Going Back for that One Last Thing in the House on Fire: How Fear, Attentiveness, Sadness, Joviality, and Other Lower Order Dimensions of Affect Influence Our Security and Privacy Behavior

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***Abstract*—A digital transformation of society has taken place over the past couple of decades. From digital cameras to social networks, we rely extensively on the digitization of our lives. Almost all photographs taken today are done in a digital format with approximately 85% of those being done on smart phones. Additionally, our lives have become digitized in ways once unimaginable through such platforms as social networking. Through the digitization of our lives, including photographs, social networking, online banking, medical records, etc., we have concurrently developed new vulnerabilities to that information being compromised. How do we protect ourselves from the threats that will seek to exploit these new vulnerabilities? Additionally, do the lower order dimensions of trait affect, such as fear, attentiveness, sadness, joviality, hostility, etc., impact the measures people take to protect themselves? These questions are explored in the context of how and why people protect themselves from having their personal information compromised. Protection Motivation Theory (PMT) is used as the theoretical framework to explore these questions. This is done by assessing the role of these lower order dimensions on three of the PMT constructs: self-efficacy, perceived threat severity, and perceived threat vulnerability. Results suggest that some of these lower order dimensions of trait affect do influence one or more of these constructs.**

***Index Terms*—security, privacy, protection motivation theory, trait affect, lower order dimensions, personal information compromise, sadness, fear, hostility, guilt, surprise, shyness, joviality, fatigue, serenity, self-assurance, and attentiveness**

I. Introduction

A digital transformation of society has taken place over the past couple of decades [42], [51]. From digital cameras to social networks, we rely extensively on the digitization of our lives. Prior to this digital transformation, a simple thought experiment was common: If your house was on fire and all people and pets were out safely, what would be one last thing you would want to save from the burning house if you had the opportunity? Inevitably, people almost always chose their photo albums. As reminders of some of the most important and precious moments in ones life, it was considered of such high sentimental value that everything else could be left behind.

However, this has since changed as almost all photographs taken today are done in a digital format with approximately 85% of those being done on smart phones [44]. Additionally, our lives have become digitized in ways once unimaginable through such platforms as social networking [1].

Through the digitization of our lives, including photographs, social networking, online banking, medical records, etc., we have concurrently developed new vulnerabilities to that information being compromised. How do we protect ourselves from the threats that will seek to exploit these new vulnerabilities? Additionally, do the lower order dimensions of trait affect, such as fear, attentiveness, sadness, joviality, hostility, etc., impact the measures people take to protect themselves? These questions are explored in the context of how and why people protect themselves from having their personal information compromised.

A significant body of research exists examining the role of several factors in how people make security and privacy determinations, such as using a backup solution [10], [17], making passwords stronger [22], or anti-malware software [4]. This includes perceived threat severity, perceived threat vulnerability, self-efficacy, response efficacy, response costs, locus of control, and social influences. Another factor continues to gain traction in helping understand these complicated decisions–affect [14], [16].

Prior research has provided us with some insight in how affect might influence the decision-making of individuals. This influence has occurred primarily through the effect affect has on the risk perceptions [32] and self-efficacy [25] of individuals. Furthermore, both of these factors have been shown to help explain the information security and privacy behavior of individuals. This suggests that these factors, in conjunction with affect, may provide even greater insight into why people do the things they do or dont do the things they should do as it relates to security and privacy.

The primary contribution of this research is to help understand the role of the lower order dimensions of trait affect in

how people make decisions related to their security and privacy behavior. This work extends earlier work that examined the higher order dimensions of affect (i.e., positive and negative) [16]. The examination undertaken here will also be done in the context of Protection Motivation Theory, which has been used extensively as a framework for understanding how individuals view a threat and the actions they take in response to it.

II. Background

A. Protection Motivation Theory

The theoretical framework used to understand the role of the lower order dimensions of trait affect is Protection Motivation Theory (PMT). PMT was developed in 1975 by Rogers to help us better understand how attitude changes occur in the wake of a fear appeal [47]. A fear appeal is a type of communication that relays the nature of a threat to ones well-being [48]. This consists of two independent appraisal processes: threat appraisal and coping appraisal. Each of these processes consists of three different components [48]. The threat appraisal process consists of: 1) the level of severity to the perceived threat; 2) the level of vulnerability to the perceived threat, and 3) both intrinsic and extrinsic rewards.

By appraising a threat in this manner, the individual is believed to inhibit a maladaptive response. How this is done though, depends on the coping appraisal process [48]. The three components that make up coping appraisal are: 1) the perceived effectiveness of a counter-response (perceived response efficacy) [48]; 2) perceived response costs, considering the cost (time, effort, financial, etc.) of the adaptive response, and 3) the belief of an individual that he/she can effectively perform the counter-response (self-efficacy) [48]. Self-efficacy has often been the most powerful predictor of whether someone performs a certain behavior or not with varying results depending on the behavior under examination [3]. It also important that self-efficacy is assessed in a context-specific manner [37].

B. Affect

Affect consists of three primary types: trait affect, mood, and emotion. However, the use of these terms has not been consistent and have often been used interchangeably [23]. This lack of consistency in the use of these terms has been problematic since it makes it difficult to compare one study to another or validate results from prior research. The general consensus is that trait affect represents a long-term and generally stable type of affect through the course of time. This makes trait affect similar to personality in some respects [15].

In contrast to trait affect, state affect does change over time and includes both emotion and mood [56]. Affective states include: sadness, fear, hostility, guilt, surprise, shyness, joviality, fatigue, serenity, self-assurance, and attentiveness [53]. Emotion is a short-lived type of state affect that can be quite intense in degree [30]. Mood lasts longer and is generally milder in degree than emotion [30]. Both types of state affect may be either integral or incidental. Integral affect is an affective response to a specific stimulus, whereas incidental affect is not in response to a specific stimuli or situation. Trait affect is always incidental.

Additionally, the concept of higher order (i.e., positive and negative) and lower order (e.g., joviality, hostility) dimensions of affect has been shown in both clinical and non-clinical settings [5], [28]. Some psychological disorders, such as anxiety disorders, may be appropriately classified within both a higher order dimension of affect (i.e., negative), as well as under a specific personality type (i.e., neuroticism) [52]. This suggests that these psychological factors are all interrelated, but nonetheless each provide some specific insight into understanding an individual [38].

Understanding affect and its many different forms is important since it has been shown to influence how people perceive the world around them [32], especially as it relates to risk and their ability to cope with that risk [31]. Affect also plays a prominent role in decision making when processing resources are at a premium, while cognition is able to exert a greater role if the availability of processing resources is higher [49]. Thus, examining the role affect plays in decision-making in general, and information security and privacy in particular, has great value.

As noted earlier, affect has been conceptualized and measured in varying ways, including within information systems [62]. For example, affect has been conceptualized as computer anxiety [7], microcomputer playfulness [58], and perceived enjoyment [12], etc. Likewise, affect has been incorporated into different theoretical perspectives, such as the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Theory of Reasoned Action (TRA) [11]. Sometimes this conceptualization of affect is simply an attitude toward something [9]. This can be seen in a study within the information security domain as well [61].

For the current study, we are interested in the lower order dimensions of trait affect that are composed of the descriptors noted earlier: sadness, fear, hostility, guilt, surprise, shyness, joviality, fatigue, serenity, self-assurance, and attentiveness [53]. By employing trait affect, we are able to see how characteristics inherent in a person influence their decision-making when confronted with a fear appeala risk. Additionally, both higher and lower order dimensions of trait affect are context freethey do not change in response to a momentary stimulus [53].

Generally speaking, affect has been conceptualized using valence-based approaches as either positive or negative affect on a bipolar continuum [32], or positive affect and negative affect as two distinct dimensions [55]. The latter approach has increased in use in recent years compared to the former approach given its higher degree of both discriminant and convergent validity [54]. The lower order dimensions of affect provide researchers with an opportunity to examine the role of affect on a more granular level than either positive or negative affect can by themselves.

C. Research Model

The research model presented in this section details five constructs that act as direct determinants of the information security and privacy behavior of individuals. Perceived threat vulnerability and perceived threat severity comprise an individuals risk perception. With respect to coping appraisal, the model consists of three constructs that assess how someone copes with the threat of having ones personal information compromisedperceived response costs, perceived response efficacy, and self-efficacy.

As noted earlier, the underlying theoretical framework used in this study is PMT. While PMT is generally concerned with behavioral intentions [47], we took a different approach for three primary reasons. First, an experimental manipulation is not involved in this study; instead, a survey was conducted to assess perceptions at one point in time, not in response to an experimental manipulation. Second, the relationship between behavior and behavioral intention has at times been overstated [57]. Finally, another factor that has also weakened the connection between behavior and behavioral intention is the level of habituation for the behavior under examination [60]. Since the activities measured in the current study may be largely habitual for those that perform them, the implied relationship between behavior and behavioral intention would be expected to be weaker.

1) Protection Motivation Theory and Behavior: In PMT, a fear appeal triggers threat appraisal. This fear appeal arises from intrapersonal or environmental information. There are two components of threat appraisal that we are concerned with in the current study: perceived threat severity and perceived threat vulnerability [48]. The threat appraisal process inhibits maladaptive responses. Thus, individuals with higher levels of perceived threat severity and perceived threat vulnerability are more likely to engage in actions necessary to protect themselves from a threat [40].

H1: Higher levels of perceived threat severity related to a threat are associated with higher levels of performing the responses necessary to mitigate this threat.

H2: Higher levels of perceived threat vulnerability related to a threat are associated with higher levels of performing the responses necessary to mitigate this threat.

Additionally, the process of coping in response to a threat is associated with higher levels of engaging in the responses necessary to mitigate the threat. Coping appraisal consists of self-efficacy, perceived response efficacy, and perceived response costs. When individuals perceive higher costs associated with performing responses that help mitigate a threat, they are less likely to do so. Likewise, when individuals believe they are capable of performing the response (i.e., self-efficacy) and that it will be effective, they are more likely to engage in the response [48].

H3: Higher levels of perceived response efficacy related to a threat are associated with higher levels of performing the responses necessary to mitigate this threat.

H4: Higher levels of perceived costs related to a threat are associated with lower levels of performing the responses necessary to mitigate this threat.

H5: Higher levels of self-efficacy related to a threat are associated with higher levels of performing the responses necessary to mitigate this threat.

2) Affect and Behavior: Affect influences risk decisions through two primary mechanisms: how people perceive a threat and their level of self-efficacy as it relates to taking the actions necessary to mitigate the threat. With respect to its influence on how people perceive risk, the literature shows the role our risk perceptions, operationalized as perceived threat severity and perceived threat vulnerability, have had on decision-making both in general [24] and as it relates to information security [10].

This influence may occur through one of two mechanisms: optimistic bias and mood maintenance. Optimistic bias results in those with higher levels of positive affect (and/or lower levels of negative affect) viewing a risk in a more optimistic light and thus not fully appreciating the actual severity of a threat and/or their vulnerability to it [35].

In contrast, the mood maintenance mechanism results in individuals wanting to maintain their current mood. Thus, for happier individuals want to continue to be happy and therefore view threats as more severe than those that are not happy, whether they are sad, angry, or hostile [31].

As we can see, these two mechanisms work in different and opposing ways. However, they do not work in concert with one another. Instead, one mechanism generally takes precedence over the other, depending on the specific context of the situation and threat. The primary difference results from how people view a particular risk. Those that view it as a mere hypothetical risk and/or the loss due to the risk would be small, we generally see optimistic bias influencing ones risk perceptions. In contrast, if the possible loss from the threat is perceived as less abstract and/or larger to the individual, then mood maintenance becomes the primary mechanism at work [31]. The current study examines ones personal information being compromised, which is inherently less abstract with more severe consequences (i.e., losses). Therefore, the mood maintenance mechanism is the primary mechanism we consider with respect to affects influence on ones risk perceptions. Thus, we offer the following hypotheses:

H6 a-c: Higher levels of the lower order dimensions associated with trait positive affect are associated with higher levels of perceived threat severity.

H7 a-c: Higher levels of the lower order dimensions associated with trait positive affect are associated with higher levels of perceived threat vulnerability.

Consistent with the above, individuals that have higher levels of the lower order dimensions associated with trait negative affect are more likely to view situations in a more pessimistic manner. Consequently, their perceptions of risks are lower than what the objective evidence available suggests.

H8 a-d: Higher levels of the lower order dimensions associated with trait negative affect are associated with lower levels of perceived threat severity.

H9 a-d: Higher levels of the lower order dimensions associated with trait negative affect are associated with lower levels of perceived threat vulnerability.

In addition to the lower order dimensions associated with a higher order dimension, we are also interested in examining the relationship between the four lower order dimensions that are not associated with a specific higher order dimension. Given the previously noted relationship between affect and risk perceptions, we argue that there will be a relationship between these four other lower order dimensions and their risk perceptions in the wake of a fear appeal.

H10 a-d: Changes in the lower order dimensions of affect not associated with a higher order dimension are associated with changes in perceived threat severity.

H11 a-d: Changes in the lower order dimensions of affect not associated with a higher order dimension are associated with changes in perceived threat vulnerability.

3) Affect, Self-Efficacy, and Behavior: As noted earlier, affect also has an influence on ones self-efficacy. Like the mood congruency effect related to risk perceptions, higher levels of positive affect (and/or lower levels of negative affect) are generally associated with greater levels of self-efficacy [25]. The more optimistic thinking results in stronger beliefs about being able to perform certain tasks related to mitigating a threat.

H12a-c: Higher levels of the lower order dimensions associated with trait positive affect are associated with higher levels of self-efficacy related to performing the responses necessary to mitigate the threat.

In contrast, those with higher levels of negative affect (and/or lower levels of positive affect) will often make self-efficacy evaluations that are more pessimistic. Thus, their level of self-efficacy related to performing the tasks necessary to protect themselves from a threat will be lower.

H13a-d: Higher levels of the lower order dimensions associated with trait negative affect are associated with lower levels of self-efficacy related to performing the responses necessary to mitigate the threat.

Finally, given the well-documented relationship between affect and self-efficacy noted previously, we expect the four lower order dimensions of affect not associated with a higher order dimension to also influence self-efficacy. H14 a-d: Changes in the lower order dimensions of affect not associated with a higher order dimension are associated with changes in self-efficacy. The research model for this study is presented in Fig. 1.

III. Methods

The purpose of this study is to explore how the lower order dimensions of trait affect may help explain the information security and privacy behavior of individuals as it relates to preventing their personal information from being compromised. Indicators used to measure PMT were adapted from prior research. For the other items, we used previously developed and validated survey instruments [53].

The model that was tested included 11 constructs related to the lower order dimensions of affect. Four of these were lower order dimensions associated with negative affect, three of these were lower order dimensions associated with positive affect, and the remaining four lower order dimensions were not associated with either higher order dimension. These constructs were each tested in individual models so as to not obfuscate relationships that may exist in this exploratory study. Each of these constructs were modeled as influencing perceived threat severity, perceived threat vulnerability, and self-efficacy.

The lower order dimensions of affect associated with one of the higher order dimensions are believed to influence these PMT constructs in the same way as the higher order dimensions they are associated with do. For the four other lower order dimensions of affect, they are modeled to have a relationship with these three PMT constructs, but not necessarily positive or negative.

A. Research Procedures

Participants in this study were recruited using Amazon's Mechanical Turk. There are several advantages to using Amazon's Mechanical Turk compared to other methods (e.g., students, word of mouth, flyers, and electronic postings). Generally, overall validity is comparable and often times higher than other approaches [20], [50]. Obtaining the requisite number of participants is quick and easy with the cost per participant relatively low. Additionally, quality generally remains quite high when compared with other methods [50]. Type II errors were mitigated by performing an a priori power analysis, which indicated we needed at least 310 responses [27]. This was based on a meta-analysis of PMT that indicated 0.21 was the lowest effect size (perceived threat vulnerability) of the five constructs that directly influence behavior [24]. This signifies a low effect size [8]. Thus, the sample of 556 participants obtained in this study surpasses the minimum threshold of 310.

There are multiple instruments that have been used to measure affect, but for this study the extended version of the Positive and Negative Affect Schedule (PANAS) was used due the extensive reliability testing and subsequent validation of the original instrument [55]. The original PANAS consists of 20 items with 2 scales: positive affect (10 items) and negative affect (10 items) [55]. In order to measure the lower order dimensions of affect, we chose the extended version known as the PANAS-X, which has 55 total indicators to measure the 11 different constructs [53]. While different time instructions may be provided to the participant when using this instrument, we chose for participants to indicate how you generally feel this way, that is, how you feel on the average since we are interested in trait affect of the lower order dimensions [55].

B. Data Analysis Procedures

Both the measurement model and structural model were tested in this study. The measurement model links the indicators that were measured to the latent variables, while the

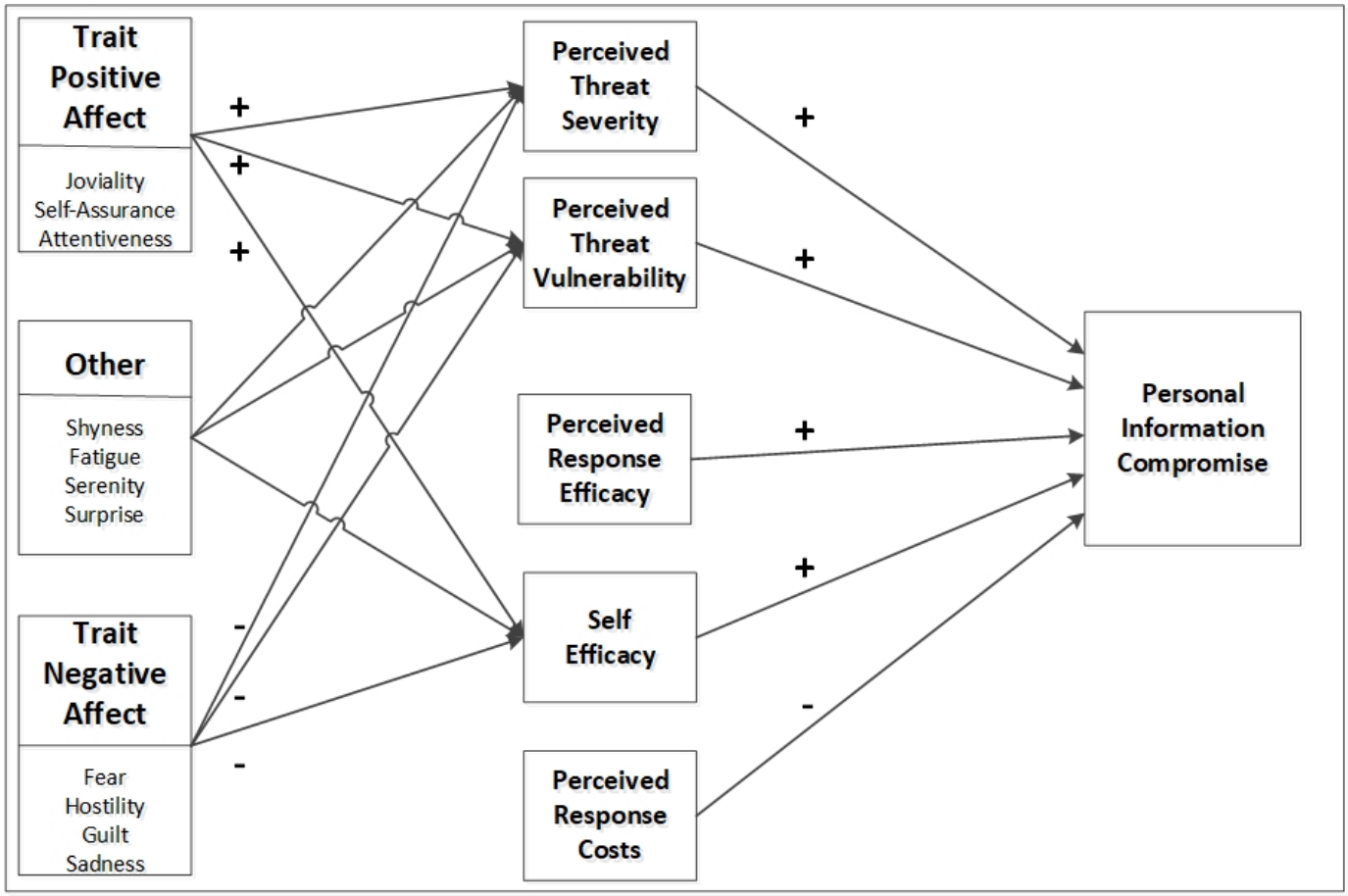

Fig. 1. Lower Order Dimensions of Trait Affect, PMT Constructs, and Personal Information Compromise

structural model connects the various latent variables to one another, consistent with the hypothesized relationships [6].

Reflective, formative, and multidimensional constructs are included in this study [41]. The independent multidimensional constructs for the independent variables representing coping appraisalself-efficacy [33], perceived response efficacy [59], and perceived response costs [39]are all reflective first-order and formative second-order. Similarly, the dependent variable also consists of multiple dimensions, but is formative first-order and formative second-order. Thus, the measurement model itself is considered formative. The following constructs are reflective: the lower order dimensions of affect [53], [55], perceived threat vulnerability, and perceived threat severity [59]. An instrument that had been previously developed and validated was used to measure the responses needed to mitigate the threat of having ones personal information compromised [18]. Consistent with challenges associated with the perceived threat vulnerability construct in other non-experimental research in which a manipulation does not occur [10], [33], we modified the wording of the indicators for this construct. For example, one of the indicators is: If I do not take appropriate steps to protect myself, then I would be at risk for having my personal information compromised. The challenge in survey research has been that participants already engaging in the responses necessary to mitigate a threat consequently did not feel vulnerable to the threat. Thus, the above rewording with the qualifier seeks to address this issue.

IV. Analysis

A. Participants

The survey instrument was pilot tested using Amazon's Mechanical Turk to solicit participants. We had 109 responses to the pilot study with 12 being rejected for failing one or both of the quality control questions. Thus, we had 97 usable responses from which to analyze the data for the pilot study portion of this research. We conducted statistical analysis tests for validity, including convergent and discriminant validity, as well as reliability, including Cronbachs Alpha and composite reliability.

Only minor wordsmithing changes were made, including a change to one of the response costs indicators since it was worded in a manner incongruent with the other indicators and thus may result in confusion. The primary study consisted of a much larger sample size of 556 usable responses after 51 were rejected for failing one or both quality control questions. This met our a priori established minimum threshold of 310. We compensated participants with $1.00 for their participation in the study.

Demographic information was also collected. It indicated that participants were generally more educated, younger, and more white, Asian, or Pacific Islander than the general population, but nonetheless represented a fair amount of diversity on key demographic variables [50]. There were also more females that participated than males, but not by much. The participants did represent the various geographic regions of the U.S. quite well and consistent with the actual populations of these regions.

B. Data Analysis

1) Common Method Bias: Since a single method was used in this research, surveys, we had to concern ourselves with the possibility of common method bias. We tested for this using Harmans single-factor test. While it does have some shortcomings [43], it is a useful indicator for whether the method itself accounted for a significant amount of the variance measured. The test indicated that the total variance explained by a single factor was under the threshold of 50% (21%). Beyond simply testing for common method bias, the study itself should be designed to minimize it. In this study, the participants were anonymous to the researchers and simply asked to respond honestly [43]. Both of these factors help reduce common method bias.

2) Reliability and Validity: Cronbachs Alpha and composite reliability values were over the 0.700 minimum threshold for the reflective constructs. Additionally, the composite reliability values were greater than the 0.500 and greater than the AVE for all constructs. Thus, reliability and convergent validity are considered acceptable [26]. Finally, discriminant validity was demonstrated. The AVE of the constructs were greater than the square of the correlations with other constructs. Likewise, the cross-loading method of assessing discriminant validity was sufficient [6]. All indicators loaded less on other constructs than the construct they intended to measure. The Heterotrait-Monotrait Ratio (HTMT) method was also used and supported discriminant validity [29].

Given the complexity of the model employed in the current study, which includes multiple dimensions, a formative first-order, formative second-order construct (dependent variable) and reflective first-order, formative second-order constructs (three of the independent variables), the process outlined in [36], [45] was used. The structural model was calculated using Smart PLS, version 3.0 [46].

The results of our analysis for the five primary constructs of PMT are in Table I. Four out of the five constructs employed from PMT were statistically significant with the only exception being perceived response efficacy. Although it was significant at the <0.10 level, it did not meet our a priori established threshold of <0.05. As noted in prior research, self-efficacy continues to be an effective predictor of behavior [24]. Overall, the research model accounted for approximately 55.6% of the variance, which is quite high considering the exploratory nature of this research.

Table II provides information on the results of our tests related to the lower order dimensions of trait affect and perceived threat severity and perceived threat vulnerability. Out of 11 sub-hypotheses related to perceived threat severity, five were supported. This includes all three lower order dimensions related to positive affect and one related to negative affect (i.e., hostility) and another not associated with a higher order dimension (i.e., serenity). Only one sub-hypotheses was supported for perceived threat vulnerability (i.e., attentiveness). Of the hypotheses supported, all were in the direction hypothesized with higher level of serenity being related to higher levels of perceived threat severity.

Table III details the results of our sub-hypotheses related to self-efficacy and the lower order dimensions of affect. In contrast to the results related to perceived threat vulnerability, almost all the lower order dimensions were statistically significant with nine out of 11 sub-hypotheses supported. Two

TABLE I
RESEARCH MODEL RESULTS, PART 1

Hypothesis	T Statistic	Sig.	Supported
H1: TS ->PIC	2.815	<0.01	Yes
H2: TV ->PIC	2.075	<0.05	Yes
H3: RE ->PIC	1.425	0.077	No
H4: RC ->PIC	2.863	<0.01	Yes
H5: SE ->PIC	8.256	<0.01	Yes

PIC: Personal Information Compromise
TS: Threat Severity — TV: Threat Vulnerability
RE: Response Efficacy — RC: Response Costs
SE: Self-Efficacy — TPA: Trait Positive Affect
TNA: Trait Negative Affect

TABLE II
RESEARCH MODEL RESULTS, PART 2

Hypothesis	T Statistic	Sig.	Supported
H6: TPA ->TS			
Joviality	4.064	<0.01	Yes (+)
Self-Assurance	4.577	<0.01	Yes (+)
Attentiveness	4.314	<0.01	Yes (+)
H7: TPA ->TV			
Joviality	0.444	0.329	No
Self-Assurance	0.499	0.30	No
Attentiveness	2.282	<0.05	Yes (+)
H8: TNA ->TS			
Fear	0.979	0.164	No
Hostility	1.913	<0.05	Yes (-)
Guilt	1.479	0.070	No
Sadness	1.557	0.060	No
H9: TNA ->TV			
Fear	0.202	0.420	No
Hostility	0.499	0.309	No
Guilt	0.260	0.397	No
Sadness	0.039	0.484	No
H10: Other ->TS			
Shyness	0.929	0.353	No
Fatigue	0.239	0.811	No
Serenity	3.094	<0.01	Yes (+)
Surprise	0.673	0.501	No
H11: Other ->TV			
Shyness	0.129	0.897	No
Fatigue	1.355	0.175	No
Serenity	0.195	0.846	No
Surprise	0.525	0.600	No

TS: Threat Severity — TV: Threat Vulnerability
TPA: Trait Positive Affect — TNA: Trait Negative Affect

TABLE III
RESEARCH MODEL RESULTS, PART 3

Hypothesis	T Statistic	Sig.	Supported
H12: TPA ->SE			
Joviality	5.639	<0.01	Yes (+)
Self-Assurance	6.020	<0.01	Yes (+)
Attentiveness	7.099	<0.01	Yes (+)
H13: TNA ->SE			
Fear	3.156	<0.01	Yes (-)
Hostility	3.588	<0.01	Yes (-)
Guilt	2.737	<0.01	Yes (-)
Sadness	3.079	<0.01	Yes (-)
H14: Other ->SE			
Shyness	2.397	<0.05	Yes (-)
Fatigue	1.618	0.106	No
Serenity	6.177	<0.01	Yes (+)
Surprise	1.043	0.297	No
SE: Self-Efficacy — TPA: Trait Positive Affect TNA: Trait Negative Affect			

of the lower order dimensions (i.e., fatigue and surprise) not associated with a higher order dimension were the exceptions. The direction of the supported relationships were all in the direction hypothesized with shyness being negatively associated with self-efficacy and serenity being positively associated.

V. DISCUSSION

A. Conclusions about the Research Problem and Hypotheses

A previously developed instrument designed to measure the responses necessary to mitigate against the threat of personal information compromise was used for the dependent variable [18]. The items for the PMT constructs were adapted from prior literature. Finally, the PANAS-X was used to measure the lower order dimensions of trait affect [53], [55].

We assessed reliability and validity through the employment of several established tests for both the pilot study and the main study. Some minor changes were made from the pilot study to the main study, which included rewording an indicator for response efficacy. A large amount of variance was explained by the model–55.6 percent.

Four out of five of the hypotheses associated with PMT were supported with perceived response efficacy being the exception. Some support was seen in the sub-hypotheses for perceived threat severity (5 out of 11) with little support seen for the sub-hypotheses related to perceived threat vulnerability (1 out of 11). Finally, self-efficacy was supported in all lower order dimension sub-hypotheses that were related to a higher order dimension (i.e., positive or negative) with support seen in two out of the four sub-hypotheses not associated with a higher order dimension.

The primary contribution made by this research is the incorporation of the lower order dimensions of affect into the research model. These lower order dimensions of affect consisted of those associated with positive affect, negative affect, as well as four other items not associated with a higher order dimension.

B. Personal Information Compromise

The threat of having ones personal information compromised represents a significant threat for individuals. Unlike some threats that may appear more abstract to the end user, the compromise of ones personal information can be significant, personal, and costly. Several different antecedents to perceived threat severity, perceived threat vulnerability, and self-efficacy were explored and shown to play varying roles related to how we view protecting our personal information.

C. Implications for Theory

Protection Motivation Theory helps explain how people evaluate this threat from a risk perspective, as well as the factors that go into their decision to take actions to help mitigate the threat. While perceived response efficacy was not statistically significant, the other four constructs were. This included the modified perceived threat vulnerability construct noted earlier.

Additionally, we showed that there are other factors that help provide inputs to the constructs of PMT. Most notably, several lower order dimensions of affect were related to peoples self-efficacy and to a lesser extent perceived threat severity, with only minimal support for perceived threat vulnerability.

Finally, this study also demonstrated the importance of being careful in how affect is conceptualized and measured. It should be done in an intentional and thoughtful way so as to allow future work to build upon prior research.

D. Implications for Practice

Similar to research that has examined issues related to the insider threat, the current study suggests individuals that are generally more hostile, sad, fearful, and higher levels of guilt, represent a greater threat to the organization as it relates to information security. To verify this relationship between the home user and the organizational user, it will be important for future work to apply the same process to threats related to users within an organization.

For home users, it will be important to provide awareness on the challenges associated with individuals that are more hostile, sad, fearful, and higher levels of guilt. Additional training mechanisms may help increase their self-efficacy and result in individuals taking protective measures that they otherwise would not. This can help counter the role of affect in these scenarios.

An additional challenge is the changing face of technology, such as the proliferation of Internet of Things (IoT) devices. IoT devices are largely unregulated with significant confusion over privacy and security issues for end users [19], [34]. Thus, for home users with higher levels of some of the lower order dimensions of trait affect discussed here, they may be at even greater risk.

E. Limitations

Two limitations of the current study are worth noting. First, social desirability bias could influence how the participants

responded to the survey questions [13]. Individuals may want to answer in a manner consistent with what they think the researcher deems socially acceptable. While this is minimized some via the level of anonymity provided to the participants, it remains a concern nonetheless.

Second, as noted earlier common method bias cannot be excluded [43]. While certain components of the process employed help to minimize it and tests related to checking for it did not show any significant issue with common method bias, it cannot be fully excluded.

F. Further Research

Beyond trait affect, it may be worthwhile to operationalize affect with shorter time instructions to see what influence, if any, that may have on how individuals perceive a threat and subsequently cope with it.

Additionally, other types of threats should be examined beyond the threat of having ones personal information compromised. For example, the loss of important files may be a threat worth pursuing.

Other psychological factors may also be explored, such as personality. Similar to trait affect, personality may help us better understand how someones personality type influences their behavior through their perceptions of a threat and their belief in being able to take appropriate measures to mitigate it.

Finally, this study examined a threat that occurs to an individual user in their own environment. An examination of how affect may influence the behavior of individuals in an organizational setting may prove to be quite insightful, as it has been done in trying to understand insider threat behavior [2], [21].

VI. Conclusion

This study demonstrated that the lower order dimensions of affect may help explain how individuals assess a threat through perceived threat severity and perceived threat vulnerability, as well as their belief in being able to take actions designed to mitigate the risk.

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