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Stewards and Conservationists: Merging Moral Norms and the Theory of Planned Behavior to Understand Altruistic Conservation Behavior Among Hunters in Southwestern Utah

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STEWARDS AND CONSERVATIONISTS: MERGING MORAL NORMS AND THE THEORY OF PLANNED BEHAVIOR TO UNDERSTAND ALTRUISTIC CONSERVATION BEHAVIOR AMONG HUNTERS IN SOUTHWESTERN UTAH

by

Jacob C. Richards

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ABSTRACT

Stewards and Conservationists: Merging Moral Norms and the Theory of Planned Behavior to Understand Altruistic Conservation Behavior Among Hunters in Southwestern Utah

by

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This research examines the utility of integrating personal norms and stewardship identity into the Theory of Planned Behavior (TPB). Our investigation focuses on the use of non-lead ammunition in the California condor recovery zone of southwestern Utah. While the TPB has been useful in predicting conservation behaviors, the addition of other constructs may increase its predictive ability. Anecdotal evidence suggests personal norms and stewardship identity are particularly strong among hunters; this was confirmed in our sample of deer hunters. Results from comparative structural equation models suggest the addition of the personal norms and stewardship identity constructs do not lead to a decrement in model fit and also marginally improves the ability of TPB to explain hunters' intention to use non-lead ammunition. We discuss the implications of these findings for the future use of the TPB and how personal norms and stewardship identity can be operationalized in communication efforts.

(54 pages)

PUBLIC ABSTRACT

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Jacob C. Richards

The leading cause of mortality in California Condors (condors) is lead poisoning, which occurs when condors ingest lead-based ammunition left in carcasses. As a critically endangered species with approximately 115 individuals remaining in the American southwest, increasing the adoption of non-lead ammunition is essential to the recovery of the species. In Utah, the Division of Wildlife Resources (DWR) uses communication with hunters as the primary tool for increasing the adoption of non-lead ammunition in southwestern Utah. In this research, we use social science theory and data collected from a survey of hunters throughout the region to develop a strategic communication framework aimed at increasing the use of non-lead ammunition among hunters. The strategic communication framework is intended to drive more specific, targeted, and effective messages regarding the use of non-lead ammunition by the Utah Division of Wildlife Resources and their conservation partners.

Our findings suggest hunters, on average, hold positive attitudes towards non-lead ammunition and that their intention to use non-lead ammunition while hunting in in the area is high. This is good news for the DWR as an initial concern of the agency was that hunters may tend to hold negative attitudes towards non-lead ammunition and not be aware of the agency's preferences and programs regarding the behavior.

We asked hunters to self-report feelings of stewardship for the landscape and for the hunting tradition, believing that these feelings could be used as key leverage points to encourage the use of non-lead ammunition. These 'personal norms' were very strong amongst hunters; 92.7% of hunters consider themselves to be a steward of the natural landscape where they hunt and 88.4% believe they are stewards of the hunting tradition for future generations. Given these findings, we provide specific guidance on how the DWR can target personal norms in their communication with hunters regarding the use of non-lead ammunition. Tapping into feelings of stewardship over the landscape and family traditions are likely to be the most effective for effectuation behavioral change, reducing the use of lead ammunition, and conserving the condor population.

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INTRODUCTION

Wildlife managers are faced with the ongoing challenge of balancing the needs of human and nonhuman actors within the systems they manage. Management approaches to these challenges can include direct (e.g., population control through hunting) or indirect (e.g., habitat management) interventions with the wildlife species in the system (Messmer, 2000). Management approaches may also include direct (e.g., enforcement of wildlife-related regulations) or indirect (e.g., education) interventions with the humans in the system (Baruch-Mordo et al., 2009). Because many of the challenges faced by wildlife managers are rooted in human behaviors which lead to undesirable outcomes for wildlife (Brown et al., 2010; Miller et al., 2019), there is a growing recognition that long-term solutions benefitting both humans and wildlife should be focused on changing those human behaviors (Baruch-Mordo et al., 2009). Because there are a variety of management strategies managers can use to influence these behaviors, the strategies used should be informed by the demographics of the relevant populations, as well as their attitudes, beliefs, opinions, and values regarding the behaviors in question (Messmer, 2000). Communication is one strategy managers can use to mitigate behaviors threatening the health of wildlife populations (Brown et al., 2010).

Managers have long used communication strategies for multiple purposes such as resource conservation, enhancing the visitor experience, mitigating environmental impacts, and improving safety, especially in public spaces such as parks and protected areas (Miller et al., 2019). Since outdoor recreation activities on public lands primarily occur in dispersed and unconfined areas, on-site messaging has often been the primary means of communication between managers and users. Messaging may be the only

contact visitors have with the managing agency, therefore the message presented can communicate more than just information; messaging can be welcoming or unwelcoming and communicate or imply the outcomes the managing agency desires for the area (Winter et al., 1998). Many of these same characteristics apply to off-site messaging strategies used by management agencies, such as outreach efforts via mail, agency publications, and social media. Therefore, research into effective communicative strategies will continue to be relevant for conservation managers who are attempting to effect behavioral change.

Communication strategies grounded in a strong theoretical foundation are significantly more effective at changing behavior when compared to those that are not guided by theory (Lessard et al., 2020; Teel et al., 2015). The Theory of Planned Behavior (TPB) has been effective in predicting conservation behaviors (Armitage & Conner, 2001). The TPB is noted for its parsimony, predictive ability, and adaptability to different contexts (Armitage & Conner, 2001; Conner & Armitage, 1998; Miller, 2017). The theory has been particularly effective within the context of wildlife management (Ajzen, 1991; Burns et al., 2003; Ham et al., 2008; Hine et al., 2014; Kaiser et al., 2005). Given this, the TPB can be used to craft effective communication strategies designed to influence and promote desirable human-wildlife interactions.

The goal of this research is to assess and potentially improve upon the ability of the TPB to predict a conservation behavior – the use of non-lead ammunition. We incorporate two additional psychological constructs, personal norms and stewardship identity, which may be particularly relevant within the context of *altruistic* conservation behaviors. While the TPB is a parsimonious model, it does allow for the incorporation of

additional components. We examine the relationship between personal norms and stewardship identity and the other TPB constructs; analyze the relationship between all of these constructs and behavioral intention; and discuss how our findings can be used to inform wildlife management efforts.

CONCEPTUAL BACKGROUND (THEORETICAL FRAMEWORK)

Theory of Planned Behavior Overview

The TPB can be a highly accurate predictor of behavioral intentions (Armitage & Conner, 2001; Miller, 2017). The theory postulates there are three primary determinants of behavioral intentions: attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). An attitude towards a behavior is the degree of favorability the individual holds towards it and is preceded by behavioral beliefs. For example, hunters who use lead ammunition may select it based on the belief that it performs better than current non-lead alternatives on the market. The subjective norm is the social component, where an individual evaluates the perceived attitudes of their social group(s) towards an object and feels a certain external pressure to perform or not perform the behavior. An example of a subjective norm in this context would be the opinion of a hunter's friends and family on non-lead ammunition. If they believe lead ammunition is superior, then the hunter may continue to use lead ammunition despite a differing personal attitude or belief. Finally, perceived behavioral control is the predicted difficulty of the behavior by the individual, and can be significantly influenced by past behavior, as well as factors such as cost, complexity, or self-efficacy (Ajzen, 1991). An example of perceived behavioral control related to the use of non-lead ammunition is the cost of the ammunition. If non-lead

ammunition is significantly more expensive than lead ammunition, then a hunter may believe that they cannot afford to use it.

The TPB has been a dominant model used to examine human behaviors towards wildlife. Table 2-1 shows studies directly applying TPB to human-wildlife interactions.

Table 1

Previous Studies Examining the Theory of Planned Behavior in a Wildlife Conservation Context.

Targeted Behavior	Other Theories Integrated	Location	Reference	Methodology	Finding
Bear spray use	Elaboration Likelihood Model	Yellowstone (USA)	Miller et al. (2019)	Survey, SEM	Components of the theory of planned behavior partially meditated the relationship between elaboration and behavioral intentions.
Hunting	None	Vermont (USA)	Hrubes et al. (2001)	Survey, regression	Hunting intentions were strongly influenced by TPB components, which correlated highly with theoretically derived sets of underlying beliefs.
Purchasing non-lead tackle	Community Based Social Marketing	New Hampshire (USA)	Leszek, M. L. (2015)	Interviews, survey, ANOVA and multivariate analyses	Social norms are especially important for bass anglers, and many anglers view purchasing and using non-lead tackle as important when addressing conservation benefits.
Integrating wildlife management into grazing livestock operations	None	Alabama, Florida, Georgia, Mississippi (USA)	Willcox et al. (2012)	Survey, regression	Results indicated that attitudes and subjective norms best explained rancher intentions. TRA would have been sufficient (it does not include PBC).
Bear canister use	None	Yosemite (USA)	Martin & McCurdy (2009)	Surveys, regression	Models containing measures of attitudes and subjective norm explained 38 to 43% of backpackers' intentions to use canisters.
Predicting hunting intention	Theory of Reasoned Action	Alabama (USA)	Rossi & Armstrong (1999)	Survey, regression	Explained 38% of the variance in hunting intention but revealed flaws in operationalization. They determined that hunting/fishing fall in the more "non-volitional range," meaning external factors were important and PBC needed to be included.
Intention to participate in volunteer work, donate money, join environmental organization	Centrality to Life (involvement)	Norway	Dybsand & Stensland (2021)	Surveys, SEM	Results showed that the perceived effects of participating in a musk ox safari had significant positive relationship with attitudes and subjective norms in all three models that, in turn, had significant positive relationships with intentions to perform all three pro-environmental behaviors.

Efficacy of TPB

The TPB is often used in efforts to influence behaviors and has been shown through many studies and meta-analyses to be an effective predictive tool. Armitage and Conner (2001) found the TPB explained an average of 27% of variance in behavior, and 39% of behavioral intention across a meta-analysis of 185 independent studies. Kaiser et al. (2005) found the constructs of the TPB (attitudes, subjective norms, and perceived behavioral control) predicted 76% of behavioral intention, and intention explained 95% of the variance in conservation behavior. Sutton (1998) summarized the findings of several meta-analyses of TPB (and its predecessor, the Theory of Reasoned Action [TRA]), determining 40-50% of the variance in behavioral intentions can be explained by the TPB/TRA. The variance in actual behavior explained was smaller (19-38%), but effect sizes for both relationships were medium to large. While these numbers may seem poor, they are quite high in comparison to typical effect sizes in the behavioral sciences (Sutton, 1998).

The TPB not only provides a relatively high explanatory power for behavioral intentions (and subsequent behaviors), but its utility also comes from its adaptability (Miller, 2017). The theory can be applied to a variety of behaviors and can incorporate other theoretical constructs relevant to the specific behavioral context being examined. TPB's simplicity makes for easier explanations and applications for non-scientists, such as wildlife or public land managers (Miller, 2017). Finally, the utility of TPB also stems from its ability to better understand behavioral antecedents and leverage that understanding to alter behaviors more effectively towards conservation outcomes. While many existing behavioral theories explain behavior, the components of TPB provide a

way to effect change in the behavior of an individual through communication targeting those internal factors (Miller, 2017).

The developer of the TPB, Icek Ajzen, recognized the nature of the relationships between his theory's components was still uncertain and that his model had the capacity to be expanded (Ajzen, 1991). He stated that TPB is "open to the inclusion of additional predictors if it can be shown they capture a significant proportion of the variance in intention or behavior after the theory's current variables have been taken into account" (p. 199). Subsequent research has shown moral norms are a significant additional predictor of behavioral intentions in the TPB (Brown et al. 2010; Conner et al., 2003; Corbett, 2005; Harland et al., 1999; Parker et al., 2011).

Moral Norms and TPB

We examine the utility of integrating two moral constructs, personal norms and stewardship identity, into the TPB. These are relevant psychological components in behavioral decision-making regarding altruistic behaviors since these behaviors often pit self-interest and other interests against each other and therefore have a moral component (Conner et al., 2003). Because of this, models incorporating moral components, such as the Value-Belief-Norm theory and Norm Activation theory (Van Liere & Dunlap, 1978; Kaiser et al., 2005), have been useful in the analysis of altruistic behavior. The addition of moral constructs to an effective behavioral model like the TPB utilizes the most relevant components of all these theories to better predict altruistic conservation behaviors.

The personal norm construct consists of beliefs held by an individual regarding whether an action is right or wrong, irrespective of what others think (Schwartz, 1977). It

is a self-imposed sense of moral obligation that is not captured by the traditional subjective norm component of TPB (Schwartz, 1977), and several studies have shown it can increase the predictive power of TPB when altruistic behaviors (such as those that benefit wildlife) are targeted (Conner et al., 2003; Corbett, 2005; Thogersen, 2002). Harland et al. (1999) performed some of the first research to examine if personal norms would increase the proportion of variance explained by the constructs of TPB regarding environmental behavior and found personal norms improved the ability of TPB constructs to predict behavioral intention significantly.

When used within the context of environmental management, stewardship identity is the extent to which an individuals' identity is related to the stewardship of a natural system, species, or landscape (Lute & Gore, 2014). Social identities are the "component of one's self concept derived from group membership" (Lute & Gore, 2014, p.268). Stewardship identity can influence personal motivation to engage in behaviors that benefit the environment, which affirms those self-identified roles (Landon et al., 2021).

TPB has been an effective model for predicting behavior. However, it is a strictly cognitive model using a rational actor framework[1], and there are other variables such as affect, identity, and morality that influence human behavior (Miller, 2017). The addition of moral norms to the TPB framework has improved the predictive ability of the TPB in studies examining altruistic environmental behaviors (Brown et al., 2010; Conner & Armitage, 1998). Hunting is one behavior influenced by deeply held personal beliefs (Hrubes et al., 2001; Kaltenborn et al., 2013), therefore moral norms could have

[1] The rational actor framework is an assumption that human decision making is a rational, cognitive process based on available information (Miller 2017). It is assumed that intentions and behaviors follow a reasonable, linear path from antecedent beliefs (Ajzen 1991).

significant impacts on predicting behavioral intention among hunters. The incorporation of a moral component into the TPB could yield a more predictive model of wildlife-related conservation behaviors, such as the use of non-lead ammunition to benefit non-game wildlife species.

Hunters Hold Strong Moral Norms

Previous research suggests hunters believe they are stewards of the game species they target and the landscapes on which they hunt, as well as holding a self-identified role as conservationists (Epps, 2014; Holsman, 2000; Landon et al., 2021; Kaltenborn et al., 2013; Richards & Smith, 2021). Stewardship identity is associated with a feeling of personal responsibility to take care of a particular place or landscape (Landon et al., 2021). Williams et al., (2018) recognized feelings of stewardship can be operationalized by wildlife managers and that hunters can be a useful management tool when these moral norms are engaged. This identity is associated with responsible behavior and is part of a self-perception among hunters as positive, law-abiding actors in the ecosystems of the landscapes in which they hunt (Holsman, 2000; Kaltenborn et al., 2013).

Although hunters may report dissatisfaction with specific management decisions (such as the restoration of predator species in certain areas), they support the general conservation of habitats and native species[2] (Heffelfinger et al., 2013). Gamborg et al. (2018) found wildlife care and management is even a primary motivator for hunting, behind only being motivated by "the nature experience" and "the social aspect." These feelings are not only expressed through responses to survey items, but also through

[2] This has been the foundation of the wildlife conservation model in the United States, where hunters provide the majority of funds supporting wildlife conservation (Heffelfinger et al., 2013).

behavior. A survey conducted in 2000 found hunters volunteer more than one million hours per year on wildlife habitat projects in Canada (Powers et al., 2000), and hunters in Maryland were over three times as likely to volunteer for state wildlife efforts than non-hunters (Duda & Young, 1993).

While the literature shows most hunters hold these feelings, as expressed in self-reports, behavior, and the structure of conservation funding models, hunters are not homogenous. Holsman (2000) found hunters sometimes engage in behaviors that do not align with wildlife management objectives, suggesting quantifying feelings of stewardship and personal norms through surveys could be particularly useful in research targeting the behavior of a particular regional group of hunters. These generalizations should not be assumed based on literature from other areas, but these studies can inform the questions to be asked and elucidate possible psychological constructs to be targeted by conservation communication strategies.

METHODS

Study Site and Context

The recovery of the California condor (condor) (*Gymnogyps californianus*) is an iconic conservation success story. Its population dwindled to only 22 individuals in 1982 (Finkelstein et al., 2012), primarily due to anthropogenic causes such as infrastructure development, poisoning of pest species that were food sources for condors, and lead poisoning from bullet fragments in game carcasses (Rideout et al., 2012). A captive breeding and release program helped the species begin to rebound, and the current global population is over 500 individuals, over half of which can be found in free-flying wild populations within Arizona, California, and Utah (USA) and Baja California (Mexico) (Walters et al., 2010).

The ingestion of lead from spent ammunition in carcasses remains the leading cause of mortality among condors (Sieg et al., 2009; Finkelstein et al., 2012). There have been multiple studies linking lead ammunition use by hunters to lead toxicosis and death among condors. Parish et al. (2007) confirmed condors are ingesting lead, which is also evidenced by the perennial chelation treatments given to an average of 20% of the condor population in California each year (Finkelstein et al., 2012). Hauck (personal communication, 04/05/22) confirmed lead poisoning from ingested ammunition was also the greatest cause of fatalities in the Arizona/Utah population, with 53% of diagnosed deaths attributed to lead toxicosis. Research shows that non-lead ammunition use within the condor's foraging range will need to be nearly 100% if the condor population is to remain independently stable without captive releases or intensive health monitoring and treatment (Finkelstein et al., 2012; Sieg et al., 2009).

Many attempts have been made to increase the use of non-lead ammunition nationwide. These have included regulatory bans on lead ammunition in California, communication campaigns, and voucher programs for free non-lead ammunition in western states with condor populations such as Arizona and Utah (Epps, 2014). The evidence suggests regulatory bans on non-lead ammunition have not been effective in reducing lead exposure to condors (Finkelstein et al., 2012; Epps, 2014). International studies have also shown bans are often ineffective, due to poor compliance, lack of enforcement, and their partial nature (Arnemo et al., 2016). Many of the advocates for a regulatory ban point to the success of the federal ban on lead ammunition for waterfowl hunting. However, this is not analogous to big game hunting for several reasons: the precision needed for big game rifles makes users more sensitive to changes in bullet specifications; there are far more rifle calibers than shotgun (which are generally used for waterfowl); and the dispersed and backcountry areas associated with big game hunting makes enforcement far more difficult (Epps, 2014). The primary target of efforts to minimize the use of lead ammunition should be high velocity rifles used for big game, since these are the types of bullets which produce the most fragmentation within the carcass (Epps, 2014) and are used while hunting in the Zion area.

Non-lead ammunition use in the Zion hunting unit of Utah (part of the nesting and foraging range of the southwest population of the condor) has been increasing, with most recent self-reported survey data showing it approaching 70% in the last five years (Richards & Smith, 2022). Programs used to reach their current number have included voucher programs for free non-lead ammunition, raffles, and communication campaigns. The relevant literature supports a voluntary strategy through communication campaigns

to achieve their target number, as opposed to top-down hunting regulations (Epps, 2014; Sieg et al., 2009).

Data Collection

We administered an online survey via email to all 6,453 hunters who drew a permit to hunt deer in the Zion hunting unit from 2017-2021. Email addresses were provided by the Utah Division of Wildlife Resources (UDWR). The email list was cleaned of all duplicates, so the survey was sent only to unique addresses. The survey was delivered via Qualtrics software. The survey was first sent on November 5, 2021, with four follow up emails sent over the next three weeks. The survey results were exported from Qualtrics into SPSS on December 6, 2021. A total of 1,845 respondents agreed to participate via the initial consent form. Data from respondents under 18 (n = 12) were removed from the dataset. A total of 86 participants did not answer any questions after agreeing to participate, so their responses were also deleted. In total, we received 1,752 valid responses with usable data. This final number put our overall response rate at 27.2%. Studies using similar electronic sampling methods tended to have lower response rates (13-23%) unless a preliminary interaction occurred either in-person or via mailed survey invitation (Dybsand & Stensland, 2021; Lessard et al., 2020; Leszek, 2015; Martin & McCurdy, 2009; Williams et al., 2018).

Measures

The instrument was divided into five sections: 1) recent Zion area hunting behavior; 2) information sources and ammunition preferences; 3) historical non-lead ammunition

use; 4) perceptions about using non-lead ammunition; 5) and sociodemographic questions. Questions regarding hunting behavior, information sources, and ammunition preferences were based on similar instruments found in the literature and input from the UDWR and other project partners (e.g., The Peregrine Fund).

Psychometric questions measuring latent constructs were based on other research using the same constructs. In total, the instrument included a total of 43 questions or statement items. All psychometrics were measured on a 7-point Likert-type scale. Scale items asked for the respondent's level of agreement with statement items on a scale of "completely disagree" (-3) to "completely agree" (+3), except for the attitude scale items which had a scale of "not at all" (-3) to "extremely" (+3). These items were recoded to a positive 1-7 scale for analysis. A full list of items can be found in Table 2.

Attitudes were measured with four statement items asking the respondent if they found using non-lead ammunition to be good, pleasant, favorable, or poor (Hrubes et al., 2001; Kaiser et al., 2005; Miller et al., 2019;). Since the fourth statement (poor) is the only negative descriptor in these items, it was reverse coded for analysis.

Subjective norms were measured with four statement items asking about the perceived opinion of a variety of groups: "people who I respect," "people important to me," "other big game hunters in the Zion area," and "wildlife managers." These groups were adapted to our study context from similar research (Harland et al., 1999; Hrubes et al., 2001; Kaiser et al., 2005; Miller et al., 2019; Parker & Stradling, 2011).

Perceived behavioral control was measured using four statement items regarding the respondent's perceived ability to use and acquire non-lead ammunition. These items

were also taken from similar research and adapted to the current behavioral context (Hrubes et al., 2001; Kaiser et al., 2005; Miller et al., 2019; Parker & Stradling, 2011).

Behavioral intention was measured by the level of agreement with the phrases "I intend…," "I will try…," and "I am determined…" "to use non-lead ammunition on my next big game hunt in the Zion region" (Hrubes et al., 2001; Kaiser et al., 2005;).

Survey items measuring personal norms and stewardship identity were also measured on a 7-point Likert-type scale. The personal norm items focused on feelings of personal moral obligation to use or purchase non-lead ammunition (Harland et al., 1999; Kim & Seock, 2019; Schwartz, 1977). Items included: "when choosing ammunition, I feel morally obligated to prioritize using non-lead ammunition;" "I would be a better person if I used non-lead ammunition;" "I feel morally obligated to purchase non-lead ammunition regardless of what others say;" and "I would feel guilt if I used lead ammunition while hunting big game in the Zion area."

Items measuring stewardship identity were primarily adapted from those developed by Landon et al. (2021), but similar items have been used to measure the norm constructs within the Value-Belief-Norm model (Lessard et al., 2020; Klain et al., 2017). There were two 7-point Likert-type scale items measuring feelings of stewardship towards "the hunting tradition for future generations" and towards "the natural landscape where I hunt."

Data Analysis

SPSS statistical software was used for descriptive statistics, exploratory factor analysis (EFA), and for data cleaning prior to input into the Analysis of Moment

Structures (AMOS) modeling software. AMOS was used for confirmatory factor analysis (CFA), measurement models, and structural equation models (SEM). SPSS performs automatic listwise deletion for all statistical analyses performed, while missing values had to be manually deleted for all analyses performed in AMOS. The final sample size used for the SEMs in AMOS was 629, which was the number of respondents who completed all survey items used to measure all latent constructs in the final model.

Internal reliability was evaluated in SPSS using Cronbach's alpha. The conventional threshold of 0.65 was used, which is considered an acceptable value in human dimensions of wildlife research (Vaske, 2008).

EFA Extracted Two Moral Components

The items used to measure personal norms and stewardship identity were taken from research measuring a variety of other constructs in addition to these two. This necessitated an EFA to determine if the measurement items for these two constructs were measuring distinct constructs. A principal component analysis with varimax rotation was performed, and components with Eigenvalues greater than 1.0 were extracted as distinct latent constructs.

CFA Tested the Measurement Model

CFA was performed to assess the fit of the data to the constructs in our measurement model. The CFA was also used to determine convergent and divergent validity of the measurement model. Convergent validity between items and constructs was determined by an Average Validity Extracted (AVE) value greater than 0.50, and discriminant

validity between constructs is determined if the square root of the AVE is greater than the squared correlation between variables (Ateş, 2020; Landon et al., 2021). Discriminant validity can also be inferred if there are no correlations between constructs greater than 0.75 (Kim & Seock 2019; Smith et al., 2012).

Model fit was determined with fit statistics criteria used in similar research. These criteria include χ^2/df value greater than 5.0, root mean square error of approximation (RMSEA) near 0.6 and below 0.10, comparative fit index (CFI) and Tucker-Lewis index (TLI) > 0.90 (Hu & Bentler, 1998; Miller et al., 2019; Smith et al., 2012). If good model fit is determined, coefficients between the latent variables within the structural model can be estimated.

A minimum criterion of 0.40 for standardized factor loadings denotes practical significance in human dimensions of wildlife research (Lessard et al., 2020; Manfredo et al., 2009). For this research, a threshold of 0.50 was used to ensure that only items with very strong factor loadings would be included in the final model.

A Structural Model Was Developed with All Our Constructs

Assuming our measurement models fit the data well, the structural coefficients between latent variables in our structural model can be estimated with a maximum-likelihood estimation procedure (Smith et al., 2012). A SEM was used to measure the relationship between the TPB constructs and the addition of the personal norm and stewardship identity constructs. The models without and with the personal norm and stewardship identity constructs were estimated sequentially. We compared the model fit

statistics to determine if the personal norm and stewardship identity constructs resulted in a decrement to model fit.

Discriminant validity between constructs in the structural model was determined using the Fornell and Larcker (1981) criterion, which requires that the correlation between any two constructs is lower than the AVE.

RESULTS

Sample Characteristics

Our sample was primarily male (88.3%). The age structure of respondents had a normal distribution, with a mean of 49.7 years and a range from 18 to 88[3]. The modal income category was between $100,000 - $149,000. More than four-fifths (82.2%) of respondents were residents of Utah, with another 12.4% coming from other western states (Arizona, California, and Nevada). Respondents tended to be experienced hunters, having hunted for an average of nearly 30 years (mean = 29.8, SD = 16.7). Nearly two-thirds of respondents (65.9%) had used non-lead ammunition in the Zion unit in the previous 12 months, and 69.0% of respondents reported using non-lead ammunition at some point in the past while hunting in the Zion unit. Two-fifths (40%) of hunters indicated they intended to use non-lead ammunition but were unable to find it in their preferred caliber. A complete breakdown of descriptive statistics for all questions in the survey can be found in the project's technical report (Richards & Smith, 2021).

Exploratory Factor Analysis

Two components were extracted from the six items that were used to measure moral norms, and these two components accounted for 84.8% of the variance among those items. The Kaiser-Meyer-Olkin (KMO) of 0.773 and Bartlett's test of sphericity

[3] Comparison with known demographic information from the DWR shows our sample is slightly older relative to all license holders in the area (mean age for sample = 49.7, mean age for population = 40.8). Our sample is also more likely to be male relative to all license holders in the area (sample = 88.3% male, population = 78.1% male) (Phil Gray, Wildlife License Coordinator, UDWR, personal communication, 14 February 2022).

were significant (χ^2 = 2,699.7, *df* = 15, $p < 0.001$). The four items intended to measure personal norms were highly correlated (> 0.85) with the first extracted component, and the two items intended to measure stewardship were highly correlated with the second extracted component (> 0.93). A full description of this EFA can be found in the supplementary materials.

Descriptive Statistics

Descriptive statistics for individual statement items within the TPB, as well as the personal norms and stewardship identity constructs and the behavioral intention measure are shown in Table 2. Generally, items measuring the standard components of the TPB were positive (means > 4.0). Stewardship identity items were exceptionally high (means > 6.0) with a lower standard deviation (1.1 and 0.9) indicating strong positive agreement with the statement items and less variation than response items measuring other constructs. Personal norm items had lower means relative to the other constructs, with three out of four items being rated negative (means < 4.0). Finally, behavioral intention items were also very positive (means > 4.8).

Factor loadings between survey items and their latent constructs suggests the statement items are good measures of their intended latent constructs. All items met our previously established minimum threshold value of 0.4. Nearly all (19 of 21) items had very strong factor loadings with a value > 0.6. Two items (ATT_4 and SN_4) were removed from the final model because their factor loading values of .49 and .43 (respectively) were substantially lower than the other items in the model.

Internal reliabilities among items measuring each single latent variable were sufficient (Cronbach's alpha > 0.78). The indicators were all deemed to be reliable measures of the constructs.

A CFA was performed for our measurement model which included the traditional components of TPB as well as our two constructs measuring the additional moral component (personal norms and stewardship identity). Despite χ^2 being significant, all other fit statistics for the measurement model indicated the model fit the data well. Fit statistics for our measurement model were: $\chi^2 = 543.295$, $df = 137$, $p < 0.001$; $\chi^2/df = 3.966$; RMSEA= 0.061; CFI = 0.963; TLI = 0.954.

Table 2

Descriptive Statistics.

Dimension and Scale Items (Code used in models)	*M*	*SD*	α	α if item deleted	Factor Loading
Attitude (ATT)			.940		
For me, using non-lead ammunition would be good* (ATT_1)	4.87	1.76		.794	.93
For me, using non-lead ammunition would be favorable* (ATT_2)	4.75	1.74		.791	.93
For me, using non-lead ammunition would be pleasant* (ATT_3)	4.62	1.65		.805	.87
For me, using non-lead ammunition would be poor*[1,2] (ATT_4)	3.35	1.73		N/A	N/A
Subjective Norm (SN)			.833		
People who I respect use non-lead ammunition** (SN_1)	4.41	1.59		.673	.83
People who are important to me think I should use non-lead ammunition** (SN_2)	4.00	1.61		.700	.87
Other big game hunters in the Zion use non-lead ammunition** (SN_3)	4.49	1.41		.727	.65
Wildlife managers want me to use non-lead ammunition in the Zion area**[1] (SN_4)	5.79	1.30		N/A	N/A
Perceived Behavioral Control (PBC)			.786		
If I wanted to, I could easily use non-lead ammunition on my next big game hunt in the Zion area** (PBC_1)	5.10	1.78		.751	.67
Acquiring non-lead ammunition is easy** (PBC_2)	3.51	1.93		.749	.64
Using non-lead ammunition is simple** (PBC_3)	4.82	1.76		.723	.76
My ability to use non-lead ammunition is totally in my control** (PBC_4)	4.92	1.91		.710	.66

Stewardship (ST)			.826		
I consider myself a steward of the hunting tradition for future generations** (ST_1)	6.05	1.13		N/A	.81
I consider myself a steward of the natural landscape where I hunt** (ST_2)	6.22	0.92		N/A	.97
Personal Norm (PN)			.924		
When choosing ammunition, I feel morally obligated to prioritize using non-lead ammunition** (PN_1)	4.46	1.81		.917	.82
I would be a better person if I used non-lead ammunition** (PN_2)	3.42	1.93		.896	.89
I feel morally obligated to purchase non-lead ammunition regardless of what others say** (PN_3)	3.62	1.94		.884	.93
I would feel guilt if I used lead ammunition while hunting big game in the Zion area** (PN_4)	3.32	1.95		.907	.86
Behavioral Intention (BI)			.912		
I intend to use non-lead ammunition on my next big game hunt in the Zion area** (BI_1)	5.19	1.78		.863	.87
I will try to use non-lead ammunition on my next big game hunt in the Zion area** (BI_2)	5.35	1.70		.876	.88
I am determined to use non-lead ammunition on my next big game hunt in the Zion area** (BI_3)	4.88	1.84		.882	.89

*These items were measured on a 7-point Likert-type scale, where -3 = not at all (good/pleasant/favorable/poor), 0 = neutral, +3 = extremely (good/pleasant/favorable/poor)
**These items were measured on a 7-point Likert-type scale, where -3 = completely disagree, -2 = disagree, -1 = slightly disagree, 0 = neither agree nor disagree, 1 = slightly agree, 2 = agree, 3 = completely agree. These items were coded on a scale of 1-7 for analysis.
[1]These items were removed before input into the measurement and structural equation models.
[2]ATT_4 was a negative descriptor of non-lead ammunition, meaning M < 4.0 is considered a positive attitude. This was reverse coded prior to analyses.

Structural Model

AVE was calculated using the standardized regression weights from AMOS. Construct validity was determined by AVE values ranging from 0.47 to 0.83, with discriminant validity confirmed by the square root of AVE being greater than all correlations between latent variables. See Supplementary Materials for a full report of AVE values.

The two structural models (without and with the personal norm and stewardship identity latent constructs) both fit the data well (Table 4-2). The differences in fit statistics between the structural models without and with the personal norm and stewardship identity latent constructs were marginal, indicating that the addition of our two moral constructs did not result in a decrement in model fit (Table 4-2). A difference

test of the two models was significant ($\chi^2 = 236$, df = 46, $p < 0.001$), meaning the inclusion of the additional constructs significantly improved the model.

Table 3

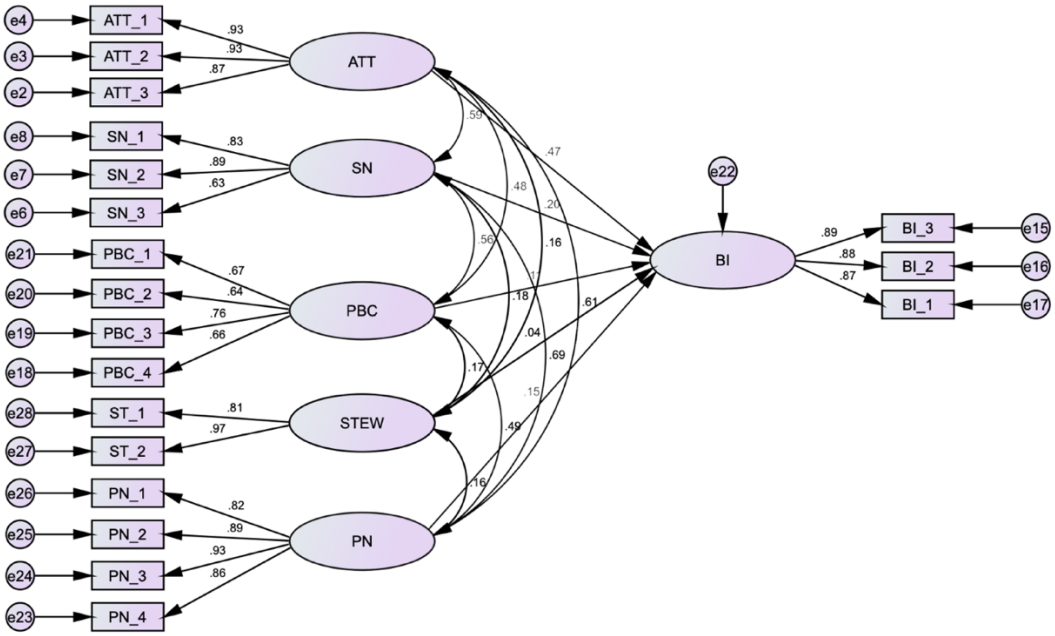
Model Fit Comparison Between the TPB Model and the Extended Model.

	χ^2	*df*	χ^2/df	*p*	CFI	TLI	RMSEA	R^2
TPB structural model	218.7	59	3.7	.000	.970	.961	.066	62.7
TPB structural model with the addition of the moral norm latent constructs	454.7	13	3.3	.000	.963	.954	.060	63.8

Additionally, we compared the squared multiple correlation values from the traditional TPB structural model and the model including our moral constructs. The latter model explained marginally more variance (1.1%) in behavioral intentions relative to the former model.

Figure 1

Structural model which includes the addition of two moral norm constructs (stewardship identity and personal norms).



Note. Fit statistics: $\chi 2 = 454.71$, df= 138, $p < 0.001$; RMSEA= 0.060, p-close = .003; CFI =0.960; TLI = 0.954. See Table 2 for corresponding variable codes.

Our structural model shows the relationship between all latent predictor variables and behavioral intention. The effect of the stewardship identity construct on behavioral intention was not significant (coef. = 0.035, $p = 0.235$). However, the effect of personal norms was significant (coef. = 0.145, p £ 0.001). Perceived behavioral control (coef. = 0.112, $p = 0.008$), subjective norms (coef. = 0.202, p £ 0.001), and attitudes (coef. = 0.471, p £ 0.001) were all significantly and positively related to behavioral intentions.

Table 4

Effect of model constructs on behavioral intention to use non-lead ammunition.

Model Component	Standardized path coefficient	Effect Size	*p*-value
Attitude	0.471	Medium-Large	£ 0.001
Subjective Norm	0.202	Small	£ 0.001
Personal Norm	0.145	Small	£ 0.001
Perceived Behavioral Control	0.112	Small	0.008
Stewardship Identity	0.035	Very Small	0.235

DISCUSSION

Summary

Communication is one of the primary tools used by wildlife managers to influence human behaviors (Brown et al., 2010; Miller et al., 2019). Research has shown effective communication is grounded in sound psychological theory (Lessard et al., 2020; Teel et al., 2015). One theoretical framework often used with wildlife conservation behaviors is the TPB (see Table 1). This theory has the capacity to be expanded based on the contextual conditions of the behavior being targeted (Ajzen, 1991).

The goal of this research was to test the predictive power of the TPB with the addition of moral constructs, since TPB is a strictly cognitive model. This is because the targeted behavior (using non-lead ammunition in the California condor recovery zone) is altruistic—it costs the individual without a direct benefit to them. Past research has recognized the inclusion of moral norms in the TPB model can increase its predictive power among these types of behaviors (Brown et al., 2010; Conner & Armitage, 1998; Thøgersen, 2002).

The strongest predictors of behavioral intention in our model were (in order): attitudes, subjective norms, personal norms, perceived behavioral control, and stewardship identity. Attitude continued to be the strongest predictor of behavioral intention, as it has shown in past studies of the TPB (Martin & McCurdy, 2009; Rossi & Armstrong, 1999).

The original components of TPB also explained a large proportion of variation (62.7%) in behavioral intention. This reinforces the utility of the TPB as a predictor of behavioral intention in wildlife management contexts, as Miller (2017) argued.

Moral Constructs Are Not Already Contained in the Traditional TPB Model

We discovered through EFA that our moral construct measures were measuring two distinct components: personal norms and stewardship identity. These two constructs had high discriminant validity from the other TPB constructs. The TPB is a parsimonious model, and its simplicity means each of its primary constructs can be further broken down into component parts. Our research supports previous research suggesting the moral antecedents of behavioral intention are not contained within the TPB model, and behaviors that have a moral component can be better explained with an expanded model (Brown et al., 2010; Conner et al., 2003; Conner & Armitage, 1998).

We included personal norms and stewardship identity specifically for this study's context. Future models that expand the TPB model should do the same, considering carefully the unique moral norms that might be present within their study population. Additional relevant constructs could be identified for any study behavior that is not strictly a cognitive decision-making process (which is the type of behavior explained by the standard TPB model). Since our behavior of study was an altruistic conservation behavior, the moral antecedents of that behavior were found to be distinct from the standard model of the TPB.

Hunters' Feelings of Stewardship Are Not Predictive of Intention to Use Non-lead Ammunition

Past research has shown hunters hold strong feelings of stewardship (Epps, 2014; Kaltenborn et al., 2013; Landon et al., 2021; Williams et al., 2018), and our survey

confirmed this for hunters in the California condor region of southwest Utah (Richards & Smith, 2021). These feelings have been operationalized by managers in areas where they were deemed relevant and significant (Williams et al., 2019). We measured this latent construct to determine if it was correlated with behavioral intention.

Our overall model was successful, in that it did not result in a decrement in model fit and showed an increase in the proportion of the variance explained in behavioral intentions (our response variable). However, stewardship identity was not significantly related with behavioral intentions. While stewardship identity was found to be very strong amongst hunters in the region, there was no meaningful relationship between those measures and the variation in behavioral intention.

Personal Norms Are Predictive of Intention to Use Non-lead Ammunition

The other moral construct measured in this study (personal norms) was significantly and positively related to behavioral intentions. It also had a stronger relationship with behavioral intentions relative to the other TPB constructs.

The items used to measure personal norms centered around feelings of moral obligation to purchase and use non-lead ammunition. These feelings were predictive of a self-reported intention to purchase and use non-lead ammunition. This could prove to be a leverage point for impacting behavioral change, since messages that successfully increase feelings of moral obligation (personal norms) would also increase behavioral intention. Since self-reported stewardship identity was already high and had no relationship with behavioral intentions, personal norms are an area of greater opportunity to achieve behavioral objectives through targeted communication efforts.

Management Implications

This research has important implications for managers who are attempting to influence altruistic conservation behaviors, such as the use on non-lead ammunition in the foraging range of the endangered California condor. It affirmed the continued use of the TPB as an effective theoretical framework for conservation communication since the strongest predictors of behavioral intention were two of the TPB components: attitudes and subjective norms. However, it also showed moral constructs are significant and meaningful predictors of behavioral intention and could be leverage points to be targeted by communication strategies.

These constructs do not exist in a vacuum, and messages can use more than one construct to influence behavior. A model which includes the addition of a moral component to a theoretical framework already proven to be effective in influencing conservation behavior can capitalize on the non-cognitive constructs found to be significant, both in this and past research.

Hunting is a unique type of conservation behavior. It is often done alone, away from crowds and infrastructure, and has deep cultural roots for many who participate. Because of these attributes, many communication strategies that are typically applied to conservation behaviors will not be effective. There are fewer places to put messages to communicate with hunters (unlike hikers or national park visitors, who are often concentrated along trails and corridors, even in the backcountry). Social norms are less effective because of the independent nature of the activity (as opposed to using normative pressure to influence the behavior of an individual participating in a group activity or

behavior). Finally, the tradition of hunting often comes with deep-seated values held strongly by many hunters. Values are deeply rooted and are antecedents of attitudes and behavior (Homer & Kahle, 1998), therefore an understanding of these values can inform communication strategies targeting the constructs built upon them.

Our research determined moral norms are constructs that are strongly held by hunters in southwestern Utah. Specifically, personal norms and feelings of stewardship were identified as latent moral constructs not captured by the TPB. By examining the relationship and strength of these components, this research identified possible ways to improve communication strategies directed at this particular audience.

Messages that have used appeals to moral norms to influence behavior include phrasing such as "If not you, who? (It's the right thing to do)" (Brown et al., 2010), activation of internalized personal obligation (Harland et al., 1999), and emphasizing the feeling of guilt that one may expect to experience after performing an action that contradicts their personal norms (Parker and Stradling 2011). Since this research found that personal norms had a significant relationship with behavioral intention, these examples could be informative to the development of communication strategies aimed at increasing the use of non-lead ammunition in the California condor recovery zone of southern Utah. Specific messages could include phrases such as "preservation of this landscape is up to you: use non-lead to protect native species," "the stewardship of this land and its wildlife is in your hands," or "responsible hunters use non-lead ammunition to protect this landscape and its wildlife." These messages draw upon feelings of stewardship identity (which we know is very strong among this population) and connect them to personal norms (which we know is correlated with behavioral intention).

This research can point wildlife managers in some very specific directions in their efforts to communicate with hunters in the Zion area about the use of non-lead ammunition. Appeals should be made to hunters' strong sense of stewardship over the landscape and the hunting tradition as these are widely held personal norms amongst those who hunt in the area. Appeals should also be made through representations of other hunters who use the area, as they are one of the most trusted groups hunters obtain their information about ammunition (Richards and Smith 2021). Collectively, these efforts can catalyze a strategic communication plan that taps into the personal characteristics and behaviors that define hunters in the area.

Limitations

Like all research, this work has limitations. First, the survey was directed at a very specific hunting group: deer hunters in the Zion area. While this was intentional to capture the largest big-game hunting group in the region, there are other hunting behaviors in the area that could introduce lead on the landscape, such as coyote or elk hunters. These groups should be included in future research, as they may have different behaviors and communication strategies directed at them should be informed by their specific characteristics.

Second, this research was also performed during the COVID pandemic, which had substantial impacts on supply chains worldwide. These external factors created a unique economic context that impacted ammunition availability, which was reflected in our survey results (Richards & Smith, 2021).

Finally, the stewardship identity construct has not been studied thoroughly in conservation literature, so there were few measurement examples upon which to adapt our own. There is a possibility that we could have found a significant relationship between stewardship identity and behavioral intention if we used more comprehensive measures, including more attitude objects (not just the hunting landscape and hunting tradition).

CONCLUSION

Many wildlife conservation behaviors can be described as “altruistic,” since they benefit wildlife at the expense of the individual. When describing or predicting these types of behaviors, the moral component of the decision-making process should be identified, as it can be significant. For hunters in the Zion region of southern Utah, our research identified the strength of two moral constructs, personal norms and stewardship identity, and how they interact with the cognitive components of the TPB. This research can serve as the foundation for new communication strategies aimed at increasing non-lead ammunition use in the California condor recovery zone. Getting lead off the landscape to save condors can happen, and through the implementation of a strategic communication plan informed by theory and data, we believe it can happen before it’s too late.

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APPENDIX

Exploratory Factor Analysis (EFA) to Determine Moral Norms Latent Constructs

There were both theoretical and statistical reasons to keep the personal norms and stewardship identity items as separate latent variables in the final structural equation model. Theoretically, the statement items were derived from different literatures. The personal norms items were taken from Harland et al. (1999), Kim and Seock (2019), and Schwartz (1977), while the stewardship identity questions were taken from Landon et al. (2021), Lessard et al. (2020), and Klain et al. (2017). Statistically, an EFA identified them as separate latent constructs.

The EFA involved principal components identification using varimax rotation. Two components were extracted with Eigenvalues > 1.0 that collectively explained 84.8% of the variance within the measures. The Kaiser-Meyer-Olkin (KMO) of 0.773 and Bartlett's test of sphericity were significant (χ^2 = 2,699.69, df = 15, p = 0.000). The four items intended to measure personal norms were highly correlated (> 0.85) with the first extracted component, and the two items intended to measure stewardship were highly correlated with the second extracted component (> 0.93).

Table 5

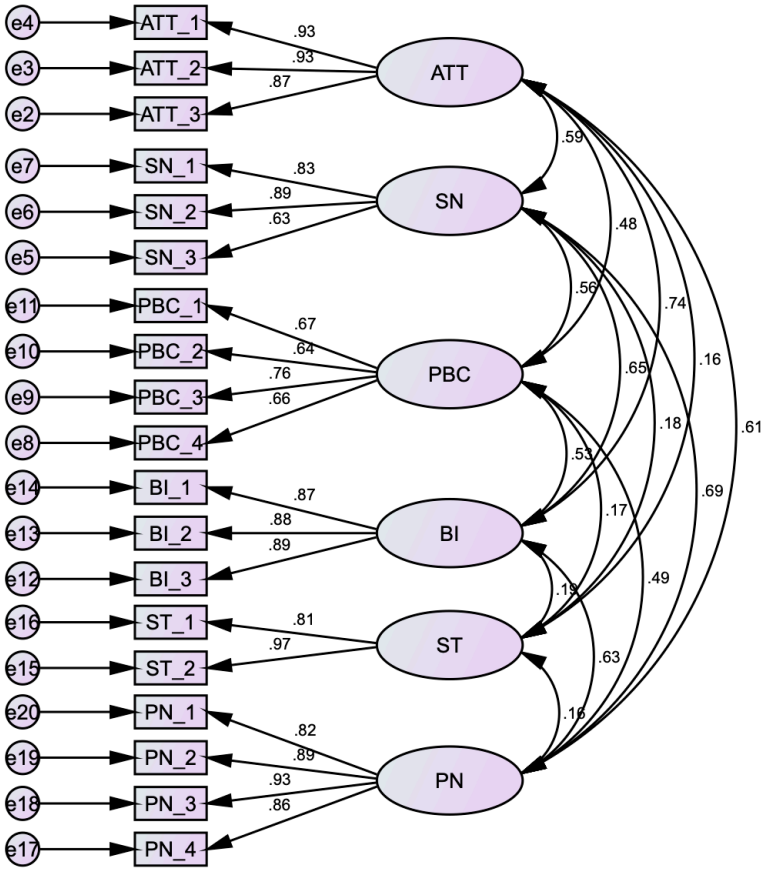
Rotated Component Matrix for Exploratory Factor Analysis of Moral Norms Statement Items.

	Component	
Moral Norms Statement Items	1	2
ST_1	.061	.939
ST_2	.090	.939
PN_1	.857	.185
PN_2	.916	.015
PN_3	.942	.058
PN_4	.901	.045

Note. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 3 iterations. See Table 2 for wording of individual statement items.

Figure 2

Measurement model with inclusion of all constructs and items.



Average Variance Extracted (AVE) Calculated to Determine Convergent and Discriminant Construct Validity

Convergent validity shows how closely the indicator variables are related. It is done separately for each construct. Discriminant validity demonstrates how different each latent variable deviates from the others. In the measurement model, values between indicator variables and latent variables are loadings. Values between latent variables are correlations. Convergent validity requires determining AVE, which equals the sum of the standardized loadings (squared) divided by number of indicators. Convergent validity is determined by an AVE greater than 0.5. Discriminant validity is established if the square root of AVE is more than the correlations between the latent variables.

Table 6

Discriminant Validity Determined by Average Variance Extracted Greater than Correlations Between Constructs.

		Standardized Loadings	Squared	Summed	AVE	Square root of AVE			Correlation
ATT_3	ATT	0.87	0.75				ATT	SN	0.59
ATT_2	ATT	0.93	0.87				ATT	PBC	0.48
ATT_1	ATT	0.93	0.87	2.50	0.83	0.91	ATT	BI	0.74
SN_3	SN	0.63	0.40				ATT	ST	0.16
SN_2	SN	0.89	0.79				PN	ATT	0.61
SN_1	SN	0.83	0.68	1.88	0.63	0.79	SN	PBC	0.56
PBC_4	PBC	0.66	0.43				SN	BI	0.65
PBC_3	PBC	0.76	0.57				SN	ST	0.18
PBC_2	PBC	0.64	0.41				PN	SN	0.69
PBC_1	PBC	0.67	0.45	1.87	0.47	0.68	PBC	BI	0.53
BI_3	BI	0.89	0.79				PBC	ST	0.17
BI_2	BI	0.88	0.77				PN	PBC	0.49
BI_1	BI	0.88	0.77	2.33	0.78	0.88	BI	ST	0.19
ST_2	ST	0.97	0.93				PN	BI	0.63
ST_1	ST	0.81	0.65	1.58	0.79	0.89	PN	ST	0.17
PN_4	PN	0.86	0.74						
PN_3	PN	0.94	0.87						
PN_2	PN	0.89	0.78						
PN_1	PN	0.82	0.68	3.08	0.77	0.88			

Note. See Table 2 for wording of individual statement items.