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An Evaluation of Two Scales Used for Measuring Attribution

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ABSTRACT

People fail using technologies on a daily basis. In the user's eye there can be various reasons to attribute this failure. This study investigates the psychometric properties of two leading scales of attribution, the Causal Dimension Scale and the Learned Helplessness Scale as a preparatory response to address the underutilization of attribution theories in the MIS field. Our findings show both scales suffer psychometric as well as predictive problems. The research sets the stage for proposing and developing a new scale to measure learned helplessness and attributional style.

Keywords

learned helplessness, attributional style, measurement development

INTRODUCTION

If you can't control your peanut butter, you can't expect to control your life.
--Bill Watterson, The Authoritative Calvin and Hobbes: A Calvin and Hobbes Treasury

Humans have been attempting to control various aspects of their lives for thousands of years. Whether it be your job, marriage, or something as small as the amount of peanut butter on your toast, people are always searching for control over their lives. Theory has long suggested that people strive for feelings of control over their daily lives, with this feeling of control leading to better mental health and self-actualization (Adler 1924). If control is lost this leads to a sense of inferiority and helplessness that can be detrimental (Ansbacher and Ansbacher 1956). Many areas within information systems (IS) pose hurdles to average users as being difficult or uncontrollable that can lead to a sense of helplessness. Better understanding of these personal sentiments and the contributing attributional factors holds promise for positively impacting individual use of IS.

Two major theories have looked at the methods of personal attribution, attribution theory (Weiner 1974) and learned helplessness (Abramson et al. 1978). While useful theoretically, the measurement instruments used to assess each of these theories have been shown to be flawed. Several measures of attribution style were evaluated and found to be problematic both theoretically, psychometrically, and operationally (Fernández-Ballesteros 2002). Furthermore, the primary measure of learned helplessness (the learned helplessness scale or LHS) was derived using a non-theoretically based post-hoc method (Quinless and Nelson 1988) which has led to questions about the measure. In order to effectively measure personal attributions towards technology use, a quality measure is needed.

The purpose of this research is to evaluate measures of attribution and learned helplessness. Specifically, we look at two popular measures of each, the causal dimension scale (CDS) and the learned helplessness scale (LHS). We measure both of these scales in the context of computer security. Findings show that both of these scales display problems psychometrically with regard to reliability, convergent and discriminant validity, and predictive validity within a nomological net.

BACKGROUND

Learned Helplessness

Common to attribution theories in general, the Learned Helplessness theory suggests that the attributions people give for good and bad outcomes affect their expectations about future outcomes. Learned helplessness is grounded in early animal research (Abramson et al. 1978; Maier and Seligman 1976) that found that when an animal was presented with uncontrollable events it would eventually learn that none of its responses would control future outcomes, even if that was not actually the case. For human subjects, motivational, cognitive and emotional deficits are likely to develop when a person perceives that

they face uncontrollable events, and they subsequently learn to expect that they are helpless to control the outcomes of future events.

In order to understand the phenomenon of perceived helplessness in finer granularity, Abrahamson et al. (1978) developed the Learned Helplessness theory along three dimensions: Internal/External, Stable/Unstable, and Global/Specific.. They first considered the idea of controllability. Not in the sense of measuring if it exists or even to the extent to which it exists, since some degree of learned helplessness is assumed. Rather they noted that a difference existed between subjects who felt helpless due to factors that also affected their relevant peers (universal helplessness) as opposed to those who felt helpless due to factors perceived as being unique to the subject (personal helplessness). Lowered self-esteem, for example, occurs only with personal helplessness. The resulting constructs for this dimension are generally labeled as "Internal" and "External". After failing a math exam, an example of an internal attribution might be "I'm bad at math", where an external attribution might be "We all did bad on that exam because it was written so poorly."

The second and third dimensions were introduced to further refine the issue of controllability. Common with Weiner's Attribution Theory, the chronicity of the attributions was addressed by considering if the attribution was expected to be stable or unstable over time. In the exam scenario above, a stable attribution might be "I've always been bad at math and I'll never figure it out" or "Math exams are always written poorly", and an unstable attribution might look more like "I did poorly on this exam because I had a cold, but I'll do better next time", or "This exam was written poorly because we had a substitute teacher."

Generality was the final dimension offered as a refinement to the overall idea of controllability. This dimension considers whether the attributions are perceived to be a function of a specific context (Specific) or generalizable to a broader environment (Global). In keeping with the math example, a specific attribution might be "I'm bad at math" or "Math exams are difficult" whereas a global attribution might be "I'm bad at school" or "All paper-based exams are difficult."

Attribution Theory

Attribution theory is a general term for "the perception or inference of cause" (Kelley and Michela 1980), though for many researchers it is best exemplified by Heider's work in interpersonal relations (Heider, 1958). Weiner's Attribution Theory was developed in the context of explaining attributions given for achievement. Similar to learned helplessness, attribution theory uses three dimensions, with both using the same Stable/Unstable dimension. Weiner's theory, however, does not assume that subjects face uncontrollable situations so uses a measure for Controllabillity in lieu of the Global/Specific dimension found in learned helplessness theory. In contrast, learned helplessness assumes there should always be some feeling of loss of control, and some level of helplessness; therefore, controllability is not a part of learned helplessness. Weiner's theory does have an Internal/External measure but it is conceptually different from the similarly labeled learned helplessness dimension. Under Weiner's theory, attributes might be internal "I succeeded because I'm smart" or within the environment "I succeed because the exam was easy". Notably this does not include an evaluation of relevant others. Learned helplessness's reliance on social comparison to define External aligns more closely with self-efficacy and self-esteem, both of which rely on modelling the experience of relevant others (Bandura 1982; Maslow 1943).

The use of attribution theories in MIS

While attribution theories are addressed extensively in psychology, they are much less represented in organizational science (Martinko et al. 2011) and barely mentioned in the MIS field (Kelley et al. 2013). Searching the MIS "Basket of 8" journals in the Web of Science's Social Sciences Citation index yields 19 instances of "attribution" as a search topic, of which only one (Lowry et al. 2015) measured one of the dimensions found in Weiner's attribution theory or learned helplessness theory (they measured Internal/External to an organization, not to self). This led Kelley and colleagues (2013) to declare attribution theories in their "spring" of existence in IS research and to call for more research in the area.

The Causal Dimension Scale and Learned Helplessness Scale

CDS (Russell 1982) and its refinement CDSII (McAuley et al. 1992) were developed to measure attributional style. They were developed due to issues with the Attributional Style Questionnaire (Peterson et al. 1982) being lengthy and primarily used in the context of clinical depression. Additionally the ASQ has obvious psychometric problems unless scale items are collapsed and aggregated. While designed to measure the three dimensions of attribution theory, the scale measured the two dimensions of locus and stability while breaking the control dimension into separate measures of personal and external control.

Quinless and Nelson (Quinless and Nelson 1988) created the the Learned Helplessness scale to develop "an objective instrument designed to measure learned helplessness." Quinless and Nelson initially developed 50 test items from extant literature on learned helplessness, and from these settled on 20 items that were tested, revised, and tested again. They named these 20 items the Learned Helplessness Scale (LHS). Later, in a Varimax rotated factor analysis of these items they identified three major factors which they labeled with the dimensions of the Learned Helplessness Theory (Internal/External, Stable/Unstable, Global/Specific). These same items were later used in a dissertation (Smallheer 2011) looking at learned helplessness in heart attack patients with the author reporting similar factor loadings.

In this study we independently evaluate the psychometric properties and predictive validity of both the CDSII and the Learned Helplessness Scale to determine their value for use in the MIS domain.

EVALUATION OF THE LEARNED HELPLESSNESS SCALE

The survey was administered to 271 individuals in an introductory course in information systems security with 206 subjects providing usable feedback.[1] All subjects were in the same section of the course taught by the same instructor. Of the respondents, 65 percent were male and over 90 percent were US citizens. The survey was administered during the middle of the semester. Subjects were emailed a link to the survey and given one week to respond, with a reminder email sent four days later to those who had not yet responded. The survey consisted of several sets of questions pertaining to the use of security tools to secure the individual's personal computer. These questions included the LHS scale questions as well as perceived usefulness and perceived ease of use with regard to the use of such security tools. All questions used a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

An initial measurement model was run to evaluate the psychometric properties of the LHS scale (see Table 1). The model showed adequate fit (χ^2 [101] = 208.52, CFI = 0.93, TLI = 0.91, RMSEA = 0.072, SRMR = 0.049). Evaluating reliability showed that the both Cronbach alpha and composite reliability demonstrated good reliability of the measures with values above the recommended 0.7 (Cronbach 1951; Fornell and Larcker 1981). Conversely, convergent validity was not demonstrated with AVE values below the recommended cutoff of 0.5 (Fornell and Larcker 1981) for all three measures. Furthermore, eight of the 16 standardized observed items loaded below 0.7 on their respective construct. This shows that the latent variables did not account for the majority of the variance in the observed variables (Bollen 1989). In addition, discriminant validity was very problematic with the square root of the AVE values well below the extremely high correlations between each of the constructs, indicating that the latent constructs cannot be easily distinguished from each other (Fornell and Larcker 1981). Overall, the model, while showing good reliability, did not show good individual item validity or convergent or discriminant validity.

						Correlations		
	Mean	**Std. Dev**	**Alpha**	**CR**	**AVE**	**GS**	**SU**	**IE**
GS	1.78	0.58	0.82	0.83	0.49	0.70		
SU	1.78	0.58	0.83	0.83	0.46	0.91	0.68	
IE	1.98	0.64	0.79	0.81	0.46	0.90	0.86	0.68

Table 1. LHS psychometric properties including mean, standard deviation, Cronbach alpha, composite reliability, average variance extracted, correlations, and square root of the AVE along the diagonal.

Further evaluation of the LHS involved assessing the constructs in relation to outcome variables expected to be in its nomological net. By assessing a construct in relation to variables it is hypothesized to affect, the construct can be better evaluated (MacKenzie et al. 2011). LHS has been hypothesized to lead to greater expectancy with regard to a specific task (Quinless and Nelson 1988). Perceived usefulness (PU) and perceived ease of use (PEU) have both been identified as types of expectations (Bhattacherjee 2001) and therefore should be affected by learned helplessness. To evaluate this relationship a covariance-based structural model was run including both the LHS and PU and PEU constructs (see Figure 1). The model was found to have adequate fit (χ^2 [243] = 446.96, CFI = 0.91, TLI = 0.90, RMSEA = 0.064, SRMR = 0.065). When evaluating the individual structural parameters, while some of the standardized weights are quite high, none of these structural paths were found to be significant. This is most likely due to the high degree of correlation between the LHS

[1] Power analysis revealed that a sample of 150 is sufficient to find a medium effect size (0.3) with power of $\beta = 0.8$ (Cohen 1988; Westland 2010).

constructs and points to the lack of predictive validity of the instrument. Overall, the results of the analysis point to an LHS scale that has problematic convergent, discriminant, and predictive validity.

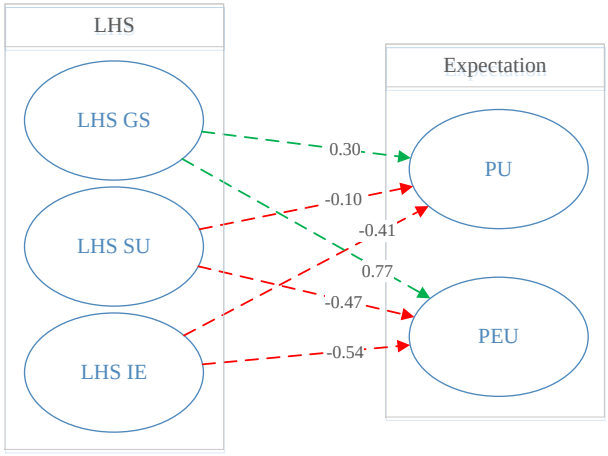

Figure 1. LHS nomological net (* p < 0.05, ** p < 0.01, *** p < 0.001)

EVALUATION OF THE CAUSAL DIMENSION SCALE VERSION II

The survey was administered to 148 individuals in an introductory course in information systems security. All subjects were in a different section of the course in a different semester from those who received the LHS questionnaire, but taught by the same instructor. Of the respondents, 65 percent were male and 93 percent were US citizens. The survey was administered at the end of the semester. Subjects were emailed a link to the survey and given one week to respond, with a reminder email sent four days later to those who had not yet responded. The survey consisted of several sets of questions pertaining to the use of security tools to secure the individual's personal computer. These questions included the LHS scale questions as well as perceived usefulness and perceived ease of use with regard to the use of such security tools. All questions used a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

An initial measurement model was run to evaluate the psychometric properties of the CDSII scale (see Table 2). The model showed adequate fit (χ^2 [271] = 419.59, p < 0.001, CFI = 0.91, NNFI = 0.89, SRMR = 0.066, RMSEA = 0.061). Evaluating reliability showed that the both Cronbach alpha and composite reliability demonstrated poor reliability for the Locus and Stability dimensions. Additionally, convergent validity was not demonstrated for Locus and Stability. Furthermore, six of the 12 observed items loaded below 0.7 on their respective construct. In addition, discriminant validity was problematic between Locus and external control with the square root of the AVE value on both well below the high correlation between them. Overall, the model showed problems with reliability, individual item validity, convergent validity, and discriminant validity.

						Correlations			
	Mean	**Std. Dev**	**Alpha**	**CR**	**AVE**	**Locus**	**Stability**	**Personal**	**External**
Locus	5.41	1.47	0.68	0.68	0.41	0.64			
Stability	4.39	1.46	0.65	0.69	0.45	0.40	0.67		
Control (personal)	5.25	1.50	0.75	0.76	0.52	0.23	0.32	0.72	
Control (external)	6.18	1.41	0.76	0.76	0.51	0.84	0.04	0.34	0.72

Table 2. CDSII psychometric properties

Further evaluation of the CDSII involved assessing the constructs in relation to outcome variables expected to be in its nomological net. To evaluate this relationship a structural model was run including both the CDSII and PU and PEU constructs (see Figure 2). The model was found to have bad fit (χ^2 [217] = 435.89, CFI = 0.83, TLI = 0.80, RMSEA = 0.083, SRMR = 0.119). When evaluating the individual structural parameters, only two of the structural paths were found to be

significant while two of the variables (IE and Control) had no significant paths. Overall, the results of the analysis point to a CDSII scale that has problematic reliability as well as convergent, discriminant, and predictive validity.

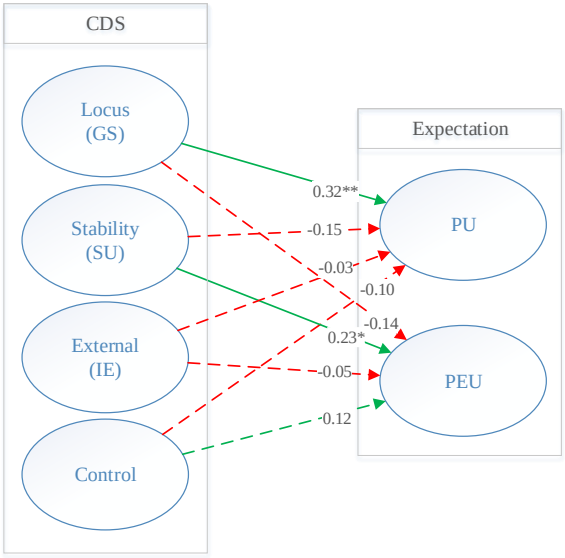

Table 3. CDSII nomological net (* p < 0.05, ** p < 0.01, *** p < 0.001)

CONCLUSIONS

Attributional scales hold promise for researchers to better understand individual attitudes towards causal events, especially when those events reflect negatively on the user. To better understand these events holds promise from designing effective training to improve user attitudes towards similar future events. The problem remains that social sciences generally underutilize attribution theories in research, and that situation is even more dire in the MIS domain.

One issue with the lack of use of attributional theories may be the lack of good metrics from measuring the constructs. Various instruments have been developed to measure user attributions, but most have serious flaws (Fernández-Ballesteros 2002). Two widely used measures of attribution are the Learned Helplessness Scale (LHS) and Causal Dimension Scale (CDSII). This research used two separate samples to evaluate these instruments in the context of computer security. Results show that both of these measures have issues with reliability, indicator validity, convergent and discriminant validity, as well as predictive validity. This confirms previous research that the scales to measure attribution are lacking.

Given the bad psychometrics of both the CDSII and LHS, and the fact that other theories of attributional style show similar shortcomings, we recommend the development of a new scale for Learned Helpless/Attributional Style that adheres to the Learned Helplessness theory and its three dimensions, but is sufficiently rigorous for use in the study of how people struggle with technologies and their uses in the MIS domain. Given the plethora of technologies used by everyone on a daily basis, the stress with not understanding these technologies is great among users. By developing a new measure, this can help to understand and hopefully implement change programs to address these issues.

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