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Cross-cultural and gender associations with anxiety about electronic data hacking

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ABSTRACT

We investigated the impact of data hacking on clinical anxiety and worry. 389 American and 216 Korean college students were recruited, surveyed using the Generalized Anxiety Disorder-7 (GAD-7) questionnaire, and adapted GAD-7 specifically assessing data hacking anxiety. Using confirmatory factor analysis with measurement invariance testing, Koreans scored higher on severity of hacking anxiety items, and differently on factor loadings. Controlling for other variables such as age and prior hacking victimization, cultural group status remained a robust predictor for hacking anxiety. Hacking anxiety in both cultural groups was higher in women than men. Results are placed into the context of theory on information privacy concerns and cross-cultural differences on such concerns.

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1. Introduction

In the modern era, people in industrialized countries have unprecedented levels of access to the internet and smartphones. National opinion polls demonstrate heavy saturation of internet access and use for most demographic groups (Perrin & Duggan, 2015), and global daily reliance on smartphones (Poushter, 2016). Such technologies are used daily for purposes such as productivity enhancement, information seeking, social interaction, diversion and relaxation, and entertainment (van Deursen, Bolle, Hegner, & Kommers, 2015). However, with this increased digital connection, people are increasingly affected by electronic data hacking and breaches (Ayyagaria, 2012; Liu, Musen, & Chou, 2015; Posey Garrison & Ncube, 2011). Furthermore, intrusive, warrantless government electronic surveillance is pervasive (Greenwald, 2014; Landau, 2013). In the present paper, we investigate what impact

electronic data hacking has on emotional distress - specifically, anxiety and worry – and the moderating role of cultural background and gender.

1.1. Background and literature review

Concern about information privacy has been studied empirically in scientific journals. This research has focused on privacy concerns about social networking sites (Chen & Chen, 2015; Nemeč Zlatolas, Welzer, Heričko, & Hölbl, 2015; Osatuyi, 2015) and smartphones (Kang & Shin, 2016; Mamonov & Benbunan-Fich, 2015). Additional concerns have been investigated about keystroke loggers, exercise health data and video surveillance (Oulasvirta, Suomalainen, Hamari, Lampinen, & Karvonen, 2014), as well as geo-location data (Mamonov & Benbunan-Fich, 2015). Most of this research has been conducted by researchers in fields such as communications, journalism, business management, and information technology/computer science. However, our focus in the present paper is to study information privacy concern from a psychological perspective, by examining associated emotional distress.

“Information privacy” is often conceptualized in the research

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literature from a values-based perspective, with the assumption and rationale that it is within an individual's rights to keep their electronic data safe. However, another perspective adds nuance by suggesting that information privacy is a commodity that may be bought, sold or exchanged (Pavlou, 2011), such as giving up some privacy when performing an internet search in exchange for free searching provided by the search engine. In more recent years, the information privacy construct has added an element of autonomy, now conceptualized as involving control by the individual as to where his/her private information is used (Smith, Dinev, & Xu, 2011). Additional nuance in this construct involves the issue of context, whereby the definition and experience of privacy may differ greatly across cultures, settings and situation (Acquisti, Brandimarte, & Lowenstein, 2015).

There are numerous threats in modern times to digital information privacy. The impact of such threats are fear reaching, including compromises to economic wealth, individual civil liberties, as well as discrimination and censorship (Acquisti et al., 2015). The targets of information privacy threats can include consumer financial data (Bohannon, 2015), private location data (You, 2015), cloud-based data (Chou, 2013), personal data mined by government entities and corporations (Bettini & Riboni, 2015), and internet of things (IoT) data from home automation devices (S. Li, Tryfonas, & Li, 2016).

"Information privacy concern" is typically defined in the literature as the perception of losing control over one's personal information, with possible use by third parties (Bélanger & Crossler, 2011; Pavlou, 2011). Other conceptualizations are similar, but add features including improper data access and errors (Acquisti et al., 2015).

Three previous papers in particular have examined clinically relevant anxiety about electronic privacy. *Chai, Bagchi-Sen, Morrell, Rao, and Upadhyaya (2009)* examined anxiety about information privacy among 285 American adolescents. The authors found that being victim of a hacking incident significantly predicted anxiety about possible future data hacking. Similar results were obtained in a more recent study of 305 American adults from a community sample (Elhai, Levine, & Hall, *in press*). Also recently, *Elhai and Hall (2016)* investigated anxiety from electronic data hacking in a community sample of 304 American adults. The authors found that anxiety about hacking was somewhat higher than, and distinct from, baseline anxiety.

1.2. Theory

Prospect Theory (PT) is a relevant theory for contextualizing this research area, focusing on how individuals arrive at decisions when risk is involved (Kahneman & Tversky, 1979). PT assumes that in estimating possible gains or losses, people use heuristics to arrive at such decisions. And such heuristics can involve distortions in probability estimation based on an individual's risk-averse or risk-seeking behavior (Tversky & Kahneman, 1992). PT has been used in conceptualizing perceptions of online privacy (e.g., Baek, 2014; Liang & Xue, 2009). Specifically, individuals may inaccurately estimate the level of risk associated with their information privacy, leading to a heightened (or minimized) concern or anxiety about electronic data breaches. Having an unrealistically high level of anxiety regarding information privacy can be emotionally distressing (Elhai & Hall, 2016), while an unrealistically low level of concern can lead to inadequate privacy protection behavior (Chai et al., 2009; Elhai et al., *in press*).

We should also acknowledge that other existing theories can explain concern about information privacy, and associated privacy protection behavior. These theories include Privacy Calculus Theory (PCT), and Protection Motivation Theory (PMT). PCT (Culnan &

Armstrong, 1999) assumes that individuals perform a risk-benefit analysis when considering whether to disclose private information. Although PCT has been widely studied in the information privacy area, it has been criticized for assuming that individuals typically make rational decisions about privacy protection (Y. Li, 2012). On the other hand, PMT (Rogers, 1983) assumes that social-cognitive variables influence privacy behavior. However, PMT has been less widely studied with regard to information privacy (Y. Li, 2012).

1.3. Aims

Some research has found cultural differences in information privacy concern (Cullen, 2009; Lowry, Everard, & Cao, 2011). Eastern cultures having a greater emphasis on information privacy than Western cultures (Lin et al., 2012; Lowry et al., 2011). Additionally, men and women differ in terms of information privacy concern and practices (Hoy & Milne, 2010; Lewis, Kaufman, & Christakis, 2008; Litt, 2013) - especially outside their close peer group (Lin et al., 2012). Women use a more diverse set of secure technology practices (Litt, 2013). And women are more likely to experience anxiety, and anxiety disorders, than men (reviewed in McLean & Anderson, 2009).

In the present study, we extend this line of inquiry regarding clinical anxiety from electronic data hacking. We administered an established measure of anxiety symptoms, and re-administered it by inquiring about anxiety specifically from data hacking. We compared a confirmatory factor analytic (CFA) model of clinical anxiety about data hacking to a factor model of general anxiety among college students. We also explored correlates of anxiety about hacking, using measurement invariance testing. Specifically, we tested the impact of culture, by testing two subgroups of college students – one from the U.S., and the other from South Korea.

1.4. Hypotheses

We posed the following hypotheses.

1). We hypothesized that anxiety about data hacking would have an equivalent symptom structure to general anxiety, in both the Korean and U.S. cultures, based on non-significant group differences in factor loadings.

Research finds similarities in the latent structure of different types of anxiety or stressors (Armour, Müllerová, & Elhai, 2016; Elhai et al., 2009). Thus we hypothesized to find equivalence between the latent structure of data hacking anxiety and general anxiety.

2). We hypothesized that for both the Korean and U.S. samples, data hacking anxiety would be rated as less severe than general anxiety, based on smaller observed variable intercept values for hacking anxiety.

Elhai and Hall (2016) found significant levels of anxiety about data hacking. However, the authors used a single-item measure of anxiety, querying different types of data breaches. Using a psychometrically-sound measure of clinical anxiety in the present study, we hypothesized that general anxiety would be higher than anxiety about data hacking. After all, notwithstanding the importance of anxiety about data hacking, anxious people worry about additional, substantial content areas other than data hacking (Lindesay et al., 2006).

3). We hypothesized that women would evidence greater levels of hacking anxiety than men, based on higher levels of hacking anxiety intercepts.

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