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FURTHER DEVELOPMENT OF A MODEL OF ENVIRONMENTAL COMMITMENT

Shane W. Boyd

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Environmental commitment is a concept based on the investment model and interdependence theory literature. Interdependence theory and the investment model were originally geared towards the study of interpersonal relationship commitment as function of relationship satisfaction and alternatives to being in that relationship. It has since been applied to areas outside of interpersonal relationship commitment such as environmental commitment. Previous research has demonstrated that environmental commitment can be predictive of environmental behavior, above and beyond several different control variables that captured different aspects of the person-environment relationship (Davis, Le, & Coy, 2011; Davis, Green, & Reed, 2009). This project strengthened the existing model by adding two new control variables: a new measure of environmental attitudes and measures of three HEXACO personality factors. My general hypothesis was that environmental commitment predicted self-reported environmental behavior, above and beyond both the new control variables and the existing control variables that were used in this model. I ran both a regression analysis and a path analysis, both incorporating the control variables to test this hypothesis. Overall, environmental commitment did display

incremental validity above and beyond the other variables used in the analysis. Also, an alternative model of environmental commitment was developed that displayed excellent global fit. This study further strengthened the utility of Davis's (2011) model for understanding environmental commitment. This study also advanced research in determinants of environmental behavior.

FURTHER DEVELOPMENT OF A MODEL OF
ENVIRONMENTAL COMMITMENT

SHANE W. BOYD

A Thesis Submitted in Partial
Fulfillment of the Requirements
for the Degree of

MASTER OF SCIENCE

Department of Psychology

ILLINOIS STATE UNIVERSITY

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FURTHER DEVELOPMENT OF A MODEL OF
ENVIRONMENTAL COMMITMENT

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S.B.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Introduction

Research on how individuals interact with the environment has long existed in the field of psychology. This research has increased significantly in recent years due to increased awareness about the flourishing environmental problems that human civilization will face in the coming years. Global warming, natural resource depletion, deforestation, and overpopulation are all issues that are largely the result of anthropocentric causes. Psychologists and scientists in other disciplines alike have recognized these issues in recent years (e.g., Gardner & Stern, 1996; Oskamp, 2000; Vitousek, Mooney, Lubchenco, & Melillo 1997). The American Psychology Association (2009) recognized the need to tackle these complications and issued a report on the need of psychology to contribute further to research on the issue of global climate change. The authors of the report desired to, "...encourage psychologists' engagement with climate change issues as researchers, academics, practitioners, and students and to foster the development of national and international collaborations with other individuals and associations inside and outside of psychology (p. 11)."

In light of this report, there is already a large body of research examining the relation between humans and their environment. Research on the relation between

environmental behavior and factors such as attitudes (Hines, Hungerford, & Tomera, 1986-1987; Milfont & Duckitt, 2004), values, affect, and motivation (Vining & Ebreo, 1990) has revealed several factors that are significant predictors of that relation. Further, models of the human-environmental relation that are dependent on factors such as connectedness to nature, identity, personality, and commitment have been shown to be significant predictors of environmental behavior.

In particular, my thesis focused solely on the relation between interpersonal commitment and environmental behavior. Previous research (Davis, Green & Reed, 2009; Davis, Le & Coy, 2011) has established that a model of commitment, based on the investment model and interdependence theory, can be used to predict environmental behavior. In the current study, I made modifications to adjust the model that Davis and colleagues (2011) proposed; these changes included using two new control variables that their model did not account for and applying these control variables in a complete path analysis to strengthen the application of the investment model concept to environmental behavior.

Interdependence Theory and the Investment Model

The study of commitment to relationships has long been one of the foundations of social psychology. One particular theory that has been used to assess relationship commitment was Interdependence Theory (Thibaut & Kelly, 1959). Interdependence theory espouses that social relationships are a function of the rewards and costs that are derived from the relationship on an individual level. A comparison level is used to assess this criterion. The comparison level is a function of an individual's expectations of what he or she expects to get out of a relationship. It also is the standard for evaluating the

relationship as a whole that is based on past experiences and relationships. If there is an alternative to being in a certain relationship that is more beneficial, relative to the comparison level, it would then be likely that an individual would end that original relationship and move on to this other, more beneficial relationship.

Rusbult (1980) built upon the interdependence theory framework laid out by Thibaut and Kelly (1959) and extended into a new theoretical concept, the investment model. Within the investment model, commitment is seen as the likelihood that two individuals will persist in continuing a relationship (Arriaga & Agnew, 2001). Further, commitment can be predicted as a result of three different bases: satisfaction, alternatives, and investments. All of these bases are also antecedents of commitment; they need to occur before commitment can truly be achieved.

Satisfaction within the investment model framework is similar to how the comparison level was defined within interdependence theory. When the beneficial outcomes of being in a relationship exceed the level of expectations that an individual has, he or she will be satisfied with the relationship. Conversely, if outcomes are not quite meeting expectation levels, then it can be expected that the relationship might falter. Thus, the higher an individual's satisfaction within a relationship, the more it can be expected that the individual will remain committed to that relationship.

Similarly, availability of *alternatives* is another base of commitment that was already contained largely within interdependence theory. If an individual perceives better outcomes from an appealing alternative, then the individual may end his or her current relationship and head towards that alternative. Further, the alternative does not necessarily have to be another relationship, and it is possible that not being in a

relationship is a viable option comparatively. The availability of alternatives is also the only base that has a negative relationship with commitment.

Finally, the main concept that Rusbult (1980) introduced with her extension of interdependence theory was the concept of *investments*. Investments are the resources that come with being in a relationship that would be lost otherwise if the partnership were to dissolve. Further, investments can be both tangible items such as a household or other material possessions or intangible in nature, such as trust, emotion, social networks, or social status. Investments typically are positively associated with commitment.

The investment model has shown robustness and applicability across a wide range of studies (see Le & Agnew, 2003, for a broader review). Within the relationship literature, the investment model has predicted several different outcomes ranging from relationship continuance and dissolution to perspective taking within a relationship. The investment model has also shown a great deal of utility. The predictive power of the investment model has been replicated across diverse ethnic backgrounds (Davis & Strube, 1993; Lin & Rusbult, 1995) and sexual orientation (Duffy & Rusbult, 1986; Kurdek, 1991, 1995). It has also been extended to assess relationship commitment in friendships (Lin & Rusbult, 1995; Rusbult, 1980) and abusive relationships (Choice & Lamke, 1999; Rusbult & Martz, 1995).

The model has also been applied to contexts outside of interpersonal relationships. Research on organizational and job commitment has used investment model constructs (i.e., Farrell & Rusbult, 1981; Vandenburg & Lance, 1992). The investment model has also been extended to assess non-relational contexts, such as looking at commitment to a program of musical study (Kosolowsky & Kruger, 1986) and cricket players'

commitment to their sport (Carpenter & Coleman, 1998). It has been extended to more politically relevant realms to predict individuals' commitment to the "War on Terror" (Agnew, Hoffman, Lehmiller, & Duncan, 2007). Commitment, as measured by the investment model, has even been extended to predict specific sets of behaviors such as job change (van Dam, 2006) and, the construct of interest here, environmental behaviors (Davis et al., 2009; 2011).

Environmental commitment. Davis and her colleagues (2009; 2011) defined environmental commitment as an interaction between humans and nature that is characterized by continued relations and a deep mental bond between the two entities. Environmental commitment is based on this extant relationship commitment literature (Arriaga & Agnew, 2001; Rusbult, Owen, Davis, & Hannon, 2001). Environmental commitment has shown predictive power towards both self-reports of environmental behavior and environmental behavior intentions (Davis et al., 2009) above and beyond environmental attitudes (Dunlap, Van Liere, Mertig, & Jones, 2000), inclusion of the nature in self (Schultz, 2001), and the potential concerns for social desirability (Crown & Marlowe, 1960). In a later study, Davis and colleagues (2011) displayed the predictive power of environmental commitment towards environmental behavior above and beyond environmental identity (Clayton, 2003) and emotional connectedness to nature (Mayer & Frantz, 2004), as well as replicating the results from the original study.

To strengthen the predictive model of environmental behavior that Davis et al. (2011) developed, two new constructs were introduced to test that relation. First, a new measure of environmental attitudes (Milfont & Duckitt, 2011) was tested to see if it has predictive power towards investigating the criterion of environmental behavior above and

beyond environmental commitment. Previously used measures of environmental attitudes treated the concept as a single unitary factor. This measure uses two overarching factors (Utilization & Preservation) that effectively describe the breadth of environmental attitudes. There are also individual facet scores within Utilization and Preservation that are described as first order factors. Utilization encompasses five of these lower-order factors. Preservation is detailed by seven lower-order factors. Second, the relationship between environmental commitment and relevant higher-order personality traits was assessed. The higher-order personality traits that were investigated were the Openness to Experience, Honesty-Humility, and Agreeableness. This research was conducted using the HEXACO six factor model of personality framework (Ashton & Lee, 2007).

Assessing Environmental Attitudes

Environmental attitudes, themselves, refer to general perceptions and evaluations of environmentally related issues. In general, environmental attitudes are incredibly complex to capture due to the multi-faceted nature that environmental issues typically encompass. Because a majority of publications within environmental psychology deal with environmental attitudes in some way (Kaiser, Wolfgang, & Fuhler, 1999), complex inventories needed to be developed to capture this phenomenon. A large number of inventories have been created to measure this concept, which has led to problems in measuring environmental attitudes.

Typically, environmental attitudes are assessed through direct self-report methods. These methods allow for a quick, but overt, way of measuring them. Three self-report measures of environmental attitudes have seen the most popularity in the field of environmental psychology (Dunlap & Jones, 2003). These three are the Ecology Scale

(Maloney, Ward & Braucht, 1975), the Environmental Concern Scale (Weigel & Weigel, 1978), and the New Ecological Paradigm (NEP; Dunlap & Van Liere, 1978; Dunlap et al., 2000). The Ecology Scale and the Environmental Concerns Scale have become dated, so their relative utility has waned. The instruments have not been revised since the 1970s. In addition, the NEP became more widely used than the other instruments. The NEP has been revised since its original publication (Dunlap et al., 2000) and still displays utility in the present day comparative to the Ecology Scale and the Environmental Concern Scale. This scale was used by Davis et al. (2011) to measure environmental attitudes.

The major issue with these three scales, though, is that they do not measure environmental attitudes as a multidimensional construct, about which is there is wide agreement in environmental psychology literature (e.g., Maloney et al., 1975; Schultz, 2001; Stern & Dietz, 1994). Milfont & Duckitt (2010) advocated that measuring a multidimensional construct, such as environmental attitudes, as a unitary construct does not capture the full nature of the variable measured. Accordingly, this reason is why they developed the Environmental Attitudes Inventory (EAI). The EAI encompasses 12 lower-order factors: enjoyment of nature, support for interventionist conservation policies, environmental movement activism, conservation motivated by anthropocentric concern, confidence in science and technology, environmental fragility, altering nature, personal conservation behavior, human dominance over nature, human utilization over nature, ecocentric concern, and support for population growth strategies. These 12 lower-order factors were derived from a wide item-base that encompassed several previously used measures of environmental attitudes. The comprehensive nature of the EAI allows researchers to get a more accurate picture in terms of measuring environmental attitudes.

Milfont & Duckitt's (2010) inventory also allowed for environmental attitudes to be measured in terms of having multiple levels of factors as well. Recent studies (Milfont & Duckitt, 2004; 2006; Milfont & Gouveia, 2006; Wiseman & Bogner, 2003) have looked at the structure of environmental attitudes as possessing two higher order factors: Preservation and Utilization. Preservation expresses a general belief that the environment is worth protecting from human use and alteration so that future generations can enjoy it. The Preservation factor used in the EAI contains seven lower-order factors: enjoyment of nature, support for interventionist conservation policies, environmental movement activism, environmental threat, personal conservation behavior, ecocentric concern, and support for population growth policies. Utilization expresses a general tendency to want to exploit the environment for current human use and gain. The Utilization factor of the EAI contains five lower-order factors: conservation motivated by anthropocentric concern, confidence in science and technology, altering nature, human dominance over nature, and human utilization of nature.

The stronger overall structure of the EAI lends itself to better assessment of environmental attitudes over other inventories. Applying this new measure of environmental attitudes to the framework of environmental commitment that Davis et al. (2011) laid out might allow for new insights into how environmental attitudes related to it that the NEP (Dunlap et al., 2000) might not have been able to cover in Davis and colleagues' previous research.

Personality, the Investment Model, and Environmental Variables

One of the suggestions that Le & Agnew (2003) provided in their meta-analysis of the investment model was to investigate the role of certain dispositional factors, such

as personality, in potentially influencing the relation between the bases of commitment, commitment, and subsequent behaviors that are associated with commitment. With the influence of personality partialled out, the predictive power of commitment on environmental behavior could potentially be altered.

Personality and the investment model. Within the realm of social psychology, there has not been a lot of research on the connections between personality factors and the investment model constructs. The reasoning behind this gap is that a majority of the work done looking at the investment model and interdependence theory looked at the constructs as being situation specific (Rusbult & Van Lange, 2003). The original emphasis of the interdependence theory was on how the situation interacted with the relationship that two people have and whether they were satisfied based on their overall outcomes. Because the interdependence theory and investment model constructs have since effectively been applied to realms outside of the context of social relationships, I believe that seeing how personality interacts with environmental commitment can provide a whole wealth of new information especially given the breadth of research on how personality factors interact with environmental attitudes and behaviors.

Focusing on how personality interacts with the investment model within a relationship framework, there has only been a single instance where personality traits have been looked at in relation to investment model constructs. Looking at the trait of narcissism, Foster (2008) investigated how the trait interacted with the investment model bases and overall commitment. He also noted that this study was probably the first to examine a personality trait and the investment model constructs together. Foster (2008) found that the trait of narcissism moderates the effects of the bases of commitment on

commitment itself. For those who scored low on narcissism, the effects of the bases of commitment appeared largely similarly to the classic “person-situation” interaction that the investment model was largely created upon. For those who scored high on narcissism, each of the bases of commitment had a stronger effect on commitment itself. Weakening each of the bases (i.e., lower scores on satisfaction and investments; higher scores on alternatives) leads to weaker overall relationship commitment scores.

Based on this literature review, this study appears to be the first one that could examine the relation between personality higher-order factors (“Big Five”/HEXACO framework) and investment model constructs. Because I am utilizing investment model constructs outside of relationship contexts, I would expect the higher-order traits that would relate to environmental commitment to be different than the higher-order traits that suggest narcissism (for a review, see Paulhus & Williams, 2002). The higher-order factors that do relate to environmental attitudes and behavior will be covered in the next section.

Personality and environmental variables. One of the first studies assessing the relation between personality traits and the environmental values was conducted by Wiseman and Bogner (2003). Their conceptualization of environmental values was measured using the two-factor structure of Preservation and Utilization that they developed. Using Eysenck’s (1981) three-factor model of personality, they found that utilization had a positive relation with Psychoticism, whereas conservation had a negative relation with Psychoticism. Further, preservation also had a small positive relation with neuroticism. This result suggests that utilization is associated with being egocentric and

focused on the self, whereas conservation may be somewhat associated with anxiety towards the environment. Future studies would help support these relations.

Using the “Big Five” model of personality (Goldberg, 1993), further developments were made when making associations with environmental attitudes. First, Hirsh & Dolderman (2007) found that the traits of Agreeableness and Openness were positively associated with a measure of environmental attitudes and environmental behavioral intentions. Building upon that original study, Hirsh (2010) replicated his findings using structural equation modeling to assess a much larger community sample from Germany.

More recently, Markowitz, Goldberg, Ashton, and Lee (2012) provided the first study assessing the relation between personality and environmental attitudes and behavior. Markowitz’s overarching goal was to profile the pro-environmental individual. Using both the Big Five (Goldberg, 1993) and the six-dimensional HEXACO framework to assess personality (Ashton & Lee, 2007), a positive, moderate association was found between Openness and environmental behavior in a community sample (Markowitz et al., 2012; Study 1). Further, Markowitz and colleagues (2012: Study 2) found the same association between Openness to Experience and self-reports of environmental behavior in a college-student sample. Further positive associations were found between Openness and environmental attitudes, as well as Openness and connectedness to nature. Hirsh’s (2007; 2010) previous finding of Agreeableness and environmental attitudes being associated was not replicated. This finding was considered a bit surprising because environmental practices and behaviors are typically considered prosocial in nature, which the trait of Agreeableness taps into.

Hilbig, Zettler, Moshagen, and Heydasch (2012) extended the relation between the environment and the HEXACO framework (Ashton & Lee, 2007) by providing further work on that relation. Despite the fact that Markowitz's (2012) study showed no relation between Honesty-Humility and environmental behavior, the work of Hilbig et al. (2012) still hypothesized that there was a relation between environmental values and Honesty-Humility. Honesty-Humility is a "value-related" factor that would contain dispositions such as being cooperative and respectful as opposed to being more devious or greedy. The fact that Markowitz et al. (2012) found no association between Honesty-Humility and environmental behavior may be due to the fact that Honesty-Humility is more related to values than behavior, as well as some possible method differences. Accordingly, Hilbig et al. (2012) found that there was a moderate positive relation between Honesty-Humility and environmental attitudes and behavior. Further, he also replicated the finding that there is a positive association between environmental attitudes/behavior and openness as found in previous studies (Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012).

Proposed Hypotheses

The overall goal of my proposed research was to investigate the relations between the bases of environmental commitment, commitment itself, and environmental behavior. First, the path model that Davis and her colleagues (2011) developed was to be replicated (see Figure 1). Satisfaction and investments should have a significant predictive relation with environmental commitment. Satisfaction displayed a predictive relation with environmental behavior. Further, environmental commitment maintained a significant predictive association with environmental behavior above and beyond the control

variables, which were incorporated into the path model to strengthen its overall connection (see Figure 2). This model included four new variables as controls above and beyond the original Davis (2011) model: the Environmental Attitudes Inventory and three personality variables. Davis and her colleagues (2011) did not include the control variables in their original path model, which was rectified in my proposed study.

First, the only control variable that was retained from Davis and colleagues' (2011) study is the inclusion of nature in the self (INS), due to it being a single item measure. The INS should display the same association that it did with environmental commitment in Davis et al. (2011). Measures of environmental identity (Clayton, 2003) and connectedness to the environment (Mayer & Frantz, 2004) were dropped due to methodological constraints and concern for participant fatigue. Specifically, I hypothesized that environmental commitment will predict ecological behavior above and beyond the INS.

Figure 1. Davis's Original Model of Environmental Commitment.

Second, I'm going to analyze the relation between the Environmental Attitudes Inventory (EAI; Milfont & Duckitt, 2011) and environmental commitment (Davis et al., 2009; 2011). I believe that the EAI will be better able to measure environmental attitudes than the New Ecological Paradigm (Dunlap et al., 2000). Further, I still expect environmental commitment to be able to predict self-reports of environmental behavior, above and beyond the EAI

Third, the final goal of the current research was to assess the effects of the three relevant personality traits that have been shown to be related to environmental behavior and person-environment relationship constructs by using the HEXACO-PI-R (Ashton & Lee, 2009): Agreeableness, Honesty-Humility, and Openness. Only these variables will be assessed due to the already established relations evident in the literature and to minimize participant fatigue by limiting the number of questionnaires. I hypothesized that Openness will likely be a stronger predictor of environmental behavior due to the consistency with which it has been shown to be related to it (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012). Further, I expected that Honesty-Humility will be related to environmental behavior but not Agreeableness. I expected to be able to replicate the findings of Hilbig and his colleagues (2012) in that regard because of the use of HEXACO-PI-R questions. Ultimately, I expect environmental commitment to be the strongest predictor of environmental behavior, above and beyond personality traits.

Figure 2. Proposed Revisions to Model of Environmental Commitment

CHAPTER II

METHOD

Participants

Three-hundred and sixty-one students from a mid-sized university in the Midwestern United States completed the first component of the survey assessing demographics. In terms of gender, 248 participants were female; 93 participants were male; and 20 participants did not give their gender. With regards to class standing, 45 respondents were freshman; 76 were sophomores; 105 were juniors; 114 were seniors; and 2 were graduate students. Nineteen respondents left class standing blank. Regarding race, 289 participants identified themselves as White; 16 identified themselves as Black; 8 identified themselves as Asian; 11 identified themselves as more than one race; 3 identified themselves as Native American; 2 identified themselves as Pacific Islander; 10 identified themselves as other; and 32 omitted the question. Of the 361 respondents, 20 identified themselves as Hispanic. After completing the initial demographics questionnaires, 287 participants were retained for the next part of the survey containing all relevant measures. This represents about 1% of the overall student population at the university and a response rate of about 3% to those who received the survey in their e-mail inboxes.

The minimum sample size needed to be 150 participants overall due to the use of hierarchical regression analysis, path analysis, and the number of measures that I used. This sample size allowed for adequate power to assess the relation between the predictor variables and the criterion. Because the number of participants collected exceeded 150, the model development approach became viable with the second set of analyses.

Participants also had the chance to be compensated for their participation in the research. Three participants each received a \$25 Amazon.com gift card which will be dispersed via random selection. Upon beginning the study, participants were assigned an ID number and asked for their e-mail address. The e-mail address was only used to notify the participants if they have been selected to receive compensation. A random number generator was used to select three participant ID numbers. Those participants were then notified that they had been selected to receive compensation.

Procedure

The survey was created in SelectSurvey software. A link to the survey was distributed via on-campus e-mail to those students who had opted in to receive research opportunities. Participants were briefed for consent at the beginning of the set of questionnaires. Demographics were then collected. Using their birthdate as a reference, participants were then assigned to one of four different sets of questionnaires. The experimental materials were presented in one of four differing orders depending on the questionnaire. Subjects then completed the questionnaires. Participants were debriefed on the purpose of the study on the final page of the survey and thanked for their participation.

Although certain limitations do exist, past research in psychology has indicated that there is no marked difference between research conducted on the internet and more traditional survey methods (Gosling, Srivastava, Vazire, John, 2004; Kraut, Olson, Banaji, Bruckman, Cohen, & Couper, 2004). Online surveying allows for access to large and diverse samples at a low cost.

Measures

Commitment to the environment. Commitment to the environment was measured using the 11-item scale developed by Davis et al. (2009), which is designed to assess long-term commitment to the environment and the psychological connection an people feel towards it (e.g., “Feeling a connection to the environment is important to me”). This measure of commitment is an adapted version of the scale developed by Rusbult and colleagues (1998) used to measure close relationships. The scale is a 9-point measure (0 – do not agree; 8 – agree completely) with excellent reliability in the current study ($\alpha = .93$). Environmental commitment was significantly related to the EAI Preservation subscale ($r = .72$), the EAI Utilization subscale ($r = -.48$), and inclusion of nature in the self ($r = .66$) in the current sample. As a result of high intercorrelations, these person-environmental relationship variables were controlled for in the current study.

Bases of commitment. Each of the bases of commitment (satisfaction, alternatives, and investments) was measured using the three scales that were compiled and created by Davis et al. (2011). Each 5-item scale was measured using a 9-point Likert measure (0 – do not agree; 8 – agree completely) with acceptable reliability in the current research ($\alpha = .85-.97$). The satisfaction scale is designed to measure the amount of satisfaction people feel towards their relationship with the environment (e.g., “The natural environment is an

ideal place to spend time”). The investments scale measures the amount of resources individuals have invested have with regards to their relationship with the environment (e.g., “I have put a lot of time, energy, and effort into the well-being of the natural environment”). The alternatives scale measures the other possible alternatives one may have than being committed to the environment (e.g., “When I’m not in the natural environment, I find other appealing places to spend my time). None of the bases of commitment were correlated with each other stronger than $r = .43$ with each other, which suggests that each base of environment commitment is unique. Additionally, all of the bases of commitment were significantly related to environmental commitment ($r = .68$, $-.37$, and $.66$). This suggests that our data does replicate Davis’s original model of environmental commitment at an inferential level.

Environmental behavior. Environmental behavior was measured using an adapted 28-item version of the general ecological behavior (GEB) scale that was created for use in a student population by Davis et al (2009). This version omits items that are not relevant towards student life on a college campus. The original version was developed by Kaiser, Doka, Hofstetter, & Rainey (2003) for assessing self-reports of ecological behavior across a wide spectrum of areas (e.g., “In winter, I turn down the heat when I leave my house for more than 4 hours”). Participants were asked to respond to each item using a 5-point scale (1 – Never; 5 – Always). The adapted scale demonstrated adequate reliability, $\alpha = .80$. Here, the adapted environmental behavior scale was significantly related with environmental commitment ($r = .49$), the EAI Preservation subscale ($r = .56$), the EAI Utilization subscale ($r = -.39$), and inclusion of nature in the self ($r = .33$). Further, it was revealed to be significantly related to all three bases of commitment:

satisfaction with the environment ($r = .50$), investments in the environment ($r = .45$), and alternatives to the environment ($r = -.16$).

Inclusion of nature in self. The inclusion of nature in self scale (INS; Davis et al., 2009; Schultz, 2002) is an adapted version of the inclusion of other in self scale published by Aron, Aron, and Smollan (1992), which originally measured the degree of interconnectedness that individuals feel with their partners. This 1-item measure uses a series of progressively overlapping seven Venn Diagrams to assess how much participants include nature in the definition of their self. The responses will be coded on a Likert type response scale (1 – least overlap; 7 – most overlap). No estimates of reliability were provided because the INS is a single item measure. In our current study, the INS was significantly related to environmental commitment ($r = .65$), the EAI Preservation subscale ($r = .51$), and the EAI Utilization subscale ($r = -.39$).

Environmental attitudes. The Environmental Attitudes Inventory (EAI) is a psychological inventory designed to assess the evaluative attitudes that participants feel towards the environment as a result of the work of Milfont & Duckitt (2007; 2010). The scale is a multidimensional and hierarchical scale with two higher order factors, Preservation and Utilization, which are comprised of seven and five lower order factors respectively. The particular version of the EAI used here is a shortened 24-item version of their original 120-item questionnaire (EAI-24; Milfont, 2009). The EAI-24 will be scored on a 7-point scale (1 – Strongly Disagree; 7 – Strongly Agree) and still contains two subfactors, *Preservation* and *Utilization*. Reliability was shown to be adequate here for the Preservation ($\alpha = .87$) subscale. The Utilization ($\alpha = .58$) subscale on the EAI-24 demonstrated less than adequate reliability in the current study. An example of an item

that loads onto the Preservation factor is “Governments should control the rate at which raw materials are used to ensure that they last as long as possible.” An example of an item that loads onto the Utilization factor is “Human beings were created or evolve to dominate the rest of nature.” In these analyses, each of the EAI-24 subscales will be treated as separate scales.

Here, the EAI Preservation subscale was significantly related to environmental commitment ($r = .73$), the EAI Utilization subscale ($r = -.64$), and inclusion of nature in self ($r = .51$). The EAI Utilization subscale was also significantly related to environmental commitment ($r = -.48$) and inclusion of nature in self ($r = -.38$).

Personality. Personality was measured using 15 items from the shortened version of the HEXACO-PI-R (Lee & Ashton, 2009) from the 3 personality trait factors that have been consistently shown to be related to environmental attitudes and behavior:

Agreeableness, Openness to Experience, and Honesty-Humility (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012;). Five items were used assess each factor. The questions came from the self-report version of the HEXACO-PI-R where 10 items are used to assess each factor. The five items used to assess the personality were randomly selected ensuring that each of the four facets for each of the HEXACO factors used in the study were represented. This allowed the full breadth of each factor to be covered. An example of an item used to assess Openness to Experience is “People have often told me that I have a good imagination.” An example of an item used to assess Agreeableness is “Even when people make a lot of mistakes, I rarely say anything negative.” An example of an item used to assess Honesty-Humility is “Having a lot of money is not especially important to me.” The measure will use a 5-point Likert

scale (1 – Strongly Disagree; 5 – Strongly Agree). Each of the 5-item versions of the HEXACO-PI-R subscales showed less than adequate levels of reliability in the current study ($\alpha = .52$ to $.63$).

Analyses

Prior to multiple imputation and primary analyses, descriptive statistics and correlations were computed. Reliability coefficients and relevant correlations were also computed to account for internal consistency and validity. These analyses factored in participants who were removed because they did not complete the entire survey or were removed via listwise deletion (had too many missing values despite completing the survey).

Missing Data Analysis. Only participants ($N = 287$) who made it to the second component of the survey on SelectSurvey were initially included in the analyses. Participants who did not make it to the end of the online survey in the second component and had incomplete datasets were excluded from the analyses. Two hundred and fifty-six participants remained after the exclusion.

Two methods of handling missing data were employed to account for participants who did not fully complete each question (but did make it to the end of the survey) for all of the survey measures. First, listwise deletion (complete-case analysis) was employed for participants who omitted more than four questions from all of the items in the survey. With listwise deletion, all of the data was discarded for those individuals. I chose to employ this method for two reasons. First, there was a large discrepancy in the number of missing items across participants who omitted survey data with the distribution of number of items omitted jumping from 4 to 24. Second, the overall sample size for the

survey was not affected drastically by removing the data from these participants. Only eight participants were removed from the survey using listwise deletion. This only removed 3.32% of the data ($n = 8$) from the remaining 256 participants.

Whereas listwise deletion is arguably the most convenient method of missing data analysis to use, it is limited in its overall scope. To use listwise deletion for every participant who has omitted an item is ill advised (Wilkinson & Task Force on Statistical Inference, 1999). A significant amount of power is lost when a large number of participants are deleted from statistical analyses. It should only be employed when the number of participants being excluded from analyses is less than five percent of the total sample size (Graham, 2009). Otherwise, the loss of power and the increase in bias are too great. This described situation is the case here; only eight participants were excluded through listwise deletion.

Of the remaining 248 participants, 50 omitted four or fewer questions. Multiple imputation was used to account for the missing data left out by these subjects (Rubin, 1987). Imputation is a better method than listwise deletion for these 50 participants because it produces a full data set and retains its statistical power. Multiple imputation is a type of imputation that is used to estimate multiple missing values. It is widely seen as one of the best missing data techniques based on the views of data analysts and statisticians (Schafer & Graham, 2002). The appeal of multiple imputation continues in that it is easily accomplished in popular data analysis software packages.

With multiple imputation, a missing point in a data set is replaced by an individual list of two or more generated values. These produced values are based on the other data points within the measure. All of the possible values that are generated in the

imputation are then combined into a plausible estimate of what the missing value could be. Multiple imputation also provides variance estimates to reflect the overall uncertainty that is present in estimating the missing values. A more complete review of the multiple imputation process can be found in articles by Schafer and Graham (2002) and Sinharay, Stern, and Russell (2001).

Further, multiple imputation is also efficient. Historically, researchers have indicated less than 10 imputations are needed to obtain a good array of plausible values for each missing data point while still maintaining a high level of power (Schafer, 1999). Schafer (1999) concluded that five to ten imputations provides a good combination of practicality, while still maintaining a high rate of efficiency. More recent evidence has suggested that more imputations may be needed to obtain more accurate estimates of standard errors, ranges of confidence, and p-values (Graham, Olchowski, and Gilreath, 2007). Graham and colleagues (2007; Table 5) also provided recommendations on how many imputations may be needed depending the amount of information that is missing and the amount of power an individual is willing to lose. For example, if a data set has 10 to 50% percent data missing and a researcher is willing to sacrifice around 5% of their power, 10 imputations should be enough. However, if a researcher is only willing to let around 1% of their power falloff, upwards of 40 imputations is needed.

All of the missing values of the remaining 248 participants were replaced with estimated values generated in SPSS Version 19 (IBM Corp., 2010) using a multiple imputation process specific to each individual scale. Each multiple imputation used 5 imputations conducted over 100 iterations. The number of imputations and iterations was selected due to the small percentage of questions that had missing data (65 of 23,312;

0.28%) and recommendations by previous researchers (Graham et al., 2007). Due to the very number of missing items, the loss of power should be negligible. The Markov chain Monte Carlo method (Gilks, Richardson, & Spiegelhalter, 1996) was used to generate the plausible values to fill the missing data points. The Markov chain Monte Carlo method was used due to the random patterns with which missing data occurred. The pattern of missing data was assessed using the scan feature of the Multiple Imputation analysis tool in SPSS. The multiple imputation process generated a complete data set which was then used in the subsequent analyses.

Regression analyses. After conducting the missing data analyses, I used hierarchical multiple regression to assess the relation between the person-environmental relationship constructs (INS, environmental commitment, EAI), a measure of personality factors (HEXACO-PI-R), and ecological behavior (GEB). Past research has indicated that environmental commitment is a significant predictor above and beyond the other person-environment relationship measures used in the past (Davis et al. 2009; 2011). I sought to replicate this result. The hierarchical regression analysis was performed in three steps with all of the predictors regressed on the adapted version of the GEB. On the first step, the single predictor retained from Davis and colleagues' (2011) original study was entered. On the second step, the predictors of interest for this study, the three HEXACO traits (Agreeableness, Honesty-Humility, and Openness to Experience) and the two relevant EAI-24 subscales (Preservation and Utilization), were added. On the third step, environmental commitment was entered to see if it is predictive of the criterion of environmental behavior, above and beyond the previously entered predictors. I hypothesized that environmental commitment will be a significant predictor that accounts

for more variance, above and beyond that which is accounted for by the other variables in the model.

Path analysis. For my second set of primary analysis, I developed a path model utilizing a model development approach to attempt to reveal the association between the bases of environmental commitment, environmental commitment, and ecological behavior as measured by the GEB scores. The relations of these variables with several control variables were also gauged. These analyses were conducted using the student version of LISREL 9.1 statistical analysis software (Jöreskog & Sörbom, 2013). The initial proposed model can be seen in Figure 2 in the appendix.

Overall, the initial model should reveal a significant association between the bases of environmental commitment of satisfaction and investments and environmental commitment as seen in the Investment Model and Interdependence Theory literature. Alternatives to commitment have been historically shown to be significantly related to commitment (e.g, Le & Agnew, 2003; Rusbult, 1980). This finding, however, has not been replicated when the Investment Model has been adapted to measure environmental commitment (Davis et al., 2011) so I did not hypothesize a relation between the alternatives base and environmental commitment. The alternatives base was still included in my model because it is an integral part of the theoretical framework of Rusbult's model of commitment.

I expected there to be a significant positive relation between environmental commitment and ecological behavior in the initial model. Several control variables were included in with the initial model as predictors of ecological behavior to assess the relation between commitment and environmental behavior. These control variables

encompass the other two person-environment relationship variables (INS and EAI) and the relevant personality traits (Agreeableness, Openness to Experience, and Honesty-Humility) as assessed by the HEXACO-PI-R. I expected that commitment was the strongest predictor of environmental behavior above and beyond the five control variables being included in the path model.

Additionally, a model development approach was employed here, which involved adjusting the initial model by eliminating or adding paths to increase model fit. This approach is being used to due to constraints in obtaining a large sample size. One possible modification is to remove the bases of commitment from the model by constraining the paths from the bases to be zero. Another modification would be to assess how the bases influence environmental behavior directly by freeing parameters that are currently constrained from zero. Different criteria will be employed for path elimination and path addition. For path deletion, the ratio of a given parameter estimate to estimated standard error (*t*-value) needs to be less than 1.96 (Schumaker & Lomax, 2004). For path addition, the proposed path between the variables need to make theoretical sense and possess a large enough modification index (higher than 3.84) to indicate that adding the path in would increase model fit (Diamantopoulos & Siguaw, 2000). I hypothesized that the number of paths that I would have to add to build a complete model would be minimal due to the strong fit of Davis and colleague's (2011) original model.

Global model fit was assessed using multiple fit indices as suggested by Tanaka (1993). This allows potential bias from only using one fit index to assess global model fit to be reduced. Four measures of global model fit were used here: the Chi-Square Goodness of Test, the Comparative Fit Index (CFI), the Standardized Root Mean

Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA). Full conceptual explanations of each fit index are beyond the scope of this paper, but Hooper, Coughlan and Mullen (2008) provide a complete review.

The recommended thresholds for each of the fit indices vary. The Chi-Square test indicates acceptable global fit if the measure is insignificant (Barrett, 2007). The Chi-Square test is sensitive to sample size so it is limited in its application. The other fit indices are more telling than the Chi-Square test. Hu and Bentler (1998) provided recommended thresholds for the other three fit indices. They suggested that a CFI of .95, an RMSEA of .06, and an SRMR of .08 indicate excellent overall global fit if the model meets all of those thresholds.

CHAPTER III

RESULTS

Initial Analyses and Missing Data Analyses

Participants who did not complete each page of the online survey or had more than 4 blank answers (i.e., had 95.74% of the data intact) were omitted prior to data analysis ($N = 248$). Means and standard deviations are shown in Table 1 for each of the measures used in this study prior to using multiple imputation to account for missing data. Additionally, intercorrelations among measures are also displayed in Table 1.

Significant relations were observed between several of the measures. Of particular note, each of the three bases of commitment was significantly related to environmental commitment (see Table 1). Satisfaction and investments both displayed strong significant relations with environmental commitment (r 's were .69 and .66 respectively). Alternatives also displayed a moderate negative relation with commitment ($r = -.39$). The intercorrelations among the bases of commitment were significant, but not strong enough to suggest a large amount of overlap among them (r 's ranged from -.41 to .45 respectively). Environmental commitment and its bases also displayed significant relations with pro-environmental behavior (r 's ranged from -.21 to .55 respectively). The primary concepts of interest here, the HEXACO personality factors and EAI-24, also displayed significant relations with self-reports of environmental behavior (see Table 1).

Honest-Humility and Agreeableness each displayed a positive significant relation with environmental behavior, but the correlations were minimal (r 's were .18 and .16 respectively). Openness to Experience and the Preservation scale of the EAI-24 displayed larger positive, significant relations with self-reports of environmental behavior (r 's were .37 and .57 respectively). The Utilization scale of the EAI-24 displayed a moderate negative relation with GEB scores ($r = -.39$).

Following obtaining initial descriptive statistics and intercorrelations, a multiple imputation analysis was conducted using SPSS Version 19 (IBM Corp., 2010). Across 5 imputations with 100 iterations, five possible values were produced for each of the remaining missing values in the table. A pooled average was taken for each of these 5 imputations and inserted back into the original dataset for further analysis.

After the multiple imputation procedure, 248 complete cases were obtained. Descriptive statistics and intercorrelations for the complete imputed data set can be seen in Table 1. Additionally, independent samples t -tests were conducted to see if there were significant differences in the means for each of the measures between the original data and the imputed data. Results for these independent samples t -tests can be seen in Table 1.

Across all of the measures used in our current research, there were no significant differences between the means from the original data set and the means obtained after the pooled imputed item means were inserted into each of the remaining missing values (All obtained t -statistics were less than $\pm .33$, p 's $> .05$). These results indicate that adding

Table 1
Comparison Between Original and Imputed Dataset

	COM	ALT	SAT	INV	GEB	AGR	OPEN	H-H	EAI PRE	EAI UTI	INS
M	70.54	29.06	36.68	25.12	67.24	15.91	16.38	16.55	69.24	38.44	4.09
SD	16.60	7.32	7.67	8.83	8.34	3.09	3.72	3.15	12.56	7.21	1.37
N	248	248	248	248	248	248	248	248	248	248	248
COM	-	-.39***	.68***	.66***	.57***	.16*	.46***	.07	.73***	-.48***	.66***
ALT	-.38***	-	-.41***	-.27***	-.22***	-.02	-.23***	-.17**	-.31***	.33***	-.34***
SAT	.69***	-.39***	-	.45***	.52***	.14*	.35***	.09	.64***	-.38***	.51***
INV	.66***	-.26***	.47***	-	.48***	.09	.40***	.01	.57***	-.38***	.61***
GEB	.55***	-.21***	.51***	.47***	-	.17**	.39***	.19**	.58***	-.39***	.45***
AGR	.15*	-.03	.14*	.09	.16*	-	.15*	.26***	.16*	-.18**	.16*
OPEN	.46***	-.22***	.36***	.40***	.37***	.15*	-	.10	.46***	-.32***	.36***
H-H	.05	-.15*	.09	.00	.18**	.25***	.10	-	.01	-.16*	.12
EAI PRE	.73***	-.32***	.65***	.58***	.57***	.15*	.46***	-.02	-	-.63***	.52***
EAI UTI	-.48***	.32***	-.40***	-.36***	-.39***	-.16*	-.32***	-.15*	-.64***	-	-.38***
INS	.66***	-.34***	.51***	.61***	.42***	.16*	.35***	.11	.51***	-.38***	-
M	70.27	29.06	36.50	25.07	66.99	15.92	16.40	16.59	69.26	38.33	4.09
SD	16.68	7.32	7.45	8.85	8.46	3.10	3.73	3.15	12.67	7.25	1.37
N	248	248	248	248	248	243	247	244	238	241	247
T	.18	<.001	.27	.06	.33	-.04	-.04	-.16	-.02	.17	-.04

Note. * $p < .05$; ** $p < .01$; *** $p < .001$. Imputed data means, standard deviations, and intercorrelations are indicated along top diagonal. Original data means, standard deviations, and intercorrelations are indicated along bottom diagonal. T indicates the observed t -score from the independent samples t -test. All independent samples t -tests had df ranging from 484 to 494 and were nonsignificant, $p > .05$. All t -tests also met equal variances assumption according to Levene's Test of the Equality of Variances. Variable names are environmental commitment (COM), alternatives to the environment (ALT), satisfaction with the environment (SAT), investments in the environment (INV), general ecological behavior (GEB), HEXACO-PI-R agreeableness questions (AGR), HEXACO-PI-R Openness To Experience questions (OPEN), HEXACO-PI-R Honesty-Humility questions (H-H), EAI-24 Preservation Scale (EAI PRE), and EAI-24 Utilization Scale (EAI UTI); Inclusion of nature in the self (INS).

the imputed values into our dataset did not change the overall distributions of each measure to a significant degree. All of the following analyses were conducted with the imputed data set.

Hierarchical Regression Analysis

To test the hypothesis that environmental commitment was predictive of self-reports of environmental behavior (GEB scores) above and beyond several other similar measures of the person-environment relationship and measures of personality, I ran a hierarchical regression analysis to examine these predictors (see Table 2 for a summary for model results). On the first step, the single trait of INS scores accounted for a highly significant amount of variance in GEB scores, $R^2 = .20$, $F(1, 246) = 60.92$, $p < .001$.

When the HEXACO personality factors and EAI-24 subscales were added on the second step, the predictive power of the model towards GEB scores increased a highly significant amount ($\Delta R^2 = .20$, $F(5, 241) = 16.15$, $p < .001$) and accounted for a highly significant portion of the variance in the dependent variable, $R^2 = .40$, $F(6, 241) = 26.74$, $p < .001$. The INS retained its status as a highly significant predictor of GEB scores ($\beta = .16$). Additionally, Honesty-Humility and the EAI-24 Preservation scale were also highly significant predictors of GEB scores (β 's were .15 and .46 respectively). Openness to Experience was a marginally significant predictor of GEB scores ($\beta = .11$).

When environmental commitment was added on the third step of my hierarchical regression analysis, the predictive power of the model towards GEB scores increased at a highly significant rate ($\Delta R^2 = .02$, $F(1, 240) = 7.63$, $p = .006$) and accounted for a larger portion of the variance in GEB scores, $R^2 = .42$, $F(7, 240) = 24.64$, $p < .001$.

Environmental commitment was a significant predictor of GEB scores in this third model

($\beta = .23$). Honesty-Humility and the EAI-24 Preservation scale retained their status as significant predictors of GEB (β 's were .15 and .34 respectively). The INS and Openness to Experience lost their status as significant scores of GEB scores in the third model (β 's were .07 and .08 respectively).

Table 2
Hierarchical Regression Analysis Results Investigating General Ecological Behavior

	β	t	$p <$	R^2
Model 1				.19
Inclusion of nature in the self	.45	7.80	<.001	
Model 2				.40
Inclusion of nature in the self	.16	2.62	.009	
Openness to experience	.11	1.87	.06	
Agreeableness	.02	.34	.74	
Honesty- Humility	.15	2.91	.004	
EAI-24 Preservation	.46	6.16	<.001	
EAI-24 Utilization	.02	.28	.78	
Model 3				.42
Inclusion of nature in the self	.07	1.09	.28	
Openness to experience	.09	1.49	.14	
Agreeableness	.02	.33	.74	
Honesty- Humility	.15	2.91	.004	
EAI-24 Preservation	.34	4.01	<.001	
EAI-24 Utilization	.02	.25	.80	
Commitment to the environment	.23	2.76	.006	

Note: $N = 248$. Standardized betas are displayed.

Path Analyses

For the second set of primary analyses, a path analysis was conducted to examine if these data would replicate the model of environmental commitment laid out by Davis et al. (2011; see Figure 1) and if environmental commitment accounted for more variance in environmental behavior than the new set of control predictors (see Figure 2) using a model development approach. LISREL Version 9.1 (Jöreskog & Sörbom, 2013) was used to test these path analyses.

First, the hypothesis that the current data could replicate Davis and colleagues' (2011) model of environmental commitment, sans the willingness to sacrifice variable, was tested. A generalized-least squares method of model parameter estimation was employed. The variance-covariance matrix was used as input. The exogenous variables of the bases of environmental commitment (satisfaction, investments, and alternatives) were allowed to correlate with each other and to be free to vary. All other model paths were fixed.

The replicated version of Davis's model using the present data can be seen in Figure 3. Overall, the reproduced model fit the data less than adequately, $\chi^2(2) = 9.86$, $p = 0.07$; Confirmatory Fit Index (CFI) = .93, Standardized Root Mean Residual (SRMR) = 0.03, Root Mean Square Error of Approximation (RMSEA) = 0.13. As predicted, satisfaction with the environment and investments in the environment were both significant predictors of environmental commitment, whereas the alternatives measure was not a significant predictor of environmental commitment. Satisfaction was also a significant predictor of environmental behavior as measured by GEB scores.

Figure 3. Replication of the Original Davis et. al (2011) Model with Current Data. Path model predicting general ecological behavior: $\chi^2(2) = 9.86$, $p = 0.07$; CFI = .93, SRMR = 0.03, RMSEA = 0.13. Curved lines represent correlations. Solid lines represent significant path coefficients. Dashed lines represent non-significant path coefficients.

Environmental commitment was also a significant predictor of environmental behavior.

The bases of environmental commitment accounted for 63% of the variance in environmental commitment; environmental behavior had 38% of its variance accounted for by environmental commitment and its bases. The obtained data here provided a close replication of the results obtained by Davis and her colleagues (2011).

The initial version of the model I sought to develop can be seen in Figure 4. A generalized method of least-squares was used to determine parameters; all of the exogenous variables in the model were allowed to correlate with each other freely. All other paths were fixed. After using the variance-covariance matrix as input, the initial specified model did not provide a good fit to the data, $\chi^2(8) = 140.57$, $p < 0.01$; CFI = .24, SRMR = 0.06, RMSEA = 0.28. As shown in the previous model, satisfaction and

Figure 4. Initial Proposed Model of Environmental Commitment in Relation to Several Control Variables.

Path model predicting general ecological behavior, $\chi^2(8) = 140.57$, $p < 0.01$; CFI = .24, SRMR = 0.06, RMSEA = 0.28. Solid lines represent significant path coefficients. Dashed lines represent nonsignificant path coefficients. Correlations between exogenous variables are omitted from figure for parsimony; all exogenous variables were allowed to correlate in the model.

investment size were significant predictors of environmental commitment; the measure of alternatives was not a significant predictor. Environmental commitment retained its status as a significant predictor of environmental behavior as measured by GEB scores. Of the constructs of interest, only the EAI-24 Preservation scale and Honesty-Humility were significant predictors of environmental behavior. Overall, 73% of the variance in environmental commitment was accounted for by the bases in this version of the model. All of the predictors also accounted for 44% of the variance in environmental behavior as measured by GEB scores.

When using the model development approach, changes can be made to develop the model so it may better fit the data. For path addition, the relation between the two variables needs to make theoretical sense and the modification index (estimated using LaGrangian Multipliers) needs to be at least 3.84. The LISREL output suggested that adding a path allowing the EAI-24 Preservation scale to predict environmental commitment would increase model fit. Adding that path strengthened model fit significantly, $\Delta \chi^2(1) = 101.23, p < 0.01$.

This adjusted model provided a stronger global fit to the data than the original proposed model test, $\chi^2(7) = 39.34, p = 0.053$; CFI = .81, SRMR = 0.03, RMSEA = 0.14; however, global fit still remained less than adequate. The added path showed that the EAI-24 preservation scale is a significant predictor of environmental commitment. With the addition of the new path, satisfaction now became a significant predictor of GEB scores. The exogenous variables in the model now accounted for 72% of the variance in environmental commitment and 44% of the variance in environmental behavior as measured by the GEB.

The modification indices (estimated using LaGrangian Multipliers) then suggested that a path be added between the INS scale and environmental commitment to further develop the model. Adding that path significantly increased model fit, $\Delta \chi^2(1) = 29.52, p < 0.01$. The resulting model had excellent global fit, $\chi^2(6) = 9.82, p = 0.13$; CFI = .98, SRMR = 0.01, RMSEA = 0.05. INS was a significant predictor of environmental commitment as assessed by the new path added in the new model. Satisfaction with the environment and the EAI-24 Preservation Scale remained significant predictors of both environmental commitment and ecological behavior. Investments in the environment retained its status as a significant predictor of environmental commitment. Honesty-Humility remained a significant predictor of GEB scores. Overall, the predictors in the path model accounted for 72% of the variance in environmental commitment and 43% of the variance in environmental behavior as assessed by GEB scores. This model can be seen in Figure 5.

Figure 5. Final Model of Environmental Commitment in Relation to Several Other Variables*.

Path model predicting general ecological behavior, $\chi^2(6) = 9.82$, $p = 0.13$; CFI = .98, SRMR = 0.01, RMSEA = 0.05. Solid lines represent significant path coefficients. Dashed lines represent nonsignificant path coefficients. Correlations between exogenous variables are omitted from figure for parsimony; all exogenous variables were allowed to correlate in the model.

CHAPTER IV

DISCUSSION

Discussion of Obtained Results

Previous research has shown that environmental commitment can be used to predict self-reports of pro-environmental behavior above and beyond similar measures assessing the person-environment relationship (NEP and the INS) and social desirability (Davis, Green, & Reed, 2009; Study 2). A follow-up study also revealed that the antecedents of commitment (satisfaction, investments, and alternatives) could be applied to predict environmental commitment (Davis, Le, & Coy, 2011). Davis and colleagues' 2011 study also showed that environmental commitment had predictive validity of self-reports of environmental behavior, as measured through an adapted version of the GEB (Kaiser et al., 2003) above and beyond additional measures assessing the person-environment relationship. In the current study, I sought to develop further a model of environmental commitment by testing its relations with additional measures: a new measure of environmental attitudes that has shown promise to better capture the nature of the construct (Environmental Attitudes Inventory (EAI); Milfont & Duckitt, 2010) and broad personality factors that have been shown to be previously related to environmental behavior and attitudes (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012.)

The current study provided mixed results when being compared with previous results across the current two sets of primary analyses. When looking at the initial intercorrelations for all of the measures used in the study, the main constructs of interest appeared to be largely in line with what previous research has suggested. Openness to Experience, which is the one factor in the HEXACO Model of personality that has been shown to be consistently related to environmental attitudes and behavior (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012.) displayed a significant positive relation of a moderate degree with GEB scores. As seen in previous research, Agreeableness (Hirsh, 2010; Hirsh & Dolderman, 2007) and Honesty-Humility (Hilbig et al., 2012) also displayed positive significant relations with GEB scores. The degree of association, however, was smaller, which may also suggest why these findings have not been consistently replicated across all research relating broad personality factors and environmental attitudes/behaviors. The two scales of the EAI-24 measuring environmental attitudes also displayed significant relations with GEB scores, as seen with the NEP in Davis and colleagues' past studies (2009; 2011). The Preservation subscale displayed a strong positive relation with GEB scores; the Utilization subscale displayed a moderate negative association with GEB scores. These results appear to suggest that the EAI may be better at assessing the multidimensional nature of environmental attitudes than the NEP (Dunlap et al., 2000). These positive results increase the EAI's utility in the current study.

The hierarchical regression analyses revealed that environmental commitment possessed incremental validity in assessing pro-environmental behavior above and beyond similar measures of the person-environment relation and the three relevant

personality factors. This finding was consistent with the hypotheses and with previous research (Davis et al., 2009; 2011). Adding environmental commitment to the model accounted for an additional 2% of variance with the existing measures. This result increases the environmental commitment scale's overall utility. If a researcher is looking for a short measure to assess the person-environment relation, then the 11-item environmental commitment scale could be an attractive option.

A second finding in the hierarchical regression analyses was that only Honesty-Humility, the EAI-24 Preservation Scale, and environmental commitment remained significant predictors of pro-environmental behavior once all of the other predictors in the model were controlled. The finding that the EAI-24 Preservation Scale and the environmental commitment were significantly predictive of pro-environmental behavior has been seen in previous research. These results replicate findings obtained by Davis et al. (2009; 2011); the EAI-24 Preservation scale used in the present study can largely be considered analogous to the revised version of the NEP (Dunlap et al., 2000) used by Davis and colleagues (2009; 2011) in their environment commitment research.

The finding that only Honesty-Humility is a significant predictor of pro-environmental behavior from the three factors of the HEXACO-PI-R is a peculiar one, especially because Honesty-Humility has only been found to be consistently related to environmental behavior and attitudes in one previous study (Hilbig et al., 2012). On a theoretical level, Honesty-Humility displaying a positive relation with pro-environmental behavior makes sense. Ashton and Lee (2007) showed that the Honesty-Humility factor of their HEXACO model of personality corresponds to an individual's feelings to be reasonable and honest in cooperation with other people and to engage actively in pro-

social behavior. Pro-environmental behavior is widely considered pro-social. Although this finding was not hypothesized, it is supported by previous research (Hilbig et al., 2012).

A surprising finding with the hierarchical regression analyses in Model 3 is that Openness to Experience was not a significant predictor of environmental behavior when controlling for other variables, as was originally hypothesized. This finding does not replicate multiple previous studies that have shown significant positive relations between Openness to Experience and pro-environmental behavior/attitudes (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012.) One possible explanation for this finding is that the relation between Openness to Experience and pro-environmental behavior is confounded by the inclusion of variables that share common variance. In particular, the inclusion of environmental commitment in Model 3 changed Openness to Experience from marginally significant in Model 2 to nonsignificant in Model 3. Openness to Experience and environmental commitment possess a moderate positive relation between the two variables ($r = .46$). Additionally, the EAI-24 Preservation Scale and Openness to Experience also possess a moderate positive correlation. It is possible that including these two variables in the predictive model of environmental behavior obfuscates the association between Openness to Experience and pro-environmental behavior as indicated by the initial correlation. Further research is needed to analyze the relation between Openness to Experience and person-environment relationship measures.

After employing a model development approach, the final obtained model possessed excellent global fit. However, these findings do not validate the current model

of environmental commitment as superior. Despite having the exact same final sample size ($N = 248$), Davis and colleagues' sample was different demographically, using a population of students at a mid-sized, urban public university in the Eastern United States rather than a population of students at a mid-sized, public university located in the Midwest United States. Finally, Davis and colleagues (2011) also included another variable in their final model measuring a willingness to sacrifice for the environment, which measures the degree to which individuals were prepared to sacrifice their own desires for the overall benefit of nature. The component of willingness to sacrifice is based on research of relationship commitment that shows that partners are willing to sacrifice their own interests for the overall betterment of the relationship. Davis et al. (2011) found that satisfaction, investments, and environmental commitment all displayed a significant positive predictive relation with willingness to sacrifice. GEB scores possessed a moderate positive relation with willingness to sacrifice. Future research that examines the relation of environmental commitment and pro-environmental behavior should also include willingness to sacrifice within their predictive model due to the fact that the constructs of willingness to sacrifice and environmental behavior go hand-in-hand with each other. Additionally, the scale assessing willing to sacrifice for the environment (Davis et al., 2011) is also five questions so it can easily be added into a typical person-environment relationship survey. Willing to sacrifice was not included in the current research due to limitations on the number of variables in the proposed model. Keeping the number of variables to a minimum allowed for my proposed model to maintain an acceptable level of power.

The path analyses in the current study provided mixed results when comparing them to the original hypotheses. In replicating Davis and colleagues' (2011) model of environmental commitment using the current data, I was able to produce a model with adequate global fit. The antecedents of environmental commitment displayed the relations with environmental commitment that were hypothesized based on Davis et al. (2011). Satisfaction and investments displayed a significant positive association with environmental commitment; the relation between alternatives and environmental commitment was nonsignificant. Additionally, all of the other paths within Davis's (2011) model were replicated within my model. This finding suggests that the established model of environmental commitment is applicable across U.S. college student populations.

My proposed revisions to Davis's (2011) model added the control variables into the path analysis. Adding these variables into the model produced a model with inadequate fit. This display of inadequate fit is likely due to the number of nonsignificant relations that were in my original proposed model.

A number of the control variables did not display significant relations with ecological behavior (EAI-24 Utilization Scale, Openness to Experience, Agreeableness, and the INS). Similar to the regression analyses, it is likely that Openness to Experience and the INS do not possess enough unique variance to account for pro-environmental behavior when controlling for other variables. Additionally, the standardized coefficients of Openness to Experience and the INS were at normally significant levels (β 's were equal to .21 and .42 respectively). The standardized path coefficients between these variables displayed large standard errors which made the t -values below the threshold establishing significance ($t = 1.96$). The EAI-24 Utilization Scale and Agreeableness both

displayed minimal relations with the GEB as indicated by intercorrelations and the hierarchical regression analyses.

A model development approach was employed to obtain a final model that achieved excellent global fit. After looking at the modification indices, two new paths were added in two separate steps. First, a path was added from the EAI-24 Preservation Scale to environmental commitment. One of the requirements for adding a path between two constructs in a path analysis is that the path needs to make theoretical sense, which adding the path between the EAI-24 Preservation Scale and environmental commitment does. If an individual possesses ingrained preservation related environmental attitudes, then they could hypothetically view themselves as more committed to the environment. With this, individuals are more likely to engage in a long-term psychological attachment with the environment.

Second, a path was added from the INS predicting environmental commitment. Adding this path caused the model to display excellent global fit. Historically within investment model literature, relationship commitment has been shown to predict the amount an individual includes their partner in their definition of self (e.g., Agnew, Rusbult, Van Lange, & Langston, 1998) and not the other way around (as indicated here by the modification indices). However within literature examining the person-environment relationship, the INS, commitment to the environment, and other similar measures have displayed a high rate of convergent validity and can be used interchangeably to an extent (Brugger, Kaiser, and Roczen, 2011; Tam, 2013), despite the subtle differences between all of them and the original concepts they were derived from. The IOS scale and its relation with relationship commitment do not have these particular

issues. The oft-interchangeable nature of person-environment relationship measures does provide justification for this path to be included in my final model of environmental commitment.

Implications of Current Research

Overall, the results were mixed when compared to the original hypotheses. However, there are a broad range of topics covered within the current research that need to be taken under consideration. These implications were typically positive in nature.

First, the current research further establishes that the Interdependence Theory/Investment Model framework can be effectively applied to a person's relationship with their natural environment and builds upon the foundations laid in previous research (Davis et al., 2009; 2011). The relations between the antecedents of commitment and environmental commitment established in Davis and colleagues' (2011) previous research were replicated in the current research; satisfaction and investments displayed positive relations with environmental commitment, whereas investments displayed no relation with environmental commitment. Additionally, this study also replicated Davis, Le, and Coy's (2011) finding that environmental commitment could also be effectively used to predict a person's pro-environmental behaviors. Previous research has shown that environmental commitment can be used to predict specific environmental behavioral intentions as well, such as willingness to participate in a river-clean up (Davis, Green, & Reed, 2009) or support for hypothetical green initiatives on a college-campus (Coy, Farrell, Gilson, Davis, & Le, 2013).

This study helps further establish Davis and colleagues' (2009) measure of environment commitment as an efficient measure of the person-environment relationship

in college student populations in comparison to other similar measures. The environmental commitment measure is an 11-item measure with a strong coefficient alpha ($\alpha = .93$). Other similar measures used in my study were longer and possessed poor reliability (EAI-24; Milfont, 2009) or were single-item measures that may not fully capture the complex nature of the person-environment relationship (INS; Schultz, 2002). Additionally, the measure of environmental commitment is also shorter compared to other measures used in Davis and colleagues' (2009; 2011) previous work to assess the incremental validity of their measure using hierarchical regression analyses. In their 2009 and 2011 studies, Davis and colleagues' measure of environmental commitment displayed similar reliability and validity. While other measures might be more appropriate to consider depending on the needs of the researcher or the theory being used to assess an individual's relationship with the environment, Davis and colleagues' (2009) environmental commitment measure provides an efficient, reliable scale if the goal of someone's research is designed to assess humans' interconnection with the environment.

The current study is also appears to be the first study investigating person-environment relationship measures and personality factors together as predictors of pro-environmental behavior. There was a large degree of overlap in the amount of variance accounted for in pro-environmental behavior by the person-environment relationship measures and personality factors. Openness to Experience, in particular, was the HEXACO personality factor that appeared to display the biggest overlap with the person-environment relationship measures. Openness to Experience displayed moderate positive correlations with the INS, EAI-24 Preservation Subscale, and the Environmental Commitment Scale (see Table 1). This association is likely why Openness to Experience

did not emerge as a significant predictor of environmental behavior in the hierarchical regression analysis and the path analysis. Conversely, Honesty-Humility did display a significant relation with environmental behavior in both the hierarchical regression analysis and the path analysis. Honesty-Humility did not display a strong correlation with any of the person-environment relationship measures. It appears that the trait of Honesty-Humility does account for a unique portion of variance in pro-environmental behavior.

Additionally, this is also the first study relating investment model concepts with broad personality factors such as the “Big Five” model of personality (Goldberg, 1993) or, in the case of the current study, the six-factor HEXACO model of personality (Ashton & Lee, 2007). The current research is also the first known study relating personality traits and commitment in a non-relationship context. Previous research has only related investment model constructs with narcissism (Foster, 2008), not a broad personality dimension. Whereas Foster found that narcissism moderated the relationship between the bases of relationship commitment and commitment itself, only correlational analyses directly related the six HEXACO-PI-R factors and environmental commitment. As mentioned previously, there was a significant amount of overlap between Openness to Experience and environmental commitment.

Limitations and Future Directions

The current study had several limitations. First, a Midwestern U.S. college student sample was used here. This specific nature of the sample decreases the external validity of the obtained results and prevents the findings from being widely generalized to other populations. Low external validity is a problem across the board in any of the current studies using Davis’s measure of environmental commitment (2009) in their

studies. The extant research examining environmental commitment and its relations with other constructs has primarily used college student populations (Coy, Farrell, Gilson, Davis, & Le, 2013; Davis et al., 2009; 2011). Future research should expand this to other groups outside of a college student population including children, adolescents, adults, and samples from other countries. This research would help establish Davis's measure of environmental commitment (2009) as one with strong external validity that could be applied to a wide array of populations.

Another limitation related to the current sample was the timing of the data collection. The data collection primarily occurred during the last week of the semester when students are typically busy with coursework. This may have prevented the full breadth of the sample to be reached. Future research should allow for data collection to occur during another part of the academic year.

Second, environmental commitment was not tested against a complete set of person-environment relationship measures. Due to the potential limitations of obtaining an ideal sample size, only the INS (Schultz, 2002) was used from the person-environment relationship measures that were used in Davis's (2011) original study laying out environmental commitment. Future research investigating the model of environmental commitment should strive to obtain a larger sample size to be able to test Davis's measure of environment commitment (2009) against a complete battery of person-environment relationship measures. These include the Connectedness to Nature Scale (Mayer & Frantz, 2004), the Environmental Identity Scale (Clayton, 2003), the New Ecological Paradigm (Dunlap et al., 2000), and the Environmental Attitudes Inventory

(Milfont & Duckitt, 2010). Additionally, a larger sample size should increase the power of the path analysis in future studies.

Third, the process of multiple imputation was used in the current study to account for missing data as opposed to obtaining a larger sample size. This missing data analysis technique enabled the retention of several cases that would have been eliminated otherwise if complete cases analysis have been used. Obtaining a larger sample size than obtained here ($N = 248$) in future research, however, will allow for a model development approach for a model of environmental commitment to be employed without worry. A larger sample size would allow researchers to maintain the high level of power needed to complete path analyses effectively.

Fourth, the obtained reliability of several of the measures used in the current studies was below an adequate level. In particular, the Utilization subscale of the EAI-24 (Milfont & Duckitt, 2007) and the three personality factors used in the study from the HEXACO-60 (Ashton & Lee, 2009) all displayed reliabilities less than or equal to an alpha level of .63. Milfont's (2007) Utilization subscale of the EAI-24 displayed adequate reliability ($\alpha = .78$) in the original research validating the measure (Milfont, 2009; Study 2). Only one other published study has cited the EAI-24 (Jung, Suk, & Sato, 2009); reliability coefficients for the EAI-24 were not provided in that study. Generally, more research is needed to establish whether the EAI-24 is an effective shortened version of the full 120 item version of the Environmental Attitudes Inventory (Milfont & Duckitt, 2010). Additionally, all of the previous studies using the EAI-24 used either samples in South Korea and Japan (Jung, Suk, & Sato, 2009) or samples from New Zealand (Milfont, 2007). Milfont & Duckitt (2010) established the validity and reliability of the

full version of the EAI using samples from several countries; however, it is possible that the EAI-24, in particular, the Preservation scale, does not transfer across cultures well in assessing environmental attitudes. In their discussion of obtain results, Jung, Suk, and Sato (2009; pg. 6) did question whether the EAI-24 was appropriate to assess environmental attitudes in their East Asian sample. Further research is needed to determine if the EAI-24 can be used practically in cultures outside of New Zealand. When investigating its relation with commitment to the environment, I recommend that future researchers used either the 72 item-version of the Environmental Attitudes Inventory known as the EAI-S or the full version of the EAI (Milfont & Duckitt, 2010) in order to obtain a better picture of the multidimensional nature of environmental attitudes.

The shortened 5-item versions of the Honesty-Humility, Openness to Experience, and Agreeableness scales of the HEXACO-PI-R were created randomly ensuring that at least one question from each of the four facets of each factor was included. Cronbach's alpha assumes that measures are one-dimensional. Since the each of the factors of the HEXACO-PI-R are comprised of multiple facets, Cronbach's alpha is an inappropriate measure of reliability. This is likely what attenuated the reliability.

Future studies should employ the 10-item versions of each of these scales as detailed in the HEXACO-60 (Ashton & Lee, 2009). This should enable future researchers to obtain a more complete picture of each of these factors and properly investigate their relations with environmental commitment and other person-environment relationship measures. One possible direction research could go in would be to further investigate the relation between Openness to Experience and person-environmental relationship

measures. This is particularly relevant because of the high degree of convergence seen between the constructs in my research.

Fifth, recent research has shown that there is a high degree of convergent validity between person-environment relationship measures. This issue remained a problem in the current study. Brugger, Kaiser, and Roczen (2011) showed that explicit measures of the person-environment relationship, specifically the INS; the Environmental Identity Scale (Clayton, 2003); and the Connectedness to Nature Scale (Mayer & Frantz, 2004), show a substantial convergence with one another regardless of what conceptual explanation is taken to account for the person-environment relationship. This finding appears to be extended here to the strong correlations between the person-environment relationship measures in the study. Additionally, Tam (2013) provided evidence that several measures of the person-environment relationship show similar associations with various criteria and did not account for a great deal of unique variance when other factors were controlled for in several hierarchical regression analyses. Tam (2013) also showed that the results obtained from these person-environment relationship measures did only have a single-underlying factor. Despite the subtle differences between each person-environment relationship measure and the current studies, further research is needed to assess the differences between each of these person-environment relationship measures, including Davis and colleagues' (2009) commitment to the environment scale.

There are still measures that assess the person-environment relationship that need to be taken into account in future research to assess if Davis and colleagues' (2009) commitment to the environmental scale displays incremental validity above them. Tam's (2013) research on the association between measures of the person-environment

relationship highlighted three scales that have not been related with environmental commitment, but still have received a fair amount of use in assessing people's connect with nature. First, Kals, Schumacher, and Montada (1999) established the concept of emotional affinity towards nature which assesses an individual's emotional feelings towards the environment. This affinity for nature is treated as a love for nature and oneness for nature. This scale is different from Mayer and Frantz's (2004) connectedness with nature measure which has been shown to assess cognitive beliefs related towards emotions (Perrin & Benassi, 2009). Second, the concept of nature relatedness (Nisbet, Zelenski, & Murphy, 2009) is a multidimensional construct that says the person-environment connection is comprised of three unique aspects: an affective component, a cognitive component, and an experiential component. The nature relatedness scale can either have a one-factor structure or a three-factor structure depending on how it is utilized. Third, connectivity to nature (Ducher, Finley, Luloff, & Johnson, 2007) is seen as a person's perception of the sameness between themselves and the natural environment around them, similar to Schultz's (2001) INS scale (The INS is included as one of the questions in the measure). Connectivity to nature, however, has not been shown to tap into either cognitive or effective beliefs explicitly, so its use may be more limited compared to the other two aforementioned person-environment relationship measures. All three of these concepts of an individual's connection to nature provide interesting future building blocks to test commitment to the environment against.

Additionally, there are other areas future research can be implemented that are not necessarily based on limitations of this study. Davis and colleagues' (2011) measure of environmental commitment has already been used in relation with determining specific

behavioral intentions and support for hypothetical campus measures (Coy et al., 2013; Davis et al., 2009). One direction this program of research could expand into is to predict specific behaviors that are assessed by the GEB such as recycling behaviors or resource conservation. This line of research could be assessed through a diary study of differing pro-environmental behaviors, measures that assess specific pro-environmental behaviors such as recycling, water conservation, or public transportation use, or other general environmental behavior scales such as Markowitz and colleagues' (2012) Student Environmental Behavior Scales. It is also a possibility that researchers might even be able to assess environmental behavior through naturalistic observation as seen in work by Gamba and Oskamp (1994). Gamba and Oskamp (1994) used naturalistic observation to investigate factors that influenced comingled curbside recycling in differing households. These same measures can be used to assess how environmental commitment can effect or is related to different specific environmental behaviors. Finally, future research should attempt to replicate the final obtain model developed here to see if it is valid when it is applied to other samples.

Conclusion

The current study adds to the body of literature in psychology seeking to understand how people are connected with the environment and what relevant personality factors influence environmental attitudes and behavior. The person-environment relationship is a field of research within environmental psychology that will only continue to grow in the distant future as global warming and other environmental issues become bigger problems for human civilization. Using psychology to understand how pro-environmental behavior is influenced by humans' perceived interconnection with

nature, humans' ingrained attitudes towards the environment, and humans' global personality factors is one part of this proliferation. The current research was conducted within that overall mindset.

Building upon the framework of the model of environmental commitment established by Davis et al. (2011), I developed an adequate fitting model that established the same relations between the antecedents of environmental commitment and environmental commitment itself that was seen by Davis et al. (2011). Additionally, I used hierarchical regression analysis and path analysis to establish that environmental commitment has predictive power towards pro-environmental behavior above and beyond similar person-environment measures and relevant HEXACO personality factors that have been shown to be related to environmental behavior and attitudes (Hilbig et al., 2012; Hirsh, 2010; Hirsh & Dolderman, 2007; Markowitz et al., 2012). I also investigated the relations between relevant personality factors and person-environment relationship measures and found that Openness to Experience, which has most consistently shown to be related with environmental behavior and attitudes, is not the best predictor of environmental behavior due to the overlap in predictive variance with person-environment relationship factors. Across both sets of analyses, Honesty-Humility, the EAI-24 Preservation Scale, and Environmental Commitment emerged as the best predictors of GEB scores. Overall, my research furthers the work by Davis and colleagues (2009; 2011) establishing environmental commitment as relevant construct in investigating humans' interconnection with the natural world.

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