processing, the peripheral route is taken (Petty and 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 and Cacioppo 1986). Variables like the number of arguments presented and the authority of the sources are important for the peripheral route (Petty and 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 et al. 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 et al. 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 sustainable 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 sustainable tourism 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 and 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 and 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 and 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 and Cacioppo 1986; Vezeau et al. 2015). Developing indicators to measure each dimension of the construct, they 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) and changes the question from *if* elaboration was engaged to *how much* elaboration was engaged.

Although Vezeau et al. (2015) research was largely successful, the elaboration scale was conceptually incomplete (Miller et al. 2018a). This was due to a lack of variance in the "awareness" construct, resulting in its removal from the model. In work in Yellowstone National Park, Miller et al. (2018a) succeeded in developing an elaboration model that incorporated all three constructs of elaboration (interest, awareness, and cognitive engagement). Similar to previous research (Vezeau et al. 2015), Miller et al.'s (2018a) elaboration scale was predictive if a variety of related behavioral intentions.

## 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 and Fishbein 1980), TPB has proven to be useful in predicting behavioral intentions (an antecedent of actual behavior) (Armitage and Connor 2001; Madden et al. 1992; Miller 2017). 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 and 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 can 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 sustainable tourism tried to predict participation in recreation activities using the TPB model (Ajzen and Driver 1991). This research found the TPB model to be quite successful. Further research became more specific and applied. TPB was applied successfully to hunting participation (Hrubes et al. 2001), use of bear canisters in Yosemite National Park (Martin and 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; Armitage and Connor 2001; Petty et al. 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; Armitage and Connor 2001; Ham 2013; Petty and Cacioppo 1986), and recent research supports that elaboration can impact all components of TPB (e.g., attitudes, subjective norms, and perceived behavioral control) (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). In summary, ELM flows into TPB, with higher levels of elaboration influencing the components of TPB and guiding people towards a favorable action (Krosnick and 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. 2018a; 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).

H4: 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; Miller 2017). Previous research has found that bear safety behaviors are not one single behavior, but a variety of different behaviors (Miller et al. 2018a). 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 1 July and 15 August 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 randomly, 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

We developed a questionnaire 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.) and guided by Vezeau et al. (2015) work.

**Table 1** Descriptive statistics of elaboration measures[a]

| Variable | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|
| *Interest*[b] | | | | |
| Staying safe while hiking in the presence of bears | 3.4 | 1.13 | 1 | 5 |
| Knowing how to act if you see a bear | 3.6 | 1.08 | 1 | 5 |
| Proper equipment while hiking in areas where bears may be present | 3.4 | 1.12 | 1 | 5 |
| How to increase your alertness to bears in an area | 3.5 | 1.06 | 1 | 5 |
| How to avoid bear encounters while hiking | 3.5 | 1.13 | 1 | 5 |
| How to interpret bear behaviors | 3.8 | 1.08 | 1 | 5 |
| *Awareness*[c] | | | | |
| Things you can do to decrease your risk of a bear attack while hiking | 2.9 | 0.92 | 1 | 5 |
| Resources you can use to keep you safe while hiking in bear country | 2.9 | 0.93 | 1 | 5 |
| How hiking in grizzly country is different than hiking in other areas | 2.8 | 1.05 | 1 | 5 |
| Techniques that can help you avoid negative encounters with bears | 2.8 | 0.92 | 1 | 5 |
| Ways to increase your safety while hiking in bear country | 2.9 | 0.92 | 1 | 5 |
| *Cognitive engagement*[d] | | | | |
| How hikers can avoid bears while hiking | 3.6 | 1.03 | 1 | 5 |
| Encountering bears while hiking | 3.8 | 1.03 | 1 | 5 |
| The benefits of taking safety precautions while hiking in bear country | 3.9 | 0.93 | 1 | 5 |
| How to have an enjoyable experience while hiking in bear country | 3.7 | 0.96 | 1 | 5 |
| What hikers can do to stay safe from bears while hiking | 3.7 | 0.94 | 1 | 5 |
| Appropriate behaviors while hiking in the presence of bears | 3.6 | 0.98 | 1 | 5 |

[a]For full review of scale development, see Miller et al. (under review, a.)

[b]Responses measured on a 5-point Likert-type scale where 1 = not at all interested and 5 = completely interested

[c]Responses measured on a 5-point Likert-type scale where 1 = not at all aware and 5 = completely aware

[d]Responses measured on a 5-point Likert-type scale where 1 = not at all and 5 = a great deal

## 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. 2018a; Vezeau et al. 2015; Table 1). Previous research validated the scale in this sample, and for a detailed analysis see Miller et al. (2018a). 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 and Hancock 1993; Munshi 2014; Peterson and 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 and 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

**Table 2** Mean, standard deviation, and reliability for theory of planned behavior measures

| Component | Variable code | Variable | Mean (SD) |
|---|---|---|---|
| Attitudes[a] Rho = 0.92 | | | – |
| | ATT_1 | Not at all pleasant to extremely pleasant[b]. | 3.7 (1.27) |
| | ATT_2 | Not at all favorable to extremely favorable[c]. | 4.0 (1.16) |
| | ATT_3 | Not at all good to extremely good[d]. | 4.1 (1.11) |
| Subjective norms[e] 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[e] 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[f] | It is difficult to carry bear spray while hiking in Yellowstone. | 4.7 (0.69) |
| Bear spray behavior[g] 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) |

[a]Responses to the statement, "For me, carrying bear spray while hiking in Yellowstone would be…"

[b]1 = not at all pleasant, 5 = extremely pleasant

[c]1 = not at all favorable, 5 = extremely favorable

[d]1 = not at all good, 5 = extremely good

[e]1 = not at all true, 5 = completely true

[f]Item reverse coded

[g]1 = highly unlikely, 7 = highly likely

good, 2 = somewhat good, 3 = moderately good, 4 = very good, 5 = extremely good, etc.) for all three measures (see Table 2).

Subjective norms were evaluated by three different universal measures that were developed from previous research and adjusted to fit the current context (Ajzen and 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 (see Table 2).

Perceived behavioral control was assessed by three different universal measures developed from previous research and adjusted to be applicable to the current context (Ajzen and 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 (see Table 2). 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 (see Table 2).

## 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 ($\chi^2 = 566.79$, 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 (Micerri 1989). In this current data set, several of the TPB variables exhibited a negative skew in their unidimensional 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*. After 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 $\chi^2$, the Bollen–Stine bootstrap $\chi^2$ ($BS_{boot}$; a $\chi^2$ 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 $\chi^2$ 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 <0.10, with values <0.05 indicating an excellent fit (Browne and 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 <0.05. If *p*-close > 0.05, the model has a close fit (Kline 2011). SRMR values of <0.08 are considered acceptable, with values closer to 0 indicating a better fit (Hu and Bentler 1999). For both CFI and TLI, values >0.90 indicate an acceptable fit, with values >0.95 indicative of an excellent fit (Hu and 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

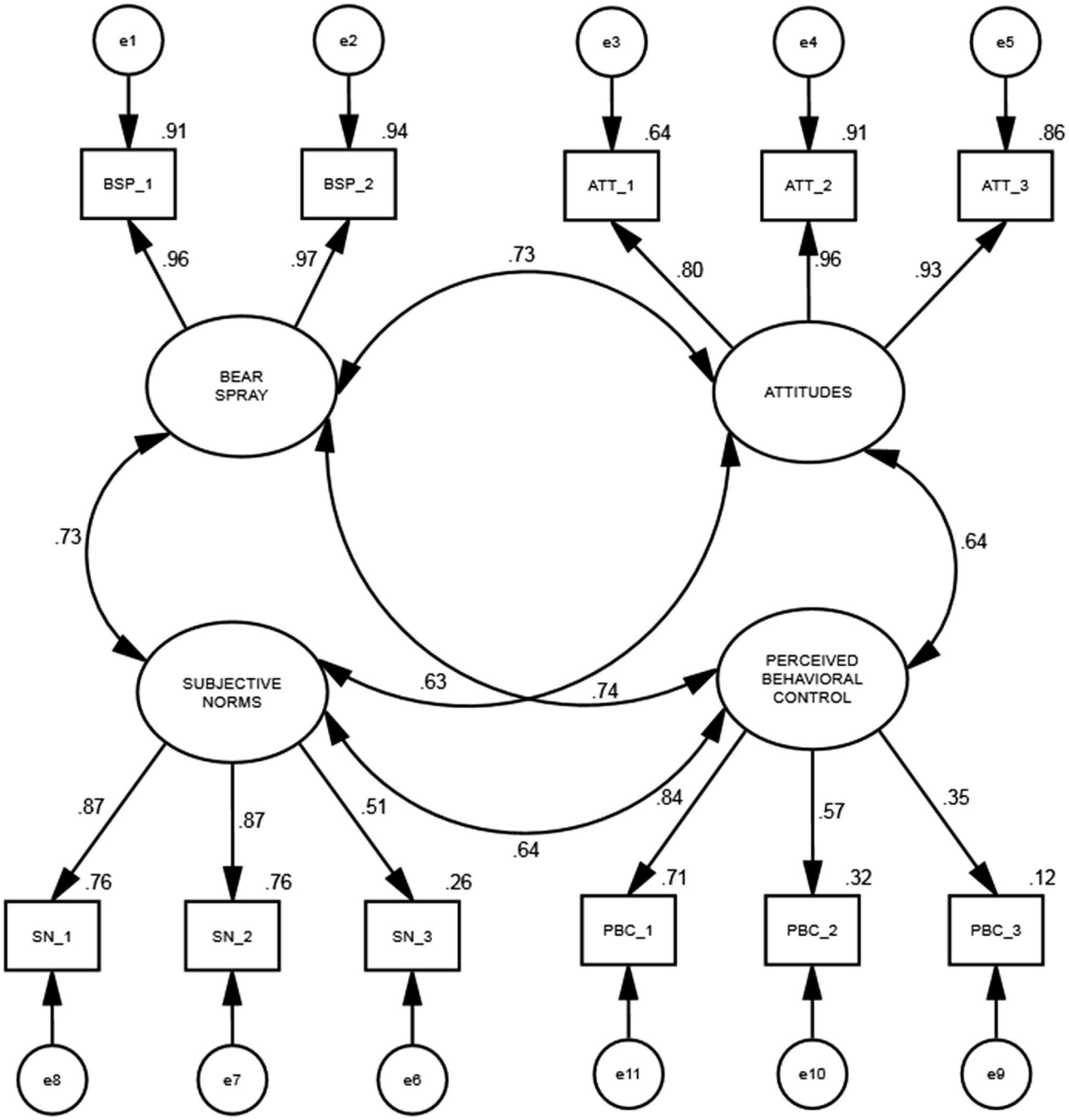


**Fig. 1** CFA of theory of planned behavior measures. All loadings are standardized and statistically significant ($p < 0.01$). Fit statistics: $\chi^2 = 78.023$, df = 38, $p < 0.001$; $BS_{boot}$, $p = 0.064$; RMSEA = 0.042, $p$-close = 0.834; SRMR = 0.0247; CFI = 0.991; TLI = 0.988. See Table 1 for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

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 2. The CFA of the TPB components provided evidence that there was a strong fit between the data and the model (Fig. 1). Although the $\chi^2$ was significant ($\chi^2 = 48.607$, 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

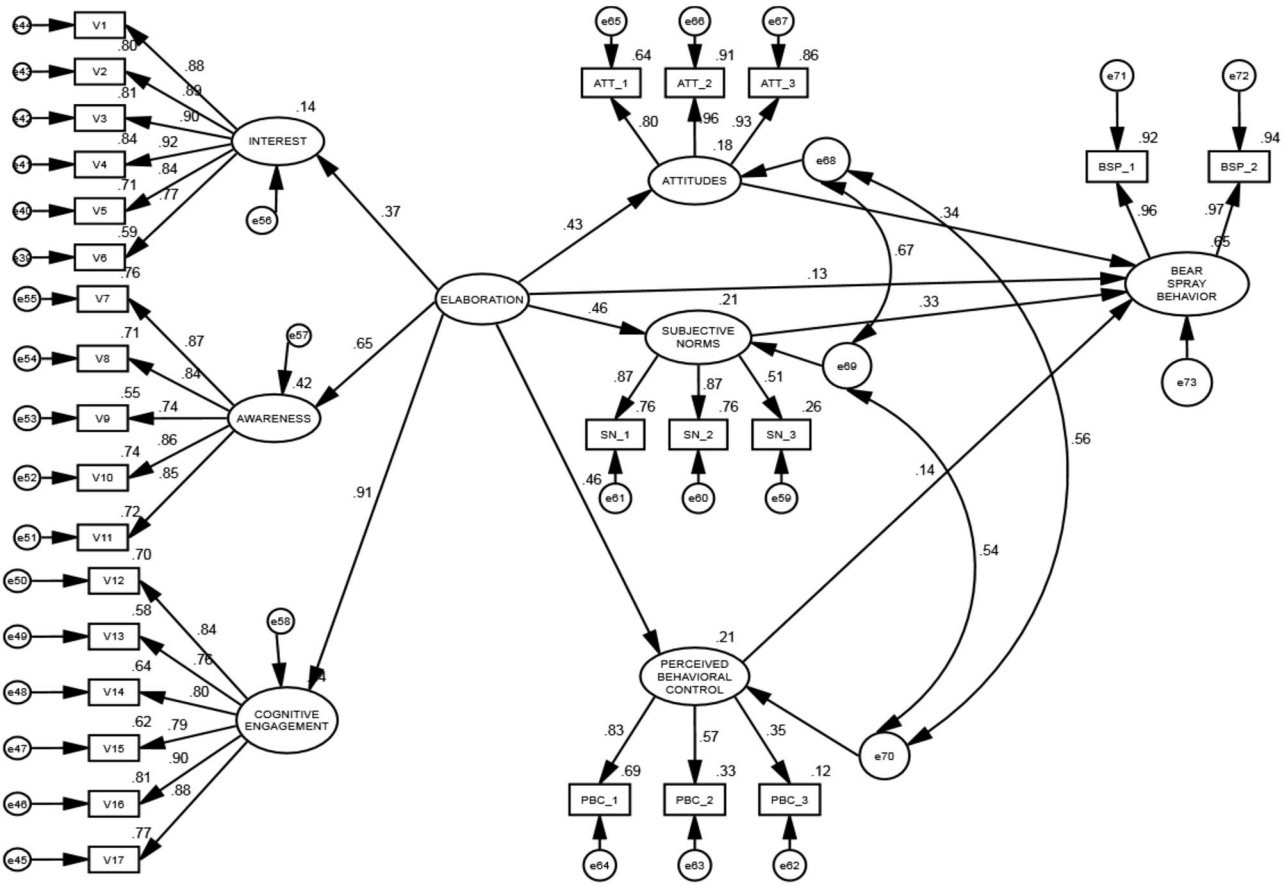


**Fig. 2** The relationship between elaboration and the theory of planned behavior. Fit statistics: $\chi^2 = 670.66$, df = 337, $p < 0.001$; $BS_{boot}$, $p = 0.002$; RMSEA = 0.041, $p$-close = 1.00; SRMR = 0.038; CFI = 0.975; TLI = 0.972. All loadings and paths were statistically significant ($p <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

each concept were also above the 0.60 threshold, and ranged from 0.65 to 0.96 (see Table 2 for all Rho coefficients). Collectively, this evidence supports Proposition 1 (The TPB measurement model is acceptable).

## 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, TPB, and behavioral intentions was built to test the remaining propositions and their associated hypotheses (Fig. 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 $\chi^2$ tests were significant ($\chi^2 = 670.66$, 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).

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 3 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).

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

**Table 3** Effect of attitudes, subjective norms, and perceived behavioral control on bear spray behavioral intentions[a]

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

[a]See Fig. 2 for full SEM

[b]Based off of Cohen (1988)

**Table 5** Effect of elaboration on bear safety behavioral intentions[a]

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

[a]See Fig. 2 for full SEM

[b]Based off of Cohen (1988)

**Table 4** Effect of elaboration on attitudes, subjective norms, and perceived behavioral control[a]

| TPB component | Standardized path coefficient | Effect size[b] | *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 |

[a]See Fig. 2 for full SEM

[b]Based off of Cohen (1988)

perceived behavioral control]). Table 4 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 1988).

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 a 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 5). 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.

## 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 and 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. 2018a; Vezeau et al. 2015) 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 and 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 (Miller 2017), 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 (Miller 2017). 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. (2015), designing communication strategies that increase interest, awareness, and cognitive engagement (collectively called elaboration) is a useful framework for developing communication materials that intend 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 and 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. 2018b), 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 (Miller et al. 2018b).

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 Fig. 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. 2018a). 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 and 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 and 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; Miller 2017).

## 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 sustainable 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 sustainable tourism. 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.

### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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