

USER COMPENSATION AS A DATA BREACH RECOVERY ACTION: AN INVESTIGATION OF THE SONY PLAYSTATION NETWORK BREACH¹

Sigi Goode

Research School of Management, College of Business and Economics, Australian National University,
Canberra, ACT, AUSTRALIA {Sigi.Goode@anu.edu.au}

Hartmut Hoehle

Department of Information Systems, Sam M. Walton College of Business, University of Arkansas,
Fayetteville, AR 72701 U.S.A. {hartmut@hartmuthoehle.com}

Viswanath Venkatesh

Department of Information Systems, Sam M. Walton College of Business, University of Arkansas,
Fayetteville, AR 72701 U.S.A. {vvenkatesh@vvenkatesh.us}

Susan A. Brown

Department of Management Information Systems, University of Arizona, 1130 East Helen Street,
Tucson, AZ 85721-0108 U.S.A. {suebrown@eller.arizona.edu}

Drawing on expectation confirmation research, we develop hypotheses regarding the effect of compensation on key customer outcomes following a major data breach and consequent service recovery effort. Data were collected in a longitudinal field study of Sony customers during their data breach in 2011. A total of 144 customers participated in the two-phase data collection that began when the breach was announced and concluded after reparations were made. Using polynomial modeling and response surface analysis, we demonstrate that a modified assimilation–contrast model explained perceptions of service quality and continuance intention and a generalized negativity model explained repurchase intention. The results of our work contribute to research on data breaches and service failure by demonstrating the impacts of compensation on customer outcomes. We discuss theoretical and practical implications.

Keywords: Data breach, security, service recovery, compensation, Sony

¹Merrill Warkentin served as the senior editor for this paper.

The appendices for this paper are located in the “Online Supplements” section of the *MIS Quarterly*’s website (<http://www.misq.org>).

Introduction

Large scale data breaches, where a significant amount of sensitive organizational data is accidentally or deliberately released to external parties, can be disastrous for a company's customer perceptions in the marketplace. Studies show that more than five significant data breach incidents are reported every day (Verizon Business 2015). The average cost of a data breach reached U.S. \$6.53 million in 2015, making this a significant problem for firms. In 2011, in the largest-ever recorded data breach at that time (Reynolds 2011), the Sony PlayStation Network was hacked, compromising the personal and financial information of more than 77 million user accounts (Richmond and Williams 2011). The direct costs of the breach exceeded U.S. \$171 million (Hachman 2011) and financial analysts estimated Sony's indirect costs exceeded U.S. \$1 billion resulting from brand damage due to negative customer sentiment (Sherr and Wingfield 2011). In addition to the Sony data breach, other multinational companies have faced large scale data breaches. For example, Adobe (a leading Fortune 500 technology company) and Target (a large U.S.-based retailer) reported data breaches and announced that personal and financial information of more than 170 million user accounts were compromised. The associated costs for both companies were comparable to those faced by Sony (Williams 2013).

A key problem for organizations is that affected customers often discontinue the customer-to-organization relationship and they do not purchase products or services again once a data breach has taken place. For instance, the Ponemon Institute (2013) reported that more than 40 percent of customers who were notified of a data breach considered discontinuing their relationship with the organization due to unfulfilled service quality expectations. This is despite the fact that firms routinely notify affected customers regarding the breach and offer an apology, provide a breach description, explain what information was stolen, recommend steps that customers should follow to protect themselves, and provide a brief description of what the organization is undertaking to prevent further breaches (HHS 2013). Such notifications are standard recovery actions and are even mandatory in certain countries (e.g., the United States) and industries (e.g., healthcare) (HHS 2013). As an effective complementary response action to such information campaigns, breached organizations can compensate customers in response to a data breach (Belanger and Crossler 2011; Forrester Research 2009, 2011; Smith et al. 2011). However, although customer compensation² is more effective than information campaigns (Forrester Research 2011), it is also more costly. Thus, managers face the chal-

lenge of determining the appropriate level of compensation in response to a data breach. As data breaches have become more frequent (Forrester Research 2011), it is critical to understand how a breached organization can best determine the optimal level of customer compensation in response to a data breach.

Three major streams of research inform our work: (1) data and information systems (IS) security; (2) service failure; and (3) expectation confirmation research. First, data breaches are central to data and IS security research. Thus, research in this area offers important background for our work. Second, data breaches are electronically mediated service failures, that is, "disruptions in the core service (e.g., a 'blackout' or unscheduled 'down-time' in computing services) and failures in service processes" (Bolton 1998, p. 49). Thus, service failure research should provide us with a foundation for understanding how firms use compensation as a response to recover from service failures. Third, expectation confirmation research provides a theory-driven approach to explain how a customer's expectations toward compensation and their actual experiences in response to a breach together explain key outcomes of interest. In reviewing literature in these streams, we were unable to identify any empirical studies examining how customer compensation can be leveraged to successfully navigate the post-breach process once customer sentiment has already been compromised (for a similar conclusion, see Belanger and Crossler 2011; Smith et al. 2011).

Against this backdrop, we identified three relevant gaps in the literature. First, although studying data breaches is critical (Barlow et al. 2013; Crossler et al. 2013; Johnston and Warkentin 2010a, 2010b; Sen and Borle 2015; Wall et al. 2015; Wang et al. 2015; Warkentin et al. 2009; Warkentin et al. 2011; Warkentin and Willison 2009; Willison and Warkentin 2013), empirical work at the individual level is sparse and we found that most, if not all, studies exclusively reported data related to the data breaches *after* they had occurred; such approaches are plagued by various biases, such as recall bias (see Tversky and Kahneman 1974). Empirical work also reporting longitudinal data collected during a breach and in the immediate post-breach stages would provide a fresh view of customers' reactions toward compensation and potentially provide rich insights into data security.

Second, related to the absence of empirical data breach research, there are few empirical field studies investigating how organizations can leverage compensation as a response to real world service failures. Although service failure is a well-established research stream in marketing (see Baker et al. 2008) and service failures in face-to-face service environments (e.g., in a restaurant when a steak is undercooked) occur more commonly than data breaches, we were unable to

²We use the term *compensation* to refer to both product and service compensation.

identify any research that leveraged longitudinal data collected during and after a real world service failure. Instead, we found literature that conceptually examined compensation as a recovery action (e.g., Orsingher et al. 2010), studies that collected data exclusively during post-recovery stages (e.g., Maxham and Netemeyer 2002), and investigations using scenario-based experiments in laboratories (e.g., Grewal et al. 2008; Prasongsukarn and Patterson 2012). Such research approaches are subject to several threats including recall bias, experimental interaction effects (e.g., when respondents are aware that they are participating in an experiment), and limitations on the generalizability of the findings to a real world context (see Compeau et al. 2012).

Third, despite the increasing interest in expectation confirmation research in IS (e.g., Brown et al. 2012, 2014; Venkatesh and Goyal 2010), we were unable to find research that studied either the modified assimilation–contrast model (see Brown et al. 2012) or the generalized negativity model (see Brown et al. 2014) in a data breach context. Instead, prior IS work has leveraged expectation confirmation research to understand individuals' expectations toward IS in voluntary (e.g., library databases) or mandatory (e.g., organizational ERP systems) use settings (Brown et al. 2008; Staples et al. 2002; Venkatesh and Goyal 2010), examining key dependent variables such as satisfaction, intention to use, and use. In their review of expectations research, Brown et al. (2014) pointed out that multiple expectations models have been supported in the literature. They posited that one reason for the conflicting findings is that different studies have been conducted in different contexts and have employed different dependent variables. They recommended that future expectations research should consider additional dependent variables. In the context of data breaches and service recovery, dependent variables that focus on customers' continuing engagement with the organization are particularly relevant. Testing expectation confirmation models in a data breach context provides an opportunity for examining additional dependent variables in order to find a match between expectations models and dependent variables in this context, thus contributing to research in the domain of data breaches and understanding the applicability and potential boundary conditions of expectation confirmation models (for a discussion on breakdowns and mystery, see Alvesson and Karreman 2007).

In order to address the gaps identified above, the current work applies a quantitative approach and examines the effect of customer compensation—the most common and expensive action that can be employed by organizations to recover from a breach—on customer sentiment. To test the effectiveness of customer compensation as a recovery action, we leverage work on expectation confirmation (e.g., Anderson 1973; Brown et al. 2014) to predict three outcome variables:

namely service quality, continuance intention, and repurchase intention. To this end, we draw on recent IS research that has highlighted the importance of expectations in explaining various outcomes following an intervention (e.g., Venkatesh and Goyal 2010). We empirically test our hypotheses using longitudinal data gathered during and after the 2011 Sony PlayStation Network data breach. This work thus has the following objectives:

- (1) Discuss the methodological limitations in prior data breach and service failure research.
- (2) Develop polynomial models to understand user compensation as a data breach recovery action.
- (3) Empirically validate the proposed models using longitudinal data collected in the context of Sony's data breach.

Our work is expected to make three major theoretical contributions. First, we contribute to research on data and IS security by examining the effect of customer compensation as a data breach recovery action. Our work thus provides insights into a real world, high-profile data breach that has customer service implications. To the best of our knowledge, our study is among the first that uses longitudinal data of a real data breach to test the effects of customer compensation on key customer outcomes, namely service quality, continuance intention, and repurchase intention. Second, we contribute to the service failure literature because our study is among the first that leverages longitudinal field data collected in the context of an electronically mediated real world service failure (i.e., Sony's data breach). Third, we contribute to research that focuses on psychological contract breaches (Zhao et al. 2007). So far, little work in this area has studied customers' reactions in situations where a customer-centric service provider has failed in its obligations. Further, our work has critical implications for practitioners because we illustrate how compensation can be leveraged as a response to a data breach. Likewise, this work will inform practitioners managing electronically mediated service failures (e.g., website outages). As service failures are inevitable for most service companies (see Baker et al. 2008), our research is relevant to a large practitioner base.

Background

Data Breaches

A data breach is an electronically mediated service failure that occurs when sensitive financial, personal, or customer data is released to or accessed by parties external to the organization. This exposure may be deliberate, such as through a hacking incident or due to the actions of a disgruntled employee, or

accidental, such as a lost laptop (Hsu et al. 2015; Johnson 2008; Johnston et al. 2016; Kwon and Johnson 2015; Lowry et al. 2015), and may relate to any aspect of an organization's activities or associations, such as customers, trading partners, and internal systems (see Symantec 2013). Because data are typically collected by an organization as it fulfills its service offerings to customers, at least some of the data stored by an organization may relate to the organization's customers themselves. Prior research has used a variety of terms to describe data breaches, such as security breaches (Cavusoglu et al. 2004), information breaches (Malhotra and Malhotra 2011), and privacy breaches (Wong et al. 2011). Following Culnan and Williams (2009) and others, we use the term *data breach* because, although the organization may know that their data has been breached, it typically does not know the content of the breached data until after the incident has been detected and investigated (Tomaszewski 2006). Thus, a data breach can incorporate security, information, and privacy breaches.

The risk of data breaches has been a topic of interest to IS researchers since the 1970s (e.g., Lane and Wright 1978). Early research focused on the risks posed by physical access to sensitive business data and the threat posed by competitor access to electronic processes (Loch et al. 1992). Research into the threat of large-scale data breaches became more popular in the early 2000s, with the growth of commercial Internet access. As organizations have become more interconnected and reliant on confidential customer data, the number and magnitude of data breaches has grown considerably (Crossler et al. 2013; Johnson 2008; Otto et al. 2007; Shropshire et al. 2010).

A review of prior literature on data breaches (see Appendix A) identified 31 studies, all of which focused on the organizational impact of data breaches. We were unable to find any studies investigating customer reactions to data breaches. Out of the 31 studies, 3 focused on managers' reactions to data breaches within organizations (Herath and Rao 2009; Rhee et al. 2012). For example, Herath and Rao (2009) developed a model explaining the adoption of information security practices and policies within organizations as a reaction to a data breach. Most of the remaining studies employed event study methods to understand market reactions to breach announcements (Rakes et al. 2012). Although providing critical information for internal organizational threats, none of these studies investigated how to manage customer reactions to data breaches. Taken together, this discussion demonstrates that there is a lack of research that helps determine the level of customer compensation that is expected as a response to data breaches.

Service Failure

Service failure is a disruption in the core service processes (Bolton 1998) and it affects customer retention and sentiment (Bitner et al. 1990). Service failures constitute negative experiences for affected customers and may include various events in different contexts, such as overly long wait times in restaurants, point-of-sale terminal downtime in retail environments, temporary network outages that could be triggered by data breaches (e.g., Sony's data breach), or an unclean hotel room. There is a considerable amount of research that has studied how to best respond to service failures across a range of industries and service failure experiences (Bitner et al. 1990; Gelbrich 2010; Lee and Lee 2012). As explained in Appendix B, we reviewed 44 articles focusing on service failure and recovery actions that firms pursue as a response strategy to these undesired events. We found several trends in this literature that are noteworthy.

First, an apology and explanation are the cheapest actions for firms as a response to a service failure and firms usually provide them as a matter of course (Baker et al. 2008). The main motivation for firms to apologize and provide information regarding the service failure is to appease affected customers. For instance, Liao (2007) studied customers' reactions to a service failure and found that an apology had a positive effect on justice perceptions that in turn positively affected individuals' satisfaction with service recovery and repurchase intentions. Given that few, if any, costs are associated with an apology and information provision regarding the service failure, much literature in this area concluded that firms should offer an apology in service failure situations regardless of the service failure severity (see Mattila 2009).

Second, we found a considerable amount of research studying the effect of compensation on customer reactions toward product and service failures (Gelbrich 2010; Lee and Lee 2012; Mattila and Patterson 2004). Although there is agreement on the positive effect of compensation as a service failure recovery strategy, there is less clarity on how to best match customers' expectations and compensation levels (see Gelbrich 2010). As indicated earlier, offering an apology is usually undertaken as a matter of course in the event of a service failure. However, prior work found that compensation is a more effective recovery strategy in a service failure scenario (Bitner et al. 1990; Gelbrich 2010; Lee and Lee 2012). Customers' expectations of compensation vary depending on the service failure severity and the context in which the service failure occurs (e.g., car recall by an automobile manufacturer, a poorly cooked meal at a restaurant, or a lost parcel by a courier service). For instance, some studies

suggested that customers expect small gifts or vouchers in response to a service failure (see Huang and Lin 2011). Customers with greater service usage or patronage levels expect content or additional products and services (e.g., extra desserts) as compensation (Grégoire et al. 2009). Other studies have suggested full compensation in order to restore perceptions of the service to the original level that existed prior to the service failure. Full compensation can include product recalls and product replacements (e.g., offering a new steak at a restaurant) (Johnston and Fern 1999). When using full compensation, the organization aims to fully reconstitute sentiment both by restoring the products to their original level and by addressing the customer's sense of loss. Further, although some studies have found that higher compensation levels have higher positive effects on customer sentiment than lower compensation levels (Boshoff 1997), vastly inflated levels of compensation can negatively affect customer outcomes because the reward can be viewed as disproportionate to the service failure and customers may associate overcompensation with guilt (Estelami and De Maeyer 2002).

Third, out of the 44 articles, we found no field study that collected longitudinal empirical data from affected customers during and after a real world service failure. Instead, much prior work studied service failures in laboratory settings where participants were confronted with artificially designed service failure situations (Baker et al. 2008; Roggeveen et al. 2011). For instance, Du et al. (2011) investigated customers' emotions during pre- and post-failure stages and the authors designed a service failure scenario in a laboratory. Similarly, many authors exposed participants to service failure scenarios and studied their reactions toward an exemplified service failure scenario (Baker et al. 2008; Gelbrich 2010). As is often the case with laboratory settings, participants must imagine how they would react to a particular scenario, which is unlikely to reflect their actual reactions to a real service failure.

In sum, prior work on service failure suggests that firms should apologize to customers in response to a service failure because it is an inexpensive recovery mechanism. Research suggests that most firms use apology as a matter of course. Further, although compensation generally is a more effective response strategy, it is also more expensive than an apology. Due to the costs involved in providing compensation, it is valuable for firms to determine the most appropriate compensation level for affected customers. Finally, little prior work has collected longitudinal empirical data from affected customers during and after a real world service failure. This highlights a key theoretical and empirical gap: there is a need to better determine the optimal level of customer compensation as a response mechanism for service failures.

Expectation Confirmation Research

Expectation confirmation has received a great deal of attention in the IS literature (Bhattacharjee 2001; Brown et al. 2008, 2012; Staples et al. 2002; Venkatesh and Goyal 2010). Recent IS research has leveraged the models identified by Oliver (1977): assimilation, contrast, assimilation–contrast, and generalized negativity (Brown et al. 2014). An assimilation view suggests that in order to reduce cognitive dissonance, individuals will adjust their outcome evaluations to be consistent with their expectations (Sherif and Sherif 1967). A contrast view is based in disconfirmation of expectations and suggests that outcome evaluations are a function of the direction and size of the gap between expectations and experiences, with experiences having a stronger effect (Churchill and Surprenant 1982; Patterson et al. 1997). Assimilation–contrast integrates these two perspectives. The assimilation model is proposed to hold for small disconfirmation magnitudes (i.e., those within a zone of tolerance) such that the outcome evaluations will be biased in favor of expectations to reduce cognitive dissonance. The contrast model is proposed to hold for large disconfirmation magnitudes, such that experiences lead to either a surprise effect (i.e., experiences greatly exceed expectations) or a disappointment effect (i.e., experiences fall very short of expectations). Finally, the generalized negativity model is based on the met expectations hypothesis (Irving and Meyer 1994; Wanous et al. 1992) and proposes that any disconfirmation, positive or negative, between experiences and expectations will negatively affect the resulting outcome evaluations.

Prior IS research has demonstrated support for each of the models. For the assimilation model, Szajna and Scamell (1993) demonstrated that by setting expectations high, user satisfaction was higher for the same system than when expectations were set low. Staples et al. (2002) demonstrated support for the contrast model by showing that unrealistically high expectations were associated with lower perceptions of system effectiveness and satisfaction, when compared to having accurate or low expectations. Venkatesh and Goyal (2010) found support for a generalized negativity model by demonstrating that any mismatch between experiences and expectations was associated with a negative response toward using the IS. Finally, Brown et al. (2012) integrated the assimilation–contrast model and prospect theory and provided evidence in support of a modified assimilation–contrast model. Drawing on prospect theory (Kahneman and Tversky 1984; Tversky and Kahneman 1991), the modified assimilation–contrast model suggests that negative disconfirmation has a greater negative effect on technology use than positive disconfirmation has in the positive direction (see Brown et al. 2012). The results showed that small disconfirmation magnitudes were assimilated toward expectations,

resulting in a positive effect on software use, whereas large negative disconfirmation magnitudes were associated with reduced use; large positive disconfirmation magnitudes were associated with increased use, although not at the same magnitude as negative disconfirmation (Brown et al. 2012). Recently, Brown et al. (2014) demonstrated similar results across multiple dependent variables: intention, use, and satisfaction. Given that much literature on service failure suggests that, once a service failure occurs, customers adjust their expectations in terms of their expected compensation, we believe that the literature around expectation confirmation provides an appropriate theoretical basis for our work. As explained in greater detail later, we draw on the modified assimilation–contrast model and the generalized negativity model to formulate our hypotheses.

Outcomes of Interest

Given the context of this study, the literature on data breaches, service failure, and expectation confirmation suggests that three outcomes (i.e., service quality, continuance intention, and repurchase intention) could serve as important metrics of the effectiveness of compensation as a data breach recovery action (Baker et al. 2008; Maxham and Netemeyer 2002; Venkatesh and Goyal 2010). Each outcome is discussed in greater detail below.

Service Quality

The earlier discussion on service failures provides a relevant base for using service quality as an important outcome for service failure recovery. Much prior work used service quality to evaluate the effect of service failure recovery actions, such as compensation (Lee and Lee 2012; Maxham and Netemeyer 2002). In the context of our work, service quality is defined as the degree to which a customer perceives the service meets his or her needs and expectations (adapted from Zeithaml et al. 1996). A service that matches the customer's requirements is deemed to be of high quality (Zeithaml et al. 1996). Because a data breach violates a customer's expectations of the service, it can cause a perception of inferior quality (Malhotra and Malhotra 2011). Therefore, a customer's perception of the quality of the service can also fall.

Continuance Intention

There is substantial research suggesting that continuance intention is a key variable to study when aiming to understand individuals' use of technology (Bhattacharjee 2001; Venka-

tesh and Goyal 2010). Given that Sony's PlayStation Network relies on users continuing to play online, continuance intention is a key outcome to study in our work. In the context of our work, continuance intention is defined as the degree to which a user feels he or she will keep using the service (Bhattacharjee 2001). A data breach disrupts the online service, thereby compromising the user's intention to continue using the system.

Repurchase Intention

Much service failure research has studied customers' repurchase intentions to understand how firms can leverage compensation as a response mechanism to service failures (Baker et al. 2008; Grewal et al. 2008; Roggeveen et al. 2011). Given that Sony's network profitability also relies on customers' repurchase behavior (e.g., purchasing new online content, such as games), repurchase intention is an important outcome to study in this context. Repurchase intention is defined as the degree to which a customer plans to purchase a product or service from a given provider or retailer again in the future (adapted from Grewal et al. 2008; Mittal and Kamakura 2001). A data breach contains material that is financially or personally sensitive to a customer. To avoid further information being breached and undue personal risk, the customer may decline to repurchase services from the provider.

Together, these three outcomes help us gain a better understanding of the effectiveness of compensation as a data breach recovery action.

Hypotheses Development

Information provision regarding a data breach is common and firms apologize as a matter of course (Baker et al. 2008). As explained later in greater detail, this was also the case in Sony's data breach. Within three days of the initial attack, Sony provided detailed information and also published an apology on their PlayStation Network blog. Also, although not providing any details, Sony indicated in the early stages of the breach that the company was considering compensation packages for affected users.

Much prior service failure research indicates that individuals expect different levels of compensation in response to a service failure (Prasongsukarn and Patterson 2012). In the case when actual compensation levels meet customers' expectations in response to a service failure, prior work suggests that compensation can positively influence several outcomes including perceived service quality (Orsingher et al. 2010),

continuance intention (Huang 2008; Lee and Lee 2012; Maxham and Netemeyer 2002; Orsingher et al. 2010), and repurchase intention (Baker et al. 2008; Grewal et al. 2008; Lee and Lee 2012; Maxham and Netemeyer 2002).

The role of expectations in influencing outcomes is more complex than simply assessing whether or not expectations are met. Expectation research argues that the magnitude and direction of expectation disconfirmation are critical (Anderson 1973; Brown et al. 2012, 2014). The assimilation–contrast model (Anderson 1973) proposes that when experiences are close to expectations (i.e., within a perceived zone of tolerance), outcome assessments will assimilate toward expectations. A zone of tolerance “represents the range of IS service performance a customer would consider satisfactory” (Kettinger and Lee 2005, p. 607). In the context of the current study, the perceived zone of tolerance is the magnitude of compensation disconfirmation that a customer would consider as satisfactory in response to Sony’s data breach. For example, a customer’s expectations would be fully met if he/she expected downloadable content (e.g., games) from Sony and actually received it as a response to the breach. In this scenario, the customer’s expectation disconfirmation would be zero (i.e., equal to the ideal point) and would have a positive effect on the customer’s perceptions of service quality, continuance intention, and repurchase intention. Likewise, those customers who expected downloadable games but received free membership as compensation from Sony would likely be satisfied with the compensation because the magnitude of disconfirmation seems relatively little—remaining within the perceived zone of tolerance. Therefore, expectation disconfirmation falling within the zone of tolerance will also be associated with positive outcome assessments. Thus, we hypothesize

H1: When the magnitude of expectation disconfirmation regarding compensation is small and within the perceived zone of tolerance, there will be a positive effect on the outcome variables of service quality, continuance intention, and repurchase intention.

Our second hypothesis focuses on the situation where the expectation disconfirmation levels are large. Large expectation disconfirmation can be positive or negative. An example of a large negative expectation disconfirmation in the context of our study would be if a customer expects a product replacement (e.g., new console) as compensation for Sony’s data breach but receives a general compensation (e.g., small cash incentive) instead. In such a scenario, when experiences fall far short of expectations, the customer will experience a disappointment effect, leading to negative outcome evaluations. An example of a large positive expectation disconfirmation would be if an affected customer expects

general compensation (e.g., small cash incentive) but actually receives a product replacement (e.g., new game console from Sony). Under normal conditions, when expectations are greatly exceeded, the customer will experience a surprise effect, leading to positive outcome evaluations. However, research on service failure suggests that inflated levels of compensation can negatively affect customer outcomes, such as service quality perceptions and service continuance (Bolton 1998; Maxham and Netemeyer 2002). This is due to the belief that the reward is disproportionate to the service failure and may be associated with guilt or insincerity on the part of the organization (Kim and Ulgado 2012). Therefore, we anticipate that a large positive expectation disconfirmation would lead to a situation in which customers feel overcompensated. Further, recent IS research (see Brown et al. 2012) examining technology use at the individual level found that for the same magnitude of expectation disconfirmation, losses loom larger than gains (Kahneman and Tversky 1979). In other words, when the magnitude of the expectation disconfirmation between experiences and expectations is equal, positive expectation disconfirmation has a smaller positive impact on outcome evaluations than negative magnitudes’ negative impact. Therefore, we anticipate that for service quality and continuance intention, the basic tenets of the modified assimilation–contrast model (Brown et al. 2012) will hold. Thus, we hypothesize

H2: When the magnitude of expectation disconfirmation regarding compensation is large and outside the perceived zone of tolerance, the positive effect of positive disconfirmation on service quality and continuance intention will be significantly smaller than the negative effect associated with the same level of negative disconfirmation.

In the context of a data breach, the outcome of repurchase intention fundamentally differs from service quality and continuance intention because it requires customers to exchange monetary value with the service provider (e.g., paying Sony via credit card for further downloadable content such as PlayStation Network games). Given the negative nature of a data breach coupled with customers’ concerns about exposing their credit card information due to unsecured data networks (Johnson 2008; Zafar et al. 2012), we suggest that customers’ expected compensation levels must be met in response to a data breach in order to retain customers’ repurchase intention. In the case of positive disconfirmation, as indicated above, customers will become suspicious of the inflated level of compensation, which will negatively affect their willingness to repurchase products from the company. In the case when expectations are negatively disconfirmed (e.g., when a customer expects a product replacement but actually receives a small gift card), customers will be disappointed and less likely

to continue paying for products from the breached company (i.e., making purchases through Sony's PlayStation Network). Thus, we hypothesize

H3: When the magnitude of expectation disconfirmation regarding compensation is outside the perceived zone of tolerance, repurchase intention will decrease, regardless of the direction of disconfirmation.

Method and Results

Setting

The study is a field study, collecting data from users of the Sony PlayStation Network, an online multiplayer gaming service with more than 100 million registered users worldwide. It constitutes a significant component of Sony's gaming division, which earned Sony US \$9B in 2010 (Edwards et al. 2011). Network access and use is restricted to owners of a Sony PlayStation 3 video game console. The network provides users with access to new games, system and game software updates, downloadable content, streaming movies on demand, and a music store. The network also provides in-game services to allow users to track their progress, earn achievements for completed tasks, and interact socially with other users. Sony uses the network to validate the operational integrity of PlayStation clients, which prevents tampering and user misbehavior on the network. To create an account on the network, users must provide personal information including their name, birth date, residential address, and a valid e-mail address. Users may also provide their credit card as part of the registration procedure. This personal identification and financial information are then encrypted and stored on a central server.

Without notice or explanation, on April 20, 2011, the network became inaccessible to users around the world and PlayStation owners could no longer access any of the network's services. A day later, Sony announced on its official blog that the network might be inaccessible for a day while they investigated the problem (Seybold 2011). This network outage eventually lasted for more than three weeks. Amid speculation about the cause, various news media outlets eventually announced that the network had been compromised, and that user details, email addresses, credit card numbers, and purchase history information had been stolen from 77 million user accounts (Cellan-Jones 2011). In May, 2011, Sony began progressively reinstating network access across individual country sites. In early June, Sony offered all network users a "Welcome Back" package as compensation, comprising a selection of free games, temporary access to premium network features, and a free one-year subscription

to a credit monitoring service. The Sony PlayStation Network data breach is one of the largest to have ever occurred. International news sources, such as the BBC and CNN, provided ongoing coverage of the breach. Major financial institutions, such as JPMorgan Chase and Bank of America, advised their customers to carefully monitor their credit card records for suspicious transaction activity (Aspan and Baldwin 2011).

Participants

We recruited participants using Mechanical Turk. In total, we received 557 usable responses in the round 1 survey. Of these, 144 also responded in round 2 of the survey. Appendix E summarizes the respondent demographics for both rounds. Table E1 shows that user demographics were comparable in both rounds. There were more men in the samples, with approximately 66% in round 1 and 62% in round 2, which is consistent with the profile of the sampling frame provided by the panel data provider. Income figures suggest a reasonable spread across salary levels. Approximately half of the respondent group was between 20 and 30 years of age, which is typical of the online population.

Design and Measurement

To design our field study, we considered three important elements. First, we needed to gather data on a range of variables among a group of users. Second, the speed of events meant that we needed an expeditious method for gathering data. Third, using expectation confirmation research necessitated a two-stage approach to gathering data in order to understand changes in user perceptions and their impacts on key outcomes. Therefore, we used a two-stage longitudinal online survey to collect data.

We developed two versions of our research instrument. The first version of our instrument was used during the first data collection round and it was designed to examine user *expectations* regarding Sony's efforts to recover from the data breach. The second version of our instrument was used during the second data collection round and it was tailored to measure user *experiences* regarding Sony's efforts to recover from the data breach. We surveyed the same users in both rounds. Figure 1 shows the timeline of the data breach juxtaposed with the two data collection rounds. Consistent with prior research (e.g., Venkatesh et al. 2003), we adapted existing scales where possible. We required two sets of compensation items, in order to capture expected compensation (C2) and experienced compensation (C1). Because we did not know what compensation would be offered by Sony, we

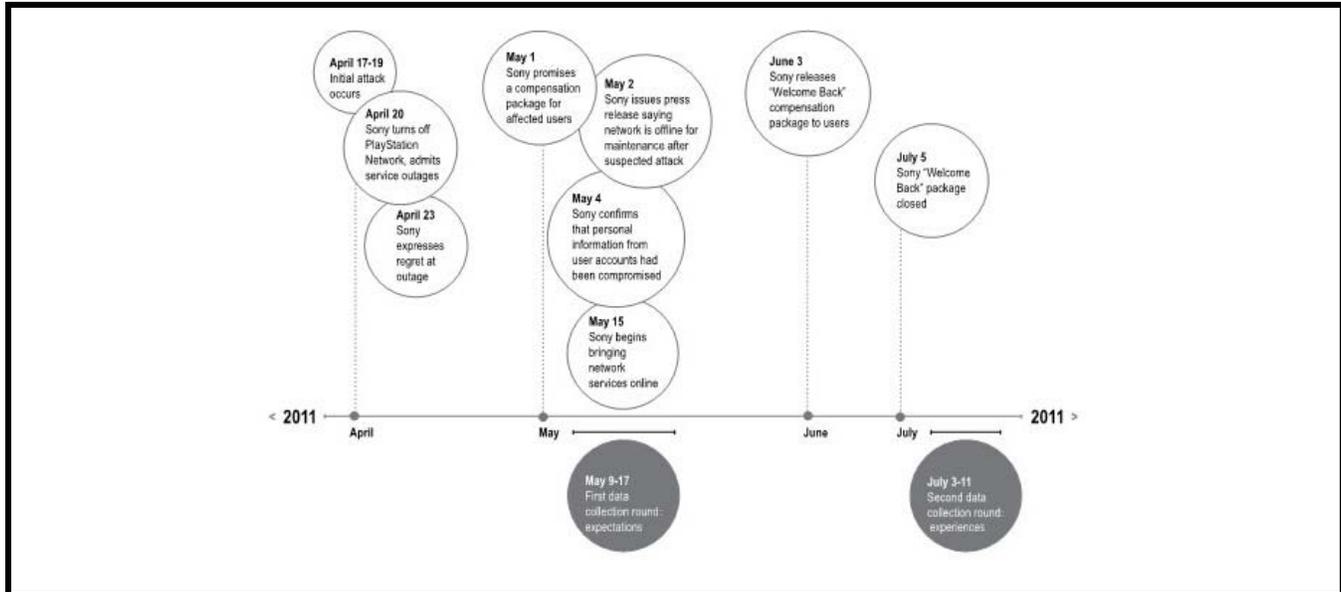


Figure 1. Timeline of Sony PlayStation Network Data Breach and Data Collection Rounds

needed to capture a variety of compensation types in both rounds (for instance, Sony could have offered one month of free service or a free replacement game console). Due to the fact that Sony focuses on providing products and services to customers, we did not survey respondents regarding financial compensation types, such as credit monitoring. Because the nature of this compensation could be both additive and mutually exclusive, we modeled compensation as an index measure. Index measures are also commonly used in service failure research and we found several studies that have used index measures to evaluate customer reactions toward service experiences (see Brown et al. 2005).

We adapted a three-item scale for compensation from Smith et al. (1999) and Smith and Bolton (1998, 2002). In developing items for compensation, we note that general items that do not specify a contextual connection could be used (e.g., "I expect that the console network provider will give me compensation if a security breach occurs") or items that leverage the context could be used (e.g., "I expect that Sony gives customers free downloadable content if the network is breached"). We used both approaches, but given the focus on context as a basis for our theory development (Alvesson and Kärreman 2007; Johns 2006), we used the context-based items in our analysis. An example expectation item (C2) was: "I expect to get a new console if the console network gets hacked." We created corresponding items for experience with compensation (C1). Following Edwards (2002), we computed the experience product score of $[x=(C1*C2)]$ in order to capture the interaction between expectations and experiences

and used the product scores in further analyses outlined below.

To measure our outcome variables, we drew on prior literature in marketing and IS because they have been widely cited in previous studies of security and IS use. The extent of prior use of these items meant that they had been validated across a variety of contexts. The scale for service quality was adapted from Yoo et al. (2000) and continuance intention items were adapted from Venkatesh and Goyal (2010). The repurchase intention construct was measured using items adapted from Brady et al. (2008). Appendix C lists the constructs and corresponding survey items employed in our study. We used seven-point Likert scales for all items. As in prior work, gender was a dichotomous variable. Based on Dillman et al. (2008), age and annual salary were measured in grouped categories, as shown in the "Results" section later (see Appendix E). Fortunately, it is possible that our analytical tool is robust to the violation of ordinal data (Conover and Inman 1981; Labovitz 1970).

Age and gender were employed as control variables in all models following prior work on service failure and IS research (see Hess et al. 2003; Morris et al. 2005). In addition, we controlled for three variables related to the context: extrinsic motivation, intrinsic motivation, and habit associated with Sony PlayStation Network gaming. The motivational model with its roots in psychology (see Vallerand et al. 1997) has been demonstrated to have substantial explanatory power in explaining human behavior including technology use (see

Venkatesh et al. 2003). Although a variety of models, such as the technology acceptance model and unified theory of acceptance and use of technology, have been widely used in IS research (Venkatesh et al. 2003; Venkatesh et al. 2012), because of the hedonic nature of gaming, we felt it was more appropriate to control for variables that related to the behavior. Specifically, there is evidence in IS research that these motivations, and especially intrinsic motivation, are particularly suited to explaining technology-related behaviors for hedonic contexts (see van der Heijden 2004; Venkatesh and Johnson 2002; Venkatesh and Speier 2000). Also, when behaviors, including technology use, have been previously performed, the role of habit can be significant (see Venkatesh et al. 2012). For these control variables, namely extrinsic motivation, intrinsic motivation, and habit, we adapted validated scales from previous research (see Venkatesh 2000; Venkatesh and Johnson 2002; Venkatesh and Speier 2000; Venkatesh et al. 2012).

Pre-test and Administration

Prior to both stages of the survey administration, we conducted a pre-test of each instrument in order to strengthen readability and face validity. We asked four IS researchers at an Australian university to complete a paper-based version of the survey. We asked respondents to flag unclear or confusing items or sections of the survey instrument. We discussed these items among the researchers and in light of the existing literature. We modified the items in accordance with the respondent feedback and produced final versions of the survey instruments.

We employed a panel data provider to administer the surveys. Candidate respondents were first required to indicate their ownership of a range of different electronic devices. Those who did not indicate ownership of a Sony PlayStation 3 were excluded from the participant group. Participation was encouraged via small monetary incentives provided by the panel data provider: each respondent was paid U.S. \$5 to participate in round 1 and US \$6 to participate in round 2.

The first survey round was undertaken when Sony's data breach initially took place, beginning on May 9, 2011, and lasting for eight days. The second round was initiated after Sony had repaired the network and offered a compensation package to users, beginning on July 3, 2011, and lasting for eight days. Once the second data collection round was completed, we examined the survey completion times of all responses. We then excluded respondents who took too little time to complete the survey or inconsistently answered items (e.g., responding "incorrectly" to reverse-coded items). We felt that comparing early versus late responses was unneces-

sary because each data collection round was completed in about a week and no reminders were employed (Churchill 1979). Because the panel data provider was asked to exclusively contact participants who also completed the survey during the first data collection round, we received fewer responses in the second round. We conducted additional testing in order to identify potential response bias. The results presented in Appendix D revealed no evidence of a response bias in round 2.

Prior work on common method bias recommends using longitudinal surveys to alleviate common method concerns. This is due to the fact that the temporal separation of survey rounds reduces the likelihood that respondents can cognitively access their initial responses during the follow-up data collection rounds (see Rindfleisch et al. 2008). Our longitudinal research design thus helps alleviate threats from common method bias. In addition, we conducted a Harman's one-factor test (see Podsakoff and Organ 1986) and the marker variable technique (Lindell and Whitney 2001; Malhotra et al. 2006) to investigate the presence of common method bias.³ For the Harman's one-factor test, we entered all variables of interest into a factor analysis to check if a single factor emerged or if one single factor accounted for the majority of the variance explained. Neither condition was met and no component explained more than 50% of the model. For the marker variable technique, we used the smallest observed correlation among the variables in our data as a proxy for common method variance (Lindell and Whitney 2001; Malhotra et al. 2006). The matrixes of item-to-item correlations for the computed models showed a high proportion of nonsignificant item-to-item correlations in the data. Given our research design, we conclude that common method bias was not a major concern for the data we collected.

Data Analysis Approach

Below, we introduce the principles of polynomial modeling, response surface methodology, and the analytical representation of the models tested for our study (see Brown et al. 2014; Venkatesh and Goyal 2010).

Polynomial Modeling

Polynomial modeling includes a hierarchical analysis of polynomial equations that allows researchers to examine com-

³Whereas both the Harmon test and the marker variable approach have serious drawbacks that can lead to erroneous conclusions about the extent of CMV (Podsakoff et al. 2003; Sharma et al. 2009), they are both still used.

plex relationships between component measures and outcome variables (Venkatesh and Goyal 2010). The constraints imposed by the direct measurement of disconfirmation can be relaxed by using the procedure described by Edwards and Harrison (1993). In contrast to linear models, polynomial modeling permits the examination of curvilinear terms and provides a more accurate representation of the relationships between the component measures and outcomes (Edwards 2002; Edwards and Harrison 1993). By relaxing the constraints of the regression equation that corresponds to the theoretical model, the constraints can be used to falsify the hypotheses. Edwards (2002) suggests that a conceptual model is supported if (1) the variance explained by the unconstrained equation is different from zero; (2) the constraints imposed by the model are satisfied; (3) all coefficients included in the regression equation follow the appropriate pattern; and (4) the variance explained by the higher-order terms (one order higher than those in the equation) does not differ from zero. As outlined by Venkatesh and Goyal (2010), component scores are initially entered into a linear equation to test their relationship with an outcome variable. The second stage of the analysis involves the inclusion of higher-order terms along with product terms into the equation in order to test for curvilinear relationships among the variables. Next, quadratic and cubic terms can be added to the equation to identify the existence of higher-order curvatures (Edwards 2002). This procedure is repeated until the variance explained by the next higher-order equation is statistically insignificant. As indicated earlier, we measure two distinct component measures, namely compensation expectations (C_2) and post-service failure compensation experiences (C_1). Polynomial modeling allows us to maintain the distinction between expectations and experiences, and separately investigate their effects on the outcome variables.

Response Surface Methodology

Response surface methodology is a collection of statistical tests used to gain a richer and deeper understanding of higher-order polynomial regressions. Because polynomial equations are often difficult to interpret, researchers use response surface methodology because it helps in visualizing the surface's equation coefficients (Edwards and Parry 1993). Response surface methodology centers around three key features of the surfaces created based on the polynomial models: stationary point, principal axes, and slopes along the lines of interest. Edwards and Parry (1993) define a stationary point as a point at which the slope of the surface is zero in all directions. Principal axes are defined as lines running perpendicular to each other with an intersection at the stationary point (Edwards and Parry 1993). The upward curvature is maximum along the first principal axis for a con-

vex surface. The downward curvature is minimum along the second principal axis for concave surfaces. The other lines of interest include the confirmation axis and disconfirmation axis. The disconfirmation axis runs perpendicular to the confirmation axis.

Proposed Models

In order to test our proposed models, we use the analytical representations developed by Brown et al. (2014). We present an overview here and the interested reader is referred to Brown et al. (2014) for a detailed discussion of the derivation of the various tests.

Assimilation–Contrast Model

We proposed a modified assimilation–contrast model (see Brown et al. 2014) for the outcome variables of service quality and continuance intention. As represented in hypotheses 1 and 2, our model proposes that if the magnitude of expectation disconfirmation is small and within the perceived zone of tolerance, there will be a direct positive effect on service quality and continuance intention. In contrast, if the magnitude is large and outside the perceived zone of tolerance, service quality and continuance intention will be influenced by the magnitude and direction of the disconfirmed expectations. High positive disconfirmation will have a large positive effect on service quality and continuance intention. High negative disconfirmation levels will have a large negative effect on service quality and continuance intention. Based on the existing assimilation–contrast literature (Brown et al. 2012), we propose that negative disconfirmation levels have a larger impact than positive disconfirmation levels. An analytical representation of this model is shown below:

$$Z = b_0 + b_1C_1 + b_2C_2 + b_3C_1^2 + b_4C_1C_2 + b_5C_2^2 + b_6C_1^3 + b_7C_1^2C_2 + b_8C_1C_2^2 + b_9C_2^3 + e \quad (1)$$

Where Z = Outcome variable (service quality, continuance intention); C_1 = Experienced compensation; and C_2 = Expected compensation.

In terms of slopes along the confirmation and disconfirmation axes, a_x represents the slope along the confirmation axis and a_y represents the slope along the disconfirmation axis.

The following tests need to be supported to find support for the model:

- Test 1: $a_y^3 > 0$
 Test 2: $|b_6|, |b_7|, |b_8|, \text{ or } |b_9| > 0$

- Test 3: $a_x > 0$
 Test 4: $a_x^2 = 0$
 Test 5: $a_x^3 = 0$
 Test 6: a_y (negative disconfirmation) = a_y (positive disconfirmation)

Generalized Negativity Model

We proposed a generalized negativity model (see Brown et al. 2014) for repurchase intention. As presented in hypothesis 3, this model is based on the assumption that a state of cognitive dissonance occurs if a person expects a certain event but experiences something different (Carlsmith and Aronson 1963). For the generalized negativity model, any disconfirmation negatively influences the outcome evaluations, independent of whether the disconfirmation is positive or negative. Thus, in the context of our study, we propose that positive or negative disconfirmation levels will have a negative effect on repurchase intention. An analytical representation of this model is shown below:

$$Z = b_0 + b_1C_1 + b_2C_2 + b_3C_1^2 + b_4C_1C_2 + b_5C_2^2 + e \quad (2)$$

Where Z = Outcome (repurchase intention); C_1 = Experienced compensation; and C_2 = Expected compensation.

As noted earlier, in terms of slopes along the confirmation and disconfirmation axes, a_x represents the slope along the confirmation axis and a_y represents the slope along the disconfirmation axis.

The following tests need to be supported to find support for the model:

- Test 1: $|b_3|, |b_4|, \text{ or } |b_5| > 0$
 Test 2: $a_y = 0$
 Test 3: $b_1 = b_2$
 Test 4: $a_y^2 < 0$
 Test 5: $a_x > 0$
 Test 6: $a_x^2 = 0$
 Test 7: $b_3 < 0; b_4 > 0; b_5 < 0$

Results

Preliminary Analysis

Given the reasoning outlined in the hypotheses development section, we expected the data to be nonlinear. Edwards (2009) suggests using polynomial regression analysis when nonlinearity is expected. Therefore, following Edwards (2002), we initially screened the data set for outliers using

Cook's D and standardized residuals from regression equations. In total, we excluded 12 cases that met the minimum criteria recommended by Bollen and Jackman (1985). Due to the fact that the number of cases excluded in this study only represents a very small part of our sample size, we concluded that our results did not suffer from a bias in the statistical model (Cohen et al. 2003). Next, we calculated the average of the scale-centered compensation items in order to estimate expectations and experiences. Edwards (2002) recommends undertaking this step by subtracting the scale midpoints from the actual scores. Scale centering reduces multicollinearity problems and improves meaningful interpretation of the polynomial equation coefficients (Edwards 2002; Edwards and Harrison 1993). The scores computed after scale-centering ranged from -3 to +3, as we used seven-point Likert agreement scales to measure our items. The variance inflation factors (VIFs) were low for all variables (< 2.5), indicating that the data did not suffer from multicollinearity problems. Because we used similar items to measure expectations and experiences, we used the Durbin-Watson test statistic to check if our data suffered from correlated measurement errors between the items—the results ($p > 0.05$) revealed that this was not a problem.

As suggested by Edwards and Parry (1993), bootstrapping and jackknifing are both appropriate procedures to estimate the significance levels for response surface components including the slopes of the confirmation and disconfirmation axes. Bootstrapping is generally believed to be freer of bias and thus we used it to calculate the significance levels for various estimates. For all analyses, C_1 represents experienced compensation, C_2 represents expected compensation and Z represents the various outcome variables (i.e., service quality, continuance intention, and repurchase intention). The scales were all found to be reliable with Cronbach alpha values exceeding .80 in all cases.

As expected, a principal component analysis with direct oblimin rotation to allow for correlated factors supported a two-factor solution across the expectations and experiences, with all loadings greater than .70 and cross-loadings less than .35. We followed Harman (1976) and chose a delta value = 0 because it yields factors that are most oblique. The pattern of results for a principal components analysis with direct oblimin rotation with all multi-item independent variables revealed a similar pattern and is shown in Table 1. Discriminant validity was supported by low cross-loadings (all were less than .40). Convergent validity is supported by loadings exceeding .707 for all constructs.

The descriptive statistics and correlations are shown in Table 2. The descriptive statistics show that the means of both expected and experienced compensation scales were all above

Table 1. Loadings and Cross-Loadings

		1	2	3	4	5
Extrinsic motivation	1	.75	.20	.08	.04	.08
	2	.77	.21	.16	.02	.05
	3	.83	.20	.23	.08	.10
Intrinsic motivation	1	.20	.84	.20	.10	.13
	2	.14	.73	.17	.13	.12
	3	.15	.75	.15	.12	.14
Habit	1	.16	.03	.73	.17	.15
	2	.14	.05	.71	.10	.10
	3	.04	.10	.80	.12	.12
Experienced compensation	1	.08	.13	.13	.73	.32
	2	.07	.07	.12	.75	.31
	3	.04	.09	.14	.77	.30
Expected compensation	1	.08	.08	.10	.30	.74
	2	.09	.05	.04	.28	.73
	3	.02	.03	.05	.26	.70

Table 2. Descriptive Statistics and Correlations

		Mean	SD	1	2	3	4	5	6	7	8	9
1	Gender	Note 1										
2	Age	Note 1										
3	Extrinsic motivation	5.12	1.05	-.44***	-.40***							
4	Intrinsic motivation	5.51	0.70	-.57***	-.33**	.23***						
5	Habit	5.60	0.66	-.60***	-.47**	.40***	.55***					
6	Experienced compensation	4.01	1.30	NA	NA	.20**	.15*	.19**				
7	Expected compensation	4.99	1.21	NA	NA	.17**	.21***	.22***	.03***			
8	Service quality	4.43	1.01	NA	NA	.12*	.08	.23***	.48***	.31***		
9	Continuance intention	4.59	1.29	NA	NA	.17**	.24***	.34***	.51***	.37***	.33***	
10	Repurchase intention	3.50	1.51	NA	NA	.15*	.30***	.37***	.58***	.41***	.37***	.40***

Notes: 1. The distribution of gender (1 represents women) and age are as shown in Appendix E.

2. * $p < .05$; ** $p < .01$; *** $p < .001$.

the midpoint of the scale and interestingly, the experienced compensation was lower than the expected compensation. The correlations between the compensation and the outcomes were positive, with expectations having a stronger effect. Also, all outcomes were correlated, which is to be expected across customer outcomes. To assess the distributional properties of the outcome variables, we initially plotted histograms and checked for skewness and kurtosis. The results showed some deviations from normality. However, tests of multivariate kurtosis (Mardia 1970) and multivariate normality (Looney 1995) demonstrated that the assumption of multivariate normality was violated. To some extent, this is

to be expected given that nonlinear relationships are expected to hold.

Hypotheses Testing

We used polynomial regression analysis to test our models. We examined the unconstrained regression equations for the assimilation–contrast model and the generalized negativity model for the different dependent variables. For the assimilation–contrast model with service quality as the dependent variable, an F -test ($p < .01$) showed that the cubic

equation ($R^2 = .61$) explained a significantly greater amount of variance than the linear equation ($R^2 = .19$) and the quadratic equation ($R^2 = .33$). Likewise, for continuance intention as the dependent variable, an F -test ($p < 0.01$) showed that the cubic equation ($R^2 = .56$) explained a significantly greater amount of variance than the linear equation ($R^2 = .26$) and the quadratic equation ($R^2 = .34$). Based on these findings, we used the cubic equation to test the modified assimilation–contrast model. For the generalized negativity model, the F -test ($p < 0.01$) showed that the quadratic equation ($R^2 = .48$) explained a significantly greater amount of variance than the linear equation ($R^2 = .19$) and the cubic equation ($R^2 = .44$) did not add substantial additional variance, with all cubic terms being nonsignificant. Therefore, we used the quadratic equation to test the generalized negativity model.

H1 held that when the magnitude of expectation disconfirmation regarding compensation is small and within the perceived zone of tolerance, expectations would have a positive effect on the outcome variables of service quality, continuance intention, and repurchase intention. Based on the results shown in Tables 3 and 4, using the tests mentioned earlier, this hypothesis was supported. H2 held that when the magnitude of expectation disconfirmation regarding compensation is large and outside the perceived zone of tolerance, the increase in service quality and continuance intention would be significantly smaller than the decrease associated with negative disconfirmation. Based on the results shown in Tables 3 and 4, using the tests mentioned earlier, this hypothesis was supported. H3 held that when the magnitude of expectation disconfirmation regarding compensation is outside the perceived zone of tolerance, the repurchase intention would decrease, regardless of the direction of disconfirmation. Based on the results shown in Tables 3 and 4, using the tests mentioned earlier, this hypothesis was supported.

Response Surface Analysis

As shown in Table 3, the higher-order terms for predicting all dependent variables were significant, indicating that the relationship between compensation and the dependent variables is curvilinear. In order to provide additional support for our hypotheses, we used response surface analysis to better understand the exact relationship between compensation and the three dependent variables.

Modified Assimilation–Contrast Model. As noted earlier, H1 and H2 were supported if the cubic slope of the surface along the disconfirmation (a_y^3) axis was significant and positive. Table 4 shows that the cubic slopes of the surface along the

disconfirmation axis were found to be positive and significant for service quality ($a_y^3 = 2.31, p < .01$) and continuance intention ($a_y^3 = 2.55, p < .01$), thus providing additional support for H1 and H2. Likewise, the linear slope for service quality ($a_x = 0.21, p < .01$) and continuance intention ($a_x = 0.39, p < .01$) along the confirmation axis was significant and positive. The curvilinear slopes for service quality (quadratic slope $a_x^2 = -0.14, p < .05$; cubic slope $a_x^3 = 0.35, p < .05$) and continuance intention (quadratic slope $a_x^2 = -0.09, p < .01$; cubic slope $a_x^3 = 0.37, p < .05$) along the confirmation axis were also significant. It should be noted that despite the significant p -values, the values for the curvilinear slope for continuance intention were close to zero, providing only weak support for the model (see Edwards 2002; Edwards and Parry 1993). Additionally, prior work in IS and reference disciplines has noted that small coefficients, although statistically significant, may not be practically significant because small coefficients are not significantly different from zero (see Edwards, 2002; Lin et al. 2013).

Overall, we note that the response surfaces for H1 and H2 have three important characteristics. First, the relationship between compensation and service quality and continuance intention is curvilinear such that for high magnitude of disconfirmation, service quality and continuance intention are driven by the level and direction of disconfirmation. For low magnitude of disconfirmation, service quality and continuance intention are driven by expectations. Second, the levels of service quality and continuance intention are highest for positive disconfirmation and lowest for negative disconfirmation. Third, decreases in service quality and continuance intention for negative disconfirmation are higher than the increases in service quality and continuance intention.

Generalized Negativity Model. H3 was supported if the quadratic slope of the surface along the disconfirmation (a_y^2) axis was significant and negative. Table 4 shows that the quadratic slope of the surface along the disconfirmation axis was negative and significant for repurchase intention ($a_y^2 = -2.58, p < .01$), indicating that H3 was supported. Similarly, the linear slope for repurchase intention ($a_x = 1.42, p < .01$) along the confirmation axis was significant and positive. The curvilinear slope for repurchase intention (quadratic slope $a_x^2 = -0.48, p < .05$) along the confirmation axis was also negative and significant. Also, the results of an F -test ($p < .01$) showed that the cubic model did not explain significantly higher variance than the quadratic model for repurchase intention. Thus, the generalized negativity model was supported. We followed the procedures outlined in Edwards (2002) to interpret our coefficients; additionally, we note that given the magnitude of our coefficients and our modest sample size, they are practically significant.

Table 3. Predicting Outcomes Using Compensation										
Dependent Variable	Predictors	First-Order Linear Equation			Second-Order Quadratic Equation			Third-Order Cubic Equation		
		R ²	B	SE	R ²	B	SE	R ²	B	SE
Service quality	Age	0.19	-0.13	0.02	0.33	-0.15	0.04	0.61	-0.11	0.02
	Gender		0.20*	0.02		0.13	0.03		0.10	0.02
	EM		.14*	0.03		0.07	0.03		0.06	0.04
	IM		.13*	0.03		0.11*	0.03		0.08	0.03
	Habit		.20**	0.04		0.17*	0.04		0.13*	0.04
	C ₁		0.53***	0.07		0.55***	0.02		-1.20***	0.03
	C ₂		0.39**	0.04		0.43***	0.03		1.41***	0.05
	C ₁ ²							-0.44***	0.02	
	C ₁ C ₂							0.83***	0.04	
	C ₂ ²							-0.53***	0.02	
	C ₁ ³							0.50***	0.01	
	C ₁ ² C ₂							-0.55***	0.01	
	C ₁ C ₂ ²							0.83***	0.01	
	C ₂ ³							-0.43***	0.02	
Continuance intention	Age	0.26	-0.17	0.06	0.34	-0.13	0.04	0.56	-0.10	0.02
	Gender		0.28***	0.02		0.12	0.03		0.10	0.03
	EM		0.17**	0.02		0.12*	0.02		0.07	0.04
	IM		0.15*	0.03		0.11*	0.03		0.08	0.04
	Habit		0.24***	0.02		0.15*	0.02		0.12*	0.02
	C ₁		0.61***	0.05		0.51***	0.02		-0.91***	0.02
	C ₂		0.42***	0.03		0.50***	0.03		1.30***	0.04
	C ₁ ²							-0.46***	0.01	
	C ₁ C ₂							0.96***	0.03	
	C ₂ ²							-1.28***	0.05	
	C ₁ ³							0.55***	0.01	
	C ₁ ² C ₂							-0.60***	0.01	
	C ₁ C ₂ ²							0.91***	0.02	
	C ₂ ³							-0.49***	0.01	
Repurchase intention	Age	0.19	-0.12	0.02	0.44	-0.12	0.02	0.48	-0.11	0.02
	Gender		0.10	0.03		0.08	0.04		0.10	0.02
	EM		0.08	0.03		0.06	0.04		0.04	0.04
	IM		0.10	0.04		0.08	0.03		0.07	0.04
	Habit		0.06	0.03		0.05	0.03		0.04	0.04
	C ₁		1.09***	0.03		0.69***	0.02		0.69***	0.02
	C ₂		0.64***	0.03		0.73***	0.02		0.88***	0.07
	C ₁ ²							-0.80***	0.02	
	C ₁ C ₂							1.05***	0.03	
	C ₂ ²							-0.73***	0.02	
	C ₁ ³							0.04	0.03	
	C ₁ ² C ₂							0.13	0.05	
	C ₁ C ₂ ²							0.21	0.08	
	C ₂ ³							0.04	0.03	

Notes: C₁ = Experienced compensation; C₂ = Expected compensation.
 Control variables: Age, gender (1 represents women), EM (extrinsic motivation), IM (intrinsic motivation), and habit.
 *p < .05; **p < .01; ***p < .001.

Table 4. Values of Slopes along Lines of Interest

Dependent Variable	Model	Confirmation Axis $C_1 = C_2$			Disconfirmation Axis $C_1 = -C_2$			Summary
		a_x	a_x^2	a_x^3	a_y	a_y^2	a_y^3	
Service quality	Modified assimilation–contrast	0.21	-0.14	0.35			2.31	Test 1: $a_y^3 > 0$; Test 2: $ b_6 , b_7 , b_8 , \text{ or } b_9 > 0$; Test 3: $a_x > 0$; Test 4: $a_x^2 = 0$; Test 5: $a_x^3 = 0$; Test 6: a_y (negative disconfirmation) = a_y (positive disconfirmation)
Continuance intention	Modified assimilation–contrast	0.39	-0.09	0.37			2.55	
Repurchase intention	Generalized negativity	1.42	-0.48		-0.04	-2.58		Test 1: $ b_3 , b_4 , \text{ or } b_5 > 0$; Test 2: $a_y = 0$; Test 3: $b_1 = b_2$; Test 4: $a_y^2 < 0$; Test 5: $a_x > 0$; Test 6: $a_x^2 = 0$; Test 7: $b_3 < 0; b_4 > 0; b_5 < 0$

Notes: C_1 = Experienced compensation; C_2 = Expected compensation; a_x = linear slope along confirmation axis; a_y = linear slope along disconfirmation axis; a_x^2 = quadratic slope along confirmation axis; a_y^2 = quadratic slope along disconfirmation axis; a_x^3 = cubic slope along confirmation axis; and a_y^3 = cubic slope along disconfirmation axis.

All reported values are significant based on the bootstrapping procedure recommended by Edwards and Parry (1993).

The response surface for H3 has three major features. First, the highest outcome in repurchase intention occurs when there is no mismatch between expectations and experiences (i.e., the confirmation axis). Second, repurchase intention decreases when expectations fall short of experiences or expectations exceed experiences. In other words, any deviation from the confirmation axis leads to lower repurchase intention. Third, the slope of the surface changes from positive to negative at the confirmation axis. Figure 2 is a visual representation of the three-dimensional plots of the results.

Discussion

Despite being an important topic for organizations, little work has empirically investigated how to successfully manage a data breach after customer data have been compromised. Our work aimed to address this gap. First, we discussed the methodological limitations in prior data breach and service failure literature. Second, we developed polynomial models to understand compensation as a managerial response mechanism to data breaches. To develop the models, we leveraged prior expectation confirmation research to hypothesize the role of expectations and experiences in explaining three key outcome variables (i.e., service quality, continuance intention, and repurchase intention). In doing so, we respond to the call in recent research (Brown et al. 2014) to examine different contexts and additional dependent variables using expectations models. Third, we empirically validated the proposed

models in a field study in which we collected longitudinal data during and after the Sony PlayStation Network breach. We found that, as long as customers’ expectations toward compensation are met and stay within the perceived zone of tolerance, compensation is an effective tool to influence customers’ service quality perceptions and continuance intention. If there is a large magnitude of customer expectation disconfirmation related to compensation in response to a data breach, positive expectation disconfirmation (i.e., exceeding expectations) has a smaller positive effect on customers’ service perceptions and continuance intention than the negative effect of negative expectation disconfirmation (i.e., failing to meet expectations). We also established that customers’ repurchase intentions are negatively influenced when there is any discrepancy between expectations of compensation and actual experiences. This study is one of the first to use longitudinal data, proximal to the breach, to investigate customers’ reactions to compensation as a recovery action for data breaches. Our unique data set collected during and after Sony’s data breach took place, allowed us to provide recommendations for researchers and organizations interested in using compensation as a data breach recovery action.

Theoretical Contributions and Implications

Our study provides theoretical and methodological contributions. First, we contribute to the security literature through the collection of unique data associated with a public security

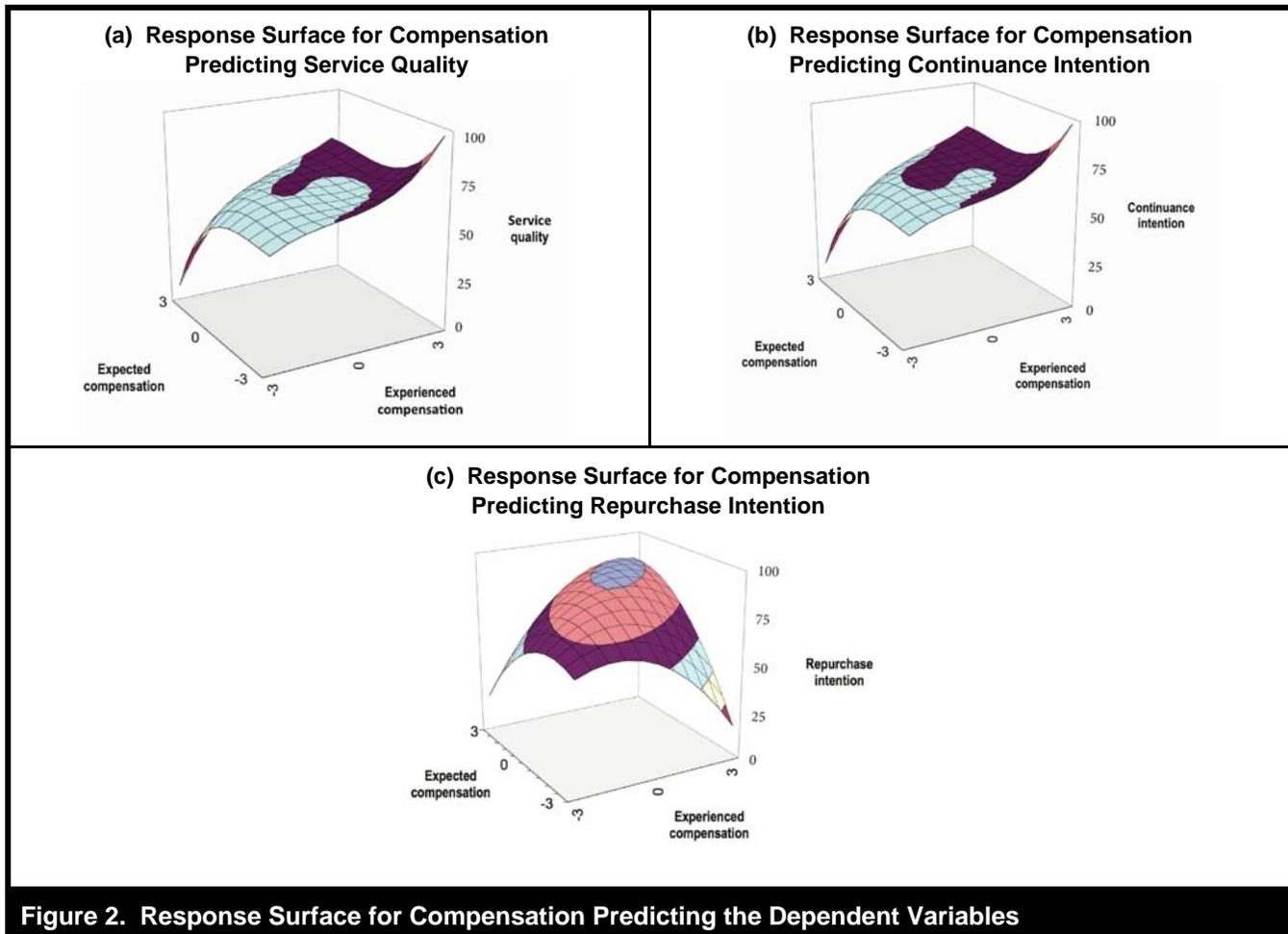


Figure 2. Response Surface for Compensation Predicting the Dependent Variables

breach. Because security incidents are typically sudden and affected organizations resist outside scrutiny, empirical data on actual security events is sparse. Crossler et al. (2013) suggest that security research lacks of empirical and longitudinal research and argue: “In Behavioral InfoSec research, longitudinal...studies are rare, and need to be fostered and encouraged in order to enrich the field” (p. 95). Data have often been collected long after the fact or have been based on stylized scenarios for respondent stimulus. In this paper, longitudinal data collected at the time of the breach enhanced our understanding of user reactions and allowed us to study the stimulus–outcome interaction. In doing so, we were able to identify the, as yet unexamined, nature of the expectations of affected users. We also applied a novel explanation from the service management literature as a “new avenue” of exploration in the IS security research repertoire (Warkentin and Willison 2009).

We also contribute to research on organizational security policies in the context of data breaches (Crossler et al. 2013).

Security policies are established by organizations to govern information system use and the majority of policies focus on password management, data storage procedures, and acceptable use policies (Crossler et al. 2013; Goode et al. 2015; Johnston and Warkentin 2010a, 2010b; Smith et al. 2011; Warkentin et al. 2011; Warkentin et al. 2009; Warkentin and Willison 2009). Prior research in this area has typically studied how organizations develop and manage security policies in order to *prevent* data breaches. However, our literature search revealed little research on security policies or policy management *during and immediately after* a data breach. Our study adds to this literature base by illustrating how researchers can leverage different individual-level theoretical perspectives to explain customer reactions and thus help organizations establish policies for compensating customers in response to a data breach. While our results suggest that organizations should match compensation with customer expectations, the results also highlight the need for a broader theoretical view when examining security policies, one that encompasses actions to prevent *and* respond to a

breach. Given recent reports of the costs associated with data breaches, such as at Sony, Adobe, and Target, this seems to be a critical issue for researchers and managers alike (Williams 2013).

Our research also contributes to the literature on service failure. Although we found much research examining compensation as a recovery mechanism for service failures, few studies, if any, leveraged longitudinal data collected during and after a real world service failure. Instead, most empirical field studies collected data during post-service failure and typically used linear models to explain the effect of compensation on outcomes, such as service quality (see Andreassen 2000; Hess et al. 2003). Linear models assume similar effects of expectations and experiences on confirmation (see Venkatesh and Goyal 2010). Thus, even if the relationship between component measures and outcomes is curvilinear, linear models oversimplify the complex relationships among variables (see Edwards 2002; Venkatesh and Goyal 2010). Given that a data breach can be viewed as an electronically mediated service failure, our work highlights the complexities between customers' expectations toward compensation in response to service failures and their actual experiences.

Third, our work has implications for research that focuses on psychological contract breaches (i.e., "an employee's perception regarding the extent to which the organization has failed to fulfill its promises or obligations," Zhao et al. 2007, p. 649). There is a considerable amount of research that studied the effects of psychological contract breaches on organizational commitment from an employee perspective (see Zhao et al. 2007). So far, few, if any, studies researched the effect of psychological contract breaches in a customer context and little work has investigated customers' reactions in scenarios where a customer centric service provider has failed its obligations. We believe that our work can be used as a springboard for theoretically motivated studies that aim to develop a cumulative research tradition in this research area. For example, the nature of the dependent variables studied here varies in terms of customer commitment—or engagement—with the breached service provider. In a data breach context (i.e., a situation in which the service provider has failed to protect customer data), a customer's repurchase intention means high commitment to the service provider because it involves future financial transactions in which the customer needs to provide financially sensitive data to the breached organization after the breach took place. In contrast, as discussed earlier, a customer's perception of service quality and continuance intention involves less engagement. Our findings suggest that the generalized negativity model works best in explaining the high commitment outcomes whereas low commitment outcomes are best explained using the modified assimilation–contrast model. Future work on psycho-

logical contract breaches in a customer context could explore if our findings also apply to alternative contract violations (e.g., unpaid debts).

Fourth, our data collection procedure exemplifies how to empirically investigate data breaches or service failures in near real-time. Research examining data breaches at the organizational level has primarily used event studies as a research methodology. Although event studies are useful for studying market reactions to data breaches, this methodology is less suited for understanding how to best manage data breaches when the breach is ongoing or for studying customer reactions toward service recovery in response to a data breach. Likewise, *post hoc* recollections of *a priori* expectations tend to be inaccurate or influenced by actual experiences (Venkatesh and Goyal 2010) and might yield inaccurate results if customers are queried after a data breach has been resolved. Our study demonstrates how to collect and leverage longitudinal data at the time of an ongoing data breach. We started collecting data immediately after we learned about Sony's data breach, by leveraging a panel data provider (i.e., Mechanical Turk) and employing screening questions as appropriate to identify relevant sample subjects. We recommend preparing theoretically grounded survey instruments and acquiring necessary institutional approvals prior to a data breach. We leveraged both general and specific items in our survey; the general items were prepared well in advance whereas the specific items were developed at the time we initiated the study. This preparation will facilitate the process of surveying affected customers immediately after an ongoing large-scale data breach is reported in the news (e.g., Sony, Adobe, Target, eBay). We also encourage researchers in this area to obtain initial customer reactions as early in the breach cycle as possible in order to further our understanding of the impacts of breaches on long-term customer-organization relationships. Again, this can be accomplished via the use of a panel data provider.

Limitations and Future Directions

Our study has some important limitations that must be acknowledged. For instance, our initial round of data collection occurred after Sony had issued an apology for the data breach. As noted earlier, because an apology is inexpensive to make, it is a common first response for many firms following a data breach announcement. Thus, it would likely be difficult to preempt or intercept such an announcement prior to commencing data collection. Yet, it should be noted that apologies can vary in terms of the depth of disclosure and sincerity of tone in the apology—and those factors, among others, may have an effect on expectations and outcomes. Ideally, future studies would also benefit from extensive

measure validation prior to data collection. In addition, and related to the aforementioned issue, the design of the quantitative study required us to survey affected customers within days after the event occurred. At that point of time, despite monitoring the news, we did not have specific information regarding the actual nature of Sony's compensation. Therefore, our instrument omitted compensation packages offered by Sony after the breach was fixed (e.g., credit monitoring).

As discussed earlier, we used a panel review to validate our measures and employed validated measures from prior literature, so as to respond quickly to unfolding events. Our research approach depended on self-reported measures of use, expectations, and experiences. Notwithstanding the potential weaknesses of self-reported measures (see Venkatesh et al. 2008), we chose this approach in order to quickly capture actual sentiment of affected users, thereby addressing a key weakness in prior security research (Crossler et al. 2013). Future research could develop alternative, objective measures of these constructs including collecting data in the form of user logs from breached customers. Such studies should also collect data regarding alternative compensation types, such as credit monitoring, or include the respondents' nationalities and cultural values. This would be interesting to explore because nationalities and cultural values could play a significant role in affecting the models tested here. As an example, respondents from collectivist cultures might be more focused on compensation that focuses on benefits to the larger community, as opposed to individual-specific benefits.

We tested two expectation models, namely a modified assimilation–contrast model and a generalized negativity model. Alternative expectation models (see Brown et al. 2014) exist and could be investigated for their suitability to the data breach context and other dependent variables of interest. Brown et al. (2014) compared six different models of expectation including assimilation, contrast, generalized negativity, assimilation–contrast, experiences only, and expectations only in a technology use context. Future studies could examine the effectiveness of each of the six models in the context of data breaches, with different dependent variables in order to determine the best model for each situation. Similarly, future research could build upon our findings and examine different types (e.g., monetary compensation versus coupons) and levels of compensation (e.g., low, medium, and high) and how customer expectations vary in light of these different compensation approaches. Likewise, future research studying data breaches at the individual level can build upon our findings and develop tools to quantify the best compensation package that fits customers' expectations.

Our conclusions regarding the zone of tolerance related to the hypotheses testing were *post hoc* interpretations. The zone of

tolerance is leveraged in other literature (for a discussion, see Kettinger and Lee 2005) much the same as we have used it here—as a theoretical idea rather than an empirically measured construct. An interesting direction for future work would be to develop and validate measures for numerically quantifying the perceived zone of tolerance regarding compensation in a data breach context, as well as other contexts in which expectations are studied. The size of the zone of tolerance could provide insights into sensitivity to expectations in different contexts. It could also provide a mechanism for differentiating between an expectations-only model and an assimilation–contrast model with a wide zone of tolerance.

This work can serve as a starting point for developing personalized compensation strategies. There are many ways of segmenting customers, ranging from their personalities to how much they spend buying products and services from particular organizations. Effectively designed compensation packages in data breach or service failure scenarios could lower the costs associated with compensation packages significantly and positively affect the outcomes studied here. The impact of using different customer compensation packages as Sony did could also have network effects, especially with the explosion of social media. It would be interesting for firms to better understand how customers spread the word (positive and negative) related to the management of data security breaches among their social networks.

Practical Implications

Given that data breaches are occurring on an increasing basis and have the potential to impact individual customers directly, our research at the individual level provides key insights about customer reactions. Although organizational-level studies explain how markets react, customer studies provide information that can have a direct impact on the bottom line. Our work provides guidance to managers who are most likely concerned about making “their managerial decisions affecting people on sensible grounds, and even prefer that these be theoretically respectable grounds” (Dubin 1976, p. 19). Specifically, by focusing on the relationship between expectations and service quality, continuance intention, and repurchase intention, the current work helps practitioners in developing appropriate strategies depending on the outcome that they seek to maximize.

For managers concerned with determining the efficacy of compensation as a recovery action for a data breach, our results provide three major findings. First, companies aiming to use compensation as response to a data breach will welcome the fact that, as long as the offered compensation meets customers' expectations (i.e., stays within the zone of toler-

ance), the compensation will have a positive effect on perceived service quality, continuance intention, and repurchase intention. Second, our findings provide evidence that over-compensation does not pay off and although managers might consider a very high compensation level as an appropriate response to data breaches, inflated levels of compensation can have a negative effect on important outcomes. Thus, managers need to carefully consider the relationship between the compensation amount and the breach severity because meeting customers' expectations, while not excessively exceeding them, is critical. Third, we found that any large disconfirmation of expectations has a negative effect on repurchase intentions. These findings are particularly important for various organizations, such as financial institutions, online retailers and online auctions that rely on the collection of significant amounts of customer data. If confronted with a data breach, it is important for managers in these organizations to understand that compensation needs to align, almost perfectly, with customers' expectations in order to retain customers for future transactions.

For managers looking to apply our model practically, a critical first step is to measure customers' *a priori* expectations regarding compensation in response to a data breach. Although data breaches are unexpected and undesired events for organizations, one course of action that data security managers can take is to survey selected customers before any threat of a breach to understand what they would expect as a satisfactory resolution to a data breach. To do this, scenario-based quasi experiments could be conducted in which customers are presented with hypothetical data breach scenarios in order to solicit their expectations toward compensation related to a given scenario. Proactive actions to estimate customer expectations could also include specific information regarding the compensation managers are willing to provide in response to a data breach. This would allow the organization to accurately associate compensation with changes in the outcome variables of interest. Such approaches are commonly used in marketing studies that aim to discover customer reactions toward new products (see Gelbrich 2010). With this information, an organization should be able to mount an effective response in the event of a breach.

Conclusions

This work integrated research on data breaches, service failure, and expectations to examine customer responses to a data breach recovery action, namely compensation. Expectations and experiences associated with compensation as a service recovery were examined as antecedents to perceptions of service quality, continuance intention, and repurchase intention. We proposed a modified assimilation–contrast model to

explain service quality and continuance intention, and a generalized negativity model to explain repurchase intention. We examined the phenomenon longitudinally, beginning when customers were first made aware of a breach and concluding after reparations were made in the context of Sony's PlayStation Network breach. The results supported the proposed models. This work provides key insights into the effects of compensation, consequent to a data breach, on customer outcomes.

Acknowledgments

We thank the senior editor, Merrill Warkentin, for his support and guidance throughout the review process. We would also like to thank the anonymous reviewers and many scholars and practitioners who offered us comments and advice that helped to improve the paper. Last but not least, we thank Jan DeGross for her efforts in typesetting this manuscript.

References

- Alvesson, M., and Kärreman, D. 2007. "Constructing Mystery: Empirical Matters in Theory Development," *Academy of Management Review* (32:4), pp. 1265-1281.
- Anderson, R. E. 1973. "Consumer Dissatisfaction: The Effect of Disconfirmed Expectancy on Perceived Product Performance," *Journal of Marketing Research* (10:1), pp. 38-44.
- Andreassen, T. W. 2000. "Antecedents to Satisfaction with Service Recovery," *European Journal of Marketing* (34:1/2), pp. 156-175.
- Aspan, M., and Baldwin, C. 2011. "Sony Breach Could Cost Card Lenders \$300 Million," *Reuters*, April 29.
- Baker, T. L., Meyer, T., and Johnson, J. D. 2008. "Individual Differences in Perceptions of Service Failure and Recovery: The Role of Race and Discriminatory Bias," *Journal of the Academy of Marketing Science* (36:4), pp. 552-564.
- Barlow, J. B., Warkentin, M., Ormond, D., and Dennis, A. R. 2013. "Don't Make Excuses! Discouraging Neutralization to Reduce IT Policy Violation," *Computers & Security* (39:B), pp. 145-159.
- Batra, R., Ahuvia, A., and Bagozzi, R. P. 2012. "Brand Love," *Journal of Marketing* (76:2), pp. 1-16.
- Bélanger, F., and Crossler, R. 2011. "Privacy in the Digital Age: A Review of Information Privacy Research in Information Systems," *MIS Quarterly* (35:4), pp. 1017-1041.
- Bhattacharjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), pp. 351-370.
- Bitner, M. J., Booms, B. H., and Tetreault, M. S. 1990. "The Service Encounter: Diagnosing Favorable and Unfavorable Incidents," *Journal of Marketing* (54:1), pp. 71-84.
- Bollen, K. A., and Jackman, R. W. 1985. "Regression Diagnostics: An Expository Treatment of Outliers and Influential Cases," *Sociological Methods & Research* (13:4), pp. 510-542.

- Bolton, R. N. 1998. "A Dynamic Model of the Duration of the Customer's Relationship with a Continuous Service Provider: The Role of Satisfaction," *Marketing Science* (17:1), pp. 45-65.
- Boshoff, C. 1997. "An Experimental Study of Service Recovery Options," *International Journal of Service Industry Management* (8:2), pp. 110-130.
- Brady, M. K., Cronin Jr., J. J., Fox, G. L., and Roehm, M. L. 2008. "Strategies to Offset Performance Failures: The Role of Brand Equity," *Journal of Retailing* (84:2), pp. 151-164.
- Brown, S. A., Venkatesh, V., and Goyal, S. 2012. "Expectation Confirmation in Technology Use," *Information Systems Research* (23:2), pp. 474-487.
- Brown, S. A., Venkatesh, V., and Goyal, S. 2014. "Expectation Confirmation: A Test of Six Competing Models," *MIS Quarterly* (38:3), pp. 729-756.
- Brown, S. A., Venkatesh, V., Kuruzovich, J., and Massey, A. P. 2008. "Expectation Confirmation: An Examination of Three Competing Models," *Organizational Behavior and Human Decision Processes* (105:1), pp. 52-66.
- Brown, T. J., Barry, T. E., Dacin, P. A., and Gunst, R. F. 2005. "Spreading the Word: Investigating Antecedents of Consumers' Positive Word-of-Mouth Intentions and Behaviors in a Retailing Context," *Journal of the Academy of Marketing Science* (33:2), pp. 123-138.
- Carlsmith, M., and Aronson, E. 1963. "Some Hedonic Consequences of the Confirmation and Disconfirmation of Expectancies," *Journal of Abnormal and Social Psychology* (66:2), pp. 151-156.
- Cavusoglu, H., Mishra, B., and Raghunathan, S. 2004. "The Effect of Internet Security Breach Announcements on Market Value: Capital Market Reactions for Breached Firms and Internet Security Developers," *International Journal of Electronic Commerce* (9:1), pp. 69-104.
- Cellan-Jones, R. 2011. "Sony Says 25m Extra Users Hacked," BBC, May 3.
- Churchill, G. A. 1979. "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research* (16:1), pp. 64-73.
- Churchill, G. A., and Surprenant, C. 1982. "An Investigation into the Determinants of Customer Satisfaction," *Journal of Marketing Research* (19:4), pp. 491-504.
- Cohen, J., Cohen, P., Westand, S. G., and Aiken, L. S. 2003. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Mahwah, NJ: Lawrence Erlbaum Associates.
- Compeau, D., Marcolin, B., Kelley, H., and Higgins, C. 2012. "Research Commentary—Generalizability of Information Systems Research Using Student Subjects—A Reflection on Our Practices and Recommendations for Future Research," *Information Systems Research* (23:4), pp. 1093-1109.
- Conover, W. J., and Inman, R. L. 1981. "Rank Transformations as a Bridge between Parametric and Nonparametric Statistics," *American Statistician* (35:3), pp. 123-129.
- Crossler, R. E., Johnston, A. C., Lowry, P. B., Hu, Q., Warkentin, M., and Baskerville, R. 2013. "Future Directions for Behavioral Information Security Research," *Computers & Security* (32), pp. 90-101.
- Culnan, M. J., and Williams, C. C. 2009. "How Ethics Can Enhance Organizational Privacy: Lessons From the Choice Point and TJX Data Breaches," *MIS Quarterly* (33:4), pp. 673-687.
- Dillman, D. A., Smyth, J. D., and Christian, L. M. 2008. *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (3rd ed.), New York: Wiley Publishing.
- Du, J., Fan, X., and Feng, T. 2011. "Multiple Emotional Contagions in Service Encounters," *Journal of the Academy of Marketing Science* (39:3), pp. 449-466.
- Dubin, R. 1976. *Theory Building in Applied Areas*, in *Handbook of Industrial and Organizational Psychology*, M. D. Dunnette (ed.), New York: Wiley.
- Edwards, C., Gullo, K., and Riley, M. 2011. "Sony Faces Lawsuit, Regulators' Scrutiny over PlayStation Breach," *Bloomberg*, p. 28.
- Edwards, J. R. 2002. "Alternatives to Difference Scores: Polynomial Regression Analysis and Response Surface Methodology," in *Measuring and Analyzing Behavior in Organizations: Advances in Measurement and Data Analysis*, F. Drasgow and N. Schmitt (eds.), San Francisco: Jossey-Bass/Pfeiffer, pp. 350-400.
- Edwards, J. R. 2009. "Latent Variable Modeling in Congruence Research: Current Problems and Future Directions," *Organizational Research Methods* (12), pp. 34-62.
- Edwards, J. R., and Harrison, R. V. 1993. "Job Demands and Worker Health: Three-Dimensional Reexamination of the Relationship between Person-Environment Fit and Strain," *Journal of Applied Psychology* (78:4), pp. 628-648.
- Edwards, J. R., and Parry, M. E. 1993. "On the Use of Polynomial Regression Equations as an Alternative to Difference Scores in Organizational Research," *Academy of Management Journal* (36:6), pp. 1577-1613.
- Estelami, H., and De Maeyer, P. 2002. "Customer Reactions to Service Provider Overgenerosity," *Journal of Service Research* (4:3), pp. 205-216.
- Forrester Research. 2009. *Articulating the Business Value of Information Security*, Cambridge, MA: Forrester Research Inc.
- Forrester Research. 2011. *Planning For Failure*, Cambridge, MA: Forrester Research Inc.
- Gelbrich, K. 2010. "Anger, Frustration, and Helplessness After Service Failure: Coping Strategies and Effective Informational Support," *Journal of the Academy of Marketing Science* (38:5), pp. 567-585.
- Goode, S., Lin, C., Tsai, J. C., and Jiang, J. J. 2015. "Rethinking the Role of Security in Client Satisfaction with Software-as-a-Service (SaaS) Providers," *Decision Support Systems* (70), pp. 73-85.
- Grégoire, Y., Tripp, T. M., and Legoux, R. 2009. "When Customer Love Turns Into Lasting Hate: The Effects of Relationship Strength and Time on Customer Revenge and Avoidance," *Journal of Marketing* (73:6), pp. 18-32.
- Grewal, D., Roggeveen, A. L., and Tsiros, M. 2008. "The Effect of Compensation on Repurchase Intentions in Service Recovery," *Journal of Retailing* (84:4), pp. 424-434.
- Hachman, M. 2011. "PlayStation Hack to Cost Sony \$171M; Quake Costs Far Higher," *PC Magazine*, May 23.
- Harman, H. H. 1976. *Modern Factor Analysis* (3rd ed.), Chicago: University of Chicago Press.

- Herath, T., and Rao, H. R. 2009. "Protection Motivation and Deterrence: A Framework for Security Policy Compliance in Organisations," *European Journal of Information Systems* (18:2), pp. 106-125.
- Hess, R. L., Ganesan, S., and Klein, N. M. 2003. "Service Failure and Recovery: The Impact of Relationship Factors on Customer Satisfaction," *Journal of the Academy of Marketing Science* (31:2), pp. 127-145.
- HHS. 2013. "Submitting Notice of a Breach to the Secretary," U.S. Department of Health & Human Services (<http://www.hhs.gov/ocr/privacy/hipaa/administrative/breachnotificationrule/brinstruction.html>).
- Hsu, J. S. C., Shih, S. P., Hung, Y. W., and Lowry, P. B. 2015. "The Role of Extra-Role Behaviors and Social Controls in Information Security Policy Effectiveness," *Information Systems Research* (26:2), pp. 282-300.
- Huang, W. -H. 2008. "The Impact of Other-Customer Failure on Service Satisfaction," *International Journal of Service Industry Management* (19:4), pp. 521-536.
- Huang, W. -H., and Lin, T. 2011. "Developing Effective Service Compensation Strategies: Is a Price Reduction More Effective Than a Free Gift?," *Journal of Service Management* (22:2), pp. 202-216.
- Irving, P. G., and Meyer, J. P. 1994. "Reexamination of the Met-Expectations Hypothesis: A Longitudinal Analysis," *Journal of Applied Psychology* (79:6), pp. 937-949.
- Johns, G. 2006. "The Essential Impact of Context on Organizational Behavior," *Academy of Management Review* (31:2), April, pp. 386-408.
- Johnson, M. E. 2008. "Information Risk of Inadvertent Disclosure: An Analysis of File-sharing Risk in the Financial Supply Chain," *Journal of Management Information Systems* (25:2), pp. 97-123.
- Johnston, A. C., and Warkentin, M. 2010a. "Fear Appeals and Information Security Behaviors: An Empirical Study," *MIS Quarterly* (34:3), pp. 549-566.
- Johnston, A. C., and Warkentin, M. 2010b. "The Influence of Perceived Source Credibility on End User Attitudes and Intentions to Comply with Recommended IT Actions," *Journal of Organizational and End User Computing* (22:3), pp. 1-21.
- Johnston, A. C., Warkentin, M., McBride, M., and Carter, L. 2016. "Dispositional and Situational Factors: Influences on Information Security Policy Violations," *European Journal of Information Systems* (25:3), pp. 231-251.
- Johnston, R., and Fern, A. 1999. "Service Recovery Strategies for Single and Double Deviation Scenarios," *Service Industries Journal* (19:2), pp. 69-82.
- Kahneman, D., and Tversky, A. 1979. "Prospect Theory: An Analysis of Decision under Risk," *Econometrica* (47:2), pp. 263-291.
- Kahneman, D., and Tversky, A. 1984. "Choices, Values, and Frames," *American Psychologist* (39:4), pp. 341-350.
- Kettinger, W. J., and Lee, C. C. 2005. "Zones of Tolerance: Alternative Scales for Measuring Information Systems Service Quality," *MIS Quarterly* (29:4), pp. 607-621.
- Kim, N., and Ulgado, F. M. 2012. "The Effect of On-the-Spot Versus Delayed Compensation: The Moderating Role of Failure Severity," *Journal of Services Marketing* (26:3), pp. 158-167.
- Kwon, J., and Johnson, M. E. 2015. "Protecting Patient Data-The Economic Perspective of Healthcare Security," *IEEE Security and Privacy* (13:5), pp. 90-95.
- Labovitz, S. 1970. "The Assignment of Numbers to Rank Order Categories," *American Sociological Review* (35:2), pp. 515-524.
- Lane, V. P., and Wright, F. G. 1978. "Human Resources Systematically Applied to Ensure Computer Security," in *Information Systems Methodology, Proceedings of the 2nd Conference of the European Cooperation in Informatics*, Lecture Notes in Computer Science (Volume 65), G. Bracchi and P. C. Lockemann (eds.), Berlin: Springer-Verlag, pp. 684-695.
- Lee, M., and Lee, J. 2012. "The Impact of Information Security Failure on Customer Behaviors: A Study on a Large-Scale Hacking Incident on the Internet," *Information Systems Frontiers* (14:2), pp. 375-393.
- Liao, H. 2007. "Do It Right This Time: The Role of Employee Service Recovery Performance in Customer-Perceived Justice and Customer Loyalty after Service Failures," *Journal of Applied Psychology* (92:2), pp. 475-489.
- Lin, M., Lucas Jr., H. C., and Shmueli, G. 2013. "Too Big to Fail: Large Samples and the P-Value Problem," *Information Systems Research* (24:4), 906-917.
- Lindell, M. K., and Whitney, D. J. 2001. "Accounting for Common Method Variance in Cross-Sectional Research Designs," *Journal of Applied Psychology* (86:1), pp. 114-121.
- Loch, K. D., Carr, H. H., and Warkentin, M. E. 1992. "Threats to Information Systems: Today's Reality, Yesterday's Understanding," *MIS Quarterly* (16:2), pp. 173-186.
- Looney, S. W. 1995. "How to Use Tests for Univariate Normality to Assess Multivariate Normality," *American Statistician* (49), pp. 64-70.
- Lowry, P. B., Posey, C., Bennett, R. B. J., and Roberts, T. L. 2015. "Leveraging Fairness and Reactance Theories to Deter Reactive Computer Abuse Following Enhanced Organizational Information Security Policies: An Empirical Study of the Influence of Counterfactual Reasoning and Organizational Trust," *Information Systems Journal* (25:3), pp. 193-273.
- Malhotra, N. K., Kim, S. S., and Patil, A. 2006. "Common Method Variance in IS Research: A Comparison of Alternative Approaches and A Reanalysis of Past Research," *Management Science* (52:12), pp. 1865-1883.
- Malhotra, A., and Malhotra, C. 2011. "Evaluating Customer Information Breaches as Service Failures: An Event Study Approach," *Journal of Service Research* (14:1), pp. 44-59.
- Mardia, K. V. 1970. "Measures of Multivariate Skewness and Kurtosis with Applications," *Biometrika* (57:3), pp. 519-530.
- Mattila, A. S. 2009. "How to Handle PR Disasters? An Examination of the Impact of Communication Response Type and Failure Attributions on Consumer Perceptions," *Journal of Services Marketing* (23:4), pp. 211-218.
- Mattila, A. S., and Patterson, P. G. 2004. "Service Recovery and Fairness Perceptions in Collectivist and Individualist Contexts," *Journal of Service Research* (6:4), pp. 336-346.
- Maxham III, J. G., and Netemeyer, R. G. 2002. "Modeling Customer Perceptions of Complaint Handling Over Time: The Effects of Perceived Justice on Satisfaction and Intent," *Journal of Retailing* (78:4), pp. 239-252.

- Mittal, V., and Kamakura, W. A. 2001. "Satisfaction, Repurchase Intent, and Repurchase Behavior: Investigating the Moderating Effect of Customer Characteristics," *Journal of Marketing Research* (38:1), pp. 131-142.
- Morris, M. G., Venkatesh, V., and Ackerman, P. L. 2005. "Gender and Age Differences in Employee Decisions About New Technology: An Extension to the Theory of Planned Behavior," *IEEE Transactions on Engineering Management* (52:1), pp. 69-84.
- Oliver, R. L. 1977. "Effect of Expectation and Disconfirmation on Postexposure Product Evaluations: An Alternative Interpretation," *Journal of Applied Psychology* (62:4), pp. 480-486.
- Orsingher, C., Valentini, S., and De Angelis, M. 2010. "A Meta-analysis of Satisfaction with Complaint Handling in Services," *Journal of the Academy of Marketing Science* (38:2), pp. 169-186.
- Otto, P. N., Anton, A. I., and Baumer, D. L. 2007. "The ChoicePoint Dilemma: How Data Brokers Should Handle the Privacy of Personal Information," *IEEE Security Privacy* (5:5), pp. 15-23.
- Patterson, P. G., Johnson, L. W., and Spreng, R. A. 1997. "Modeling the Determinants of Customer Satisfaction for Business-to-Business Professional Services," *Journal of the Academy of Marketing Science* (25:1), pp. 4-17.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., and Podsakoff, N. P. (2003). "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), pp. 879-903.
- Podsakoff, P. M., and Organ, D. W. 1986. "Self-Reports in Organizational Research: Problems and Prospects," *Journal of Management* (12:4), pp. 531-544.
- Ponemon Institute. 2013. "2013 Cost of Data Breach: Global Analysis," Research Report, Ponemon Institute.
- Prasongsukarn, K., and Patterson, P. G. 2012. "An Extended Service Recovery Model: The Moderating Impact of Temporal Sequence of Events," *Journal of Services Marketing* (26:7), pp. 510-520.
- Rakes, T., Deane, J., and Rees, L. 2012. "IT Security Planning under Uncertainty for High-impact Events," *Omega* (40:1), pp. 79-88.
- Reynolds, I. 2011. "Sony CEO Apologizes for Data Theft; Shares Fall 2 Pct," *Reuters*, May 6.
- Rhee, H.-S., Ryu, Y. U., and Kim, C.-T. 2012. "Unrealistic Optimism on Information Security Management," *Computers and Security* (31:2), pp. 221-232.
- Richmond, S., and Williams, C. 2011. "Millions of Internet Users Hit By Massive Sony PlayStation Data Theft," *The Telegraph*, April 26.
- Rindfleisch, A., Malter, A. J., Ganesan, S., and Moorman, C. 2008. "Cross-Sectional Versus Longitudinal Survey Research: Concepts, Findings, and Guidelines," *Journal of Marketing Research* (45:3), pp. 261-279.
- Roggeveen, A. L., Tsiros, M., and Grewal, D. 2011. "Understanding the Co-creation Effect: When Does Collaborating with Customers Provide a Lift To Service Recovery," *Journal of the Academy of Marketing Science* (40:6), pp. 771-790.
- Sen, R., and Borle, S. 2015. "Estimating the Contextual Risk of Data Breach: An Empirical Approach," *Journal of Management Information Systems* (32:2), pp. 314-341.
- Seybold, P. 2011. "Play On – PSN Restoration Begins Now," *PlayStation Blog*, May 14.
- Sharma, R., Yetton, P., and Crawford, J. 2009. "Estimating the Effect of Common Method Variance: The Method-Method Pair Technique with an Illustration from TAM Research," *MIS Quarterly* (33:3), pp. 473-490.
- Sherif, M., and Sherif, C. 1967. "Attitudes as the Individual's Own Categories: The Social-Judgment Approach to Attitude and Attitude Change," in *Attitude, Ego-Involvement and Change*, C. Sherif and M. Sherif (eds.), New York: Wiley Publishing, pp. 105-139.
- Sherr, I., and Wingfield, N. 2011. "Play by Play: Sony's Struggles on Breach," *Wall Street Journal*, May 7.
- Shropshire, J., Warkentin, M., and Johnston, A. C. 2010. "Impact of Negative Message Framing on Security Adoption," *Journal of Computer Information Systems* (51:1), pp. 41-51.
- Smith, A. K., and Bolton, R. N. 1998. "An Experimental Investigation of Customer Reactions to Service Failure and Recovery Encounters Paradox or Peril?," *Journal of Service Research* (1:1), pp. 65-81.
- Smith, A. K., and Bolton, R. N. 2002. "The Effect of Customers' Emotional Responses to Service Failures on Their Recovery Effort Evaluations and Satisfaction Judgments," *Journal of the Academy of Marketing Science* (30:1), pp. 5-23.
- Smith, A. K., Bolton, R. N., and Wagner, J. 1999. "A Model of Customer Satisfaction with Service Encounters Involving Failure and Recovery," *Journal of Marketing Research* (36:3), pp. 356-372.
- Smith, H. J., Dinev, T., and Xu, H. 2011. "Information Privacy Research: An Interdisciplinary Review," *MIS Quarterly* (35:4), pp. 989-1016.
- Staples, D. S., Wong, I., and Seddon, P. B. 2002. "Having Expectations of Information Systems Benefits that Match Received Benefits: Does It Really Matter?," *Information & Management* (40:2), pp. 115-131.
- Symantec. 2013. *2013 Internet Security Threat Report*, Symantec (http://www.symantec.com/security_response/publications/threatreport.jsp).
- Szajna, B., and Scamell, R. W. 1993. "The Effects of Information System User Expectations on Their Performance and Perceptions," *MIS Quarterly* (17:4), pp. 493-516.
- Tomaszewski, J. P. 2006. "Are You Sure You Had a Privacy Incident," *IEEE Security and Privacy* (4:6), pp. 64-66.
- Tversky, A., and Kahneman, D. 1974. "Judgment Under Uncertainty: Heuristics and Biases," *Science* (185:4157), pp. 1124-1131.
- Tversky, A., and Kahneman, D. 1991. "Loss Aversion in Riskless Choice: A Reference-Dependent Model," *The Quarterly Journal of Economics* (106:4), pp. 1039-1061.
- Vallerand, R. J., Fortier, M. S., and Guay, F. 1997. "Self-Determination and Persistence in a Real-Life Setting: Toward a Motivational Model of High School Dropout," *Journal of Personality and Social Psychology* (72:5), pp. 1161-1175.
- Van der Heijden, H. 2004. "User Acceptance of Hedonic Information Systems," *MIS Quarterly* (28:4), pp. 695-704.
- Venkatesh, V. 2000. "Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the

- Technology Acceptance Model,” *Information Systems Research* (11:4), pp. 342-365.
- Venkatesh, V., Brown, S. A., Maruping, L. M., and Bala, H. 2008. “Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation,” *MIS Quarterly* (32:3), pp. 483-502.
- Venkatesh, V., and Goyal, S. 2010. “Expectation Disconfirmation and Technology Adoption: Polynomial Modeling and Response Surface Analysis,” *MIS Quarterly* (34:2), pp. 281-303.
- Venkatesh, V., and Johnson, P. 2002. “Telecommuting Technology Implementations: A Within- and Between-Subjects Longitudinal Field Study,” *Personnel Psychology* (55:3), pp. 661-688.
- Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. “User Acceptance of Information Technology: Toward a Unified View,” *MIS Quarterly* (27:3), pp. 425-478.
- Venkatesh, V., and Speier, C. 2000. “Creating an Effective Training Environment for Enhancing Telework,” *International Journal of Human-Computer Studies* (52:6), pp. 991-1005.
- Venkatesh, V., Thong, J. Y. L., and Xu, X. 2012. “Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology,” *MIS Quarterly* (36:1), pp. 157-178.
- Verizon Business. 2015. “2015 Data Breach Investigations Report,” *Verizon Business*.
- Wall, J. D., Lowry, P. B., and Barlow, J. B. 2015. “Organizational Violations of Externally Governed Privacy and Security Rules: Explaining and Predicting Selective Violations under Conditions of Strain and Excess,” *Journal of the Association for Information Systems* (17:1), pp. 39-76.
- Wang, J., Gupta, M., and Rao, H. R. 2015. “Insider Threats in a Financial Institution: Analysis of Attack-Proneness of Information Systems Applications,” *MIS Quarterly* (39:1), pp. 91-112.
- Wanous, J. P., Poland, T. D., Premack, S. L., and Davis, K. S. 1992. “The Effects of Met Expectations on Newcomer Attitudes and Behaviors: A Review and Meta-Analysis,” *Journal of Applied Psychology* (77:3), pp. 288-297.
- Warkentin, M., Johnston, A. C., and Shropshire, J. 2011. “The Influence of the Informal Social Learning Environment on Information Privacy Policy Compliance Efficacy and Intention,” *European Journal of Information Systems* (20:3), pp. 267-284.
- Warkentin, M., Moore, R. S., Bekkering, E., and Johnston, A. C. 2009. “Analysis of Systems Development Project Risks: An Integrative Framework,” *DATABASE for Advances in Information Systems* (40:2), pp. 8-27.
- Warkentin, M., and Willison, R. 2009. “Behavioral and Policy Issues in Information Systems Security: The Insider Threat,” *European Journal of Information Systems* (18:2), pp. 101-105.
- Williams, L. C. 2013. “The 9 Biggest Privacy and Security Breaches That Rocked 2013,” Thinkprocess, December 31.
- Willison, R., and Warkentin, M. 2013. “Beyond Deterrence: An Expanded View of Employee Computer Abuse,” *MIS Quarterly* (37:1), pp. 1-20.
- Wong, R. C.-W., Fu, A. W.-C., Wang, K., Yu, P. S., and Pei, J. 2011. “Can the Utility of Anonymized Data Be Used for Privacy Breaches,” *ACM Transactions on Knowledge Discovery from Data* (5:3), pp. 1-24.
- Yoo, B., Tonthu, N., and Lee, S. 2000. “An Examination of Selected Marketing Mix Elements and Brand Equity,” *Journal of the Academy of Marketing Science* (28:2), pp. 195-211.
- Zafar, H., Ko, M. S., and Osei-Bryson, K.-M. 2012. “Financial Impact of Information Security Breaches on Breached Firms and Their Non-Breached Competitors,” *Information Resources Management Journal* (25:1), pp. 21-37.
- Zeithaml, V. A., Berry, L. L., and Parasuraman, A. 1996. “The Behavioral Consequences of Service Quality,” *Journal of Marketing* (60:2), pp. 31-46.
- Zhao, H. A. O., Wayne, S. J., Glibkowski, B. C., and Bravo, J. 2007. “The Impact of Psychological Contract Breach on Work-Related Outcomes: A Meta-Analysis,” *Personnel Psychology*, (60:3), pp. 647-680.

About the Authors

Sigi Goode is an associate professor of information systems in the Research School of Management at the College of Business and Economics, Australian National University. He received his Ph.D. from the Australian National University. His research interests lie in information security behavior, services and technology adoption, policy, and use. He has published papers in journals such as *Journal of Management Information Systems*, *European Journal of Information Systems*, *Decision Support Systems*, *Journal of Business Ethics*, *Information & Management*, and *European Journal of Operational Research*. He has more than 15 years’ experience designing and managing online information platforms. Sigi received the ANU Vice-Chancellor’s Award for Excellence in Education in 2005, and a Carrick Institute National Award for Teaching Excellence in 2006. He is an associate editor of *Information & Management*.

Hartmut Hoehle is an associate professor of Information Systems in the Sam M. Walton School of Business at the University of Arkansas. He received a Ph.D. in Information Systems from Victoria University of Wellington, New Zealand. He was a lecturer at the School of Accounting and Business Information Systems, Australian National University. Stemming from his professional experiences gained while working at Deutsche Bank, he is particularly interested in how services and products can be distributed through electronically mediated channels in a retail context. His work has appeared or is forthcoming in *MIS Quarterly*, *European Journal of Information Systems*, *Decision Support Systems*, *Journal of the Association for Information Science and Technology*, *Journal of Computer Information Systems*, *International Journal of Human-Computer Studies*, and others. He has presented at the International Conference on Information Systems and the European Conference on Information Systems. He has also served as a reviewer for leading journals including *MIS Quarterly*.

Viswanath Venkatesh is a Distinguished Professor and Billingsley Chair in Information Systems at the University of Arkansas, where he has been since June 2004. Prior to joining Arkansas, he was on the faculty at the University of Maryland and received his Ph.D. at the University of Minnesota. His research focuses on understanding

the diffusion of technologies in organizations and society. His work has appeared or is forthcoming in leading journals in information systems, organizational behavior, psychology, marketing, health informatics, human-computer interaction, and operations management. He is widely regarded as one of the most influential scholars in business and economics (e.g., highlycited.com), with about 65,000 cites and about 15,000 cites per Google Scholar and Web of Science, respectively. Some of his papers are among the most cited papers published in the various journals, including *Information Systems Research*, *MIS Quarterly*, *Management Science*, and *Decision Sciences Journal*. He developed and maintains a web site that tracks researcher and university research productivity (<https://myvisionresearch.com/researchrankings/>). He has served on or is currently serving on several editorial boards, including *MIS Quarterly*. He is a fellow of the Association for Information Systems and Information Systems Society (INFORMS).

Susan A. Brown is the McClelland Professor of Management Information Systems in the Eller College of the University of Arizona. She completed her Ph.D. at the University of Minnesota and an MBA at Syracuse University. Her research interests include technology implementation, individual adoption, virtual communication, technology-mediated learning, and related topics. She has received funding for her research from the National Science Foundation, and other public and private organizations. Her work has appeared in leading journals including *MIS Quarterly*, *Information Systems Research*, *Organizational Behavior and Human Decision Processes*, *Communications of the ACM*, *Journal of Management Information Systems*, *Journal of the Association for Information Systems*, and others. She has served as an Associate Editor at *MIS Quarterly*, *Information Systems Research*, *Journal of the Association for Information Systems*, and *Decision Sciences*, and is currently a Senior Editor at *MIS Quarterly*.

USER COMPENSATION AS A DATA BREACH RECOVERY ACTION: AN INVESTIGATION OF THE SONY PLAYSTATION NETWORK BREACH

Sigi Goode

Research School of Management, College of Business and Economics, Australian National University,
Canberra, ACT, AUSTRALIA {Sigi.Goode@anu.edu.au}

Hartmut Hoehle

Department of Information Systems, Sam M. Walton College of Business, University of Arkansas,
Fayetteville, A 27201 U.S.A. {hartmut@hartmuthoehle.com}

Viswanath Venkatesh

Department of Information Systems, Sam M. Walton College of Business, University of Arkansas,
Fayetteville, A 27201 U.S.A. {vvenkatesh@vvenkatesh.us}

Susan A. Brown

Department of Management Information Systems, University of Arizona, 1130 East Helen Street,
Tucson, AZ 85721-0108 U.S.A. {suebrown@eller.arizona.edu}

Appendix A

Data Breach Literature

To gather articles, we searched three literature databases of Scopus, ABI/Inform, and Google Scholar. We looked for all articles that contained various keywords, such as “data breach,” “security breach,” “privacy breach,” and “information breach.” We then narrowed our focus to include scholarly articles, excluding articles in the popular and practitioner media. Most of the articles identified in this step were conceptual. From this group, we collected all empirical studies of data breaches published in IS journals over the last 10 years, shown in Table A1. We adapted level of analysis categorizations from Smith et al. (2011) and Belanger and Crossler (2011). For each study, we also recorded the timing of the study to reflect the relationship between when the phenomenon occurred and when the study was conducted.

Table A1. Empirical Studies of Data Breaches in Prior IS Literature

Reference	Level of Analysis				Method	Data	Timing	Findings
	Artifact	Individual	Organization	Social				
Evans and Furnell (2000)	X				Experiment	700,000 IP address polls	Scenario	Organizations may not classify breaches consistently, especially for online systems.
Garg et al. (2003)			X		Event Study	22 published breach announcements	After	Data breaches have a negative effect on the breached firm's share price.
Campbell et al. (2003)			X		Event Study	43 data breach announcements in news media	After	Negative effect on market value from breach announcements, but only if the breach involves confidential data. Market consequences depend on type of data breached.
Anton et al. (2004)			X		Case Study	Publicly available reports	After	Complex policies make it difficult for end-users to understand data risks. Use templates to improve compliance.
Cavusoglu et al. (2004)			X		Event Study	66 published data breach announcements	After	Breach announcements have negative effects on breached firm market value. Industry competitors are also negatively affected.
Ko and Durantes (2006)			X		Event Study	19 publicly announced data breaches	After	Breached firms suffer reduced financial performance in the following year.
Butcher-Powell (2006)			X		Case Study	Unnamed IT hardware manufacturer	Scenario	Contrasts the value of training and technical remedies in preventing security breaches.
Erickson and Howard (2007)	X				Archival analysis	589 published data breach incidents	After	More incidents reported in 2005-2006 than in the 25 years prior. Almost half of breaches are due to external malicious attack. A quarter of breaches had no identifiable cause.
Kannan et al. (2007)			X		Event Study	72 published data breach announcements	After	Abnormal negative returns for the dotcom period, but not necessarily afterwards.
Otto et al. (2007)			X		Case Study	Public sources and published reports	After	Recommend firms have a plan to deal with breaches, including interacting with affected users. Maintain good governance and audit mechanisms.
Telang and Wattal (2007)			X		Event Study	147 announcements in newspapers and CERT reports	After	Negative market reactions accrue to the vendor after a breach announcement. The market reacts differently to different types of breaches.

Table A1. Empirical Studies of Data Breaches in Prior IS Literature (Continued)

Reference	Level of Analysis				Method	Data	Timing	Findings
	Artifact	Individual	Organization	Social				
Johnson (2008)			X		Archival analysis	Searches of P2P file sharing networks to identify sensitive documents from Forbes top 30 banks	After	Sensitive data can be inadvertently shared by employees as well as customers. Brand visibility is positively associated with disclosure likelihood.
Patel et al. (2008)	X				Case Study	Documentation from University of Louisville SCADA implementation	Scenario	Proposes a breach vulnerability method using vulnerability trees.
Shropshire (2009)		X			Archival	62 published cases of internal breaches	After	Personal relationship strains and hardship are associated with propensity to breach data.
Herath and Rao (2009)		X			Survey	312 employees from 78 firms	Scenario	Breach severity perceptions affect policy implementation and compliance.
Ko et al. (2009)			X		Event Study	69 breach announcements and matched sample of non-breached firms	After	Data breaches result in negative abnormal market value losses. Different breaches have different effects: breaches of confidentiality have long term effects, while breaches of integrity do not.
Culnan and Williams (2009)			X		Case Study	Publicly available documents	After	Ethical perspectives may improve development of data breach policy. Prior research has not examined the personal harm caused by data breaches.
Goel and Shawky (2009)			X		Event Study	168 breach announcements in newspapers and public sources	After	Breach announcements have a negative effect on firm market value in subsequent days.
Andoh-Baidoo et al. (2010)					Event Study	42 announcements in major newspapers and media outlets. Stock data from NYSE.	After	Investors view breaches negatively, but may view different types of breaches as having varying levels of severity.
Lee et al. (2011)			X		Econometric Model	Two years of breach announcements from Open Security Foundation (dataloss.org)	After	Optimal security investment depends on service cost and incident likelihood. Model provides investment levels for desired levels of protection.
Garrison and Ncube (2011)			X		Archival	Five years of published data breach announcements.	After	Device theft and exposed data are more likely to occur, but number of breached records is not related to type of breach.

Table A1. Empirical Studies of Data Breaches in Prior IS Literature (Continued)

Reference	Level of Analysis				Method	Data	Timing	Findings
	Artifact	Individual	Organization	Social				
Morse et al. (2011)			X		Event Study	306 breach announcements from Open Security Foundation (dataloss.org)	After	Market losses vary between breach types, suggesting that investors pay attention to the type and duration of the breach.
Gordon et al. (2011)			X		Event Study	Published breach announcements	After	Breaches have a negative effect on market valuations. However, different breaches have different effects, with the greatest negative effect for availability breaches.
Yayla and Hu (2011)			X		Event Study	123 published data breach events from news outlets	After	Negative effect on market valuation for breached firms, but stronger with pure e-commerce firms. More recent breaches appear to have a stronger negative effect than earlier events.
Collins et al. (2011)			X		Archival	2,219 data breach announcements from Privacy Rights Clearinghouse	After	Legislation and recording of breaches would improve breach management and research. Breach likelihood varies between firm types.
Goldstein et al. (2011)			X		Event Study	142 breach events in news media sources	After	Breached firms see reduced market value. However, availability events result in greater losses than system integrity announcements.
Rhee et al. (2012)		X			Survey	204 MIS executives	Scenario	Managers may have optimistically biased perceptions of breach and security risks.
Zafar et al. (2012)			X		Event Study	119 breach announcements and 867 non-breached competitors.	After	Data breach announcements negatively affect the market value of the breached firm, and its competitors in the same industry.
Chen et al. (2012)			X		Event Study	83 breach event announcements	After	IT consulting and technology firms suffer negative returns after a breach announcement.

References

- Andoh-Baidoo, F. K., Amoako-Gyampah, K., and Osei-Bryson, K. M. 2010. "How Internet Security Breaches Harm Market Value," *IEEE Security and Privacy* (8:1), pp. 36-42.
- Andoh-Baidoo, F. K., and Osei-Bryson, K. M. 2007. "Exploring the Characteristics of Internet Security Breaches That Impact the Market Value of Breached Firms," *Expert Systems with Applications* (32:3), pp. 703-725.
- Anton, A. I., He, Q., and Baumer, D. L. 2004. "Inside Jetblue's Privacy Policy Violations," *IEEE Security and Privacy* (2:6), pp. 12-18.
- Bélanger, F., and Crossler, R. E. 2011. "Privacy in The Digital Age: A Review of Information Privacy Research in Information Systems," *MIS Quarterly* (35:4), pp. 1017-1041.

- Butcher-Powell, L. M. 2006. "Better Securing an Infrastructure for Telework," *Journal of Cases on Information Technology* (8:4), pp. 71-86.
- Campbell, K., Gordon, L. A., Loeb, M. P., and Zhou, L. 2003. "The Economic Cost of Publicly Announced Information Security Breaches: Empirical Evidence from the Stock Market," *Journal of Computer Security* (11:3), pp. 431-448.
- Cavusoglu, H., Mishra, B., and Raghunathan, S. 2004. "The Effect of Internet Security Breach Announcements on Market Value: Capital Market Reactions for Breached Firms and Internet Security Developers," *International Journal of Electronic Commerce* (9:1), pp. 69-104.
- Chen, J. V., Li, H. C., Yen, D. C., and Bata, K. V. 2012. "Did IT Consulting Firms Gain When Their Clients Were Breached?," *Computers in Human Behavior* (28:2), pp. 456-464.
- Collins, J. D., Sainato, V. A., and Khey, D. N. 2011. "Organizational Data Breaches 2005-2010: Applying SCP to the Healthcare and Education Sectors," *International Journal of Cyber Criminology* (5:1), pp. 794-810.
- Culnan, M. J., and Williams, C. C. 2009. "How Ethics Can Enhance Organizational Privacy: Lessons from the Choicepoint and TJX Data Breaches," *MIS Quarterly* (33:4), pp. 673-687.
- Erickson, K., and Howard, P. N. 2007. "A Case of Mistaken Identity? News Accounts of Hacker, Consumer, and Organizational Responsibility for Compromised Digital Records," *Journal of Computer-Mediated Communication* (12:4), pp. 1229-1247.
- Evans, M. P., and Furnell, S. M. 2000. "Internet-Based Security Incidents and the Potential for False Alarms," *Internet Research* (10:3), pp. 238-245.
- Garg, A., Curtis, J., and Halper, H. 2003. "Quantifying the Financial Impact of IT Security Breaches," *Information Management and Computer Security* (11:2-3), pp. 74-83.
- Garrison, C. P., and Ncube, M. 2011. "A Longitudinal Analysis of Data Breaches," *Information Management and Computer Security* (19:4), pp. 216-230.
- Goel, S., and Shawkyy, H. A. 2009. "Estimating the Market Impact of Security Breach Announcements on Firm Values," *Information and Management* (46:7), pp. 404-410.
- Goldstein, J., Chernobai, A., and Benaroch, M. 2011. "An Event Study Analysis of the Economic Impact of IT Operational Risk and its Subcategories," *Journal of the Association for Information Systems* (12:9), pp. 606-631.
- Gordon, L. A., Loeb, M. P., and Zhou, L. 2011. "The Impact of Information Security Breaches: Has There Been a Downward Shift in Costs?," *Journal of Computer Security* (19:1), pp. 33-56.
- Herath, T., and Rao, H. R. 2009. "Protection Motivation and Deterrence: A Framework for Security Policy Compliance in Organisations," *European Journal of Information Systems* (18:2), pp. 106-125.
- Johnson, M. E. 2008. "Information Risk of Inadvertent Disclosure: An Analysis of File-Sharing Risk in the Financial Supply Chain," *Journal of Management Information Systems* (25:2), pp. 97-123.
- Kannan, K., Rees, J., and Sridhar, S. 2007. "Market Reactions to Information Security Breach Announcements: An Empirical Analysis," *International Journal of Electronic Commerce* (12:1), pp. 69-91.
- Ko, M., and Dorantes, C. 2006. "The Impact of Information Security Breaches on Financial Performance of the Breached Firms: An Empirical Investigation," *Journal of Information Technology Management* (17:2), pp. 13-22.
- Ko, M., Osei-Bryson, K. M., and Dorantes, C. 2009. "Investigating the Impact of Publicly Announced Information Security Breaches on Three Performance Indicators of the Breached Firms," *Information Resources Management Journal* (22:2), pp. 1-21.
- Lee, Y. J., Kauffman, R. J., and Sougstad, R. 2011. "Profit-Maximizing Firm Investments in Customer Information Security," *Decision Support Systems* (51:4), pp. 904-920.
- Morse, E. A., Raval, V., and Wingender Jr., J. R. 2011. "Market Price Effects of Data Security Breaches," *Information Security Journal* (20:6), pp. 263-273.
- Otto, P. N., Anton, A. I., and Baumer, D. L. 2007. "The Choicepoint Dilemma: How Data Brokers Should Handle the Privacy of Personal Information," *IEEE Security and Privacy* (5:5), pp. 15-23.
- Patel, S. C., Graham, J. H., and Ralston, P. A. S. 2008. "Quantitatively Assessing the Vulnerability of Critical Information Systems: A New Method for Evaluating Security Enhancements," *International Journal of Information Management* (28:6), pp. 483-491.
- Rhee, H. S., Ryu, Y. U., and Kim, C. T. 2012. "Unrealistic Optimism on Information Security Management," *Computers and Security* (31:2), pp. 221-232.
- Shropshire, J. 2009. "A Canonical Analysis of Intentional Information Security Breaches by Insiders," *Information Management and Computer Security* (17:4), pp. 296-310.
- Smith, H. J., Dinev, T., and Xu, H. 2011. "Information Privacy Research: An Interdisciplinary Review," *MIS Quarterly* (35:4), pp. 989-1016.
- Telang, R., and Wattal, S. 2007. "An Empirical Analysis of the Impact of Software Vulnerability Announcements on Firm Stock Price," *IEEE Transactions on Software Engineering* (33:8), pp. 544-557.
- Yayla, A. A., and Hu, Q. 2011. "The Impact of Information Security Events on the Stock Value of Firms: The Effect of Contingency Factors," *Journal of Information Technology* (26:1), pp. 60-77.
- Zafar, H., Ko, M. S., and Osei-Bryson, K. M. 2012. "Financial Impact of Information Security Breaches on Breached Firms and their Non-Breached Competitors," *Information Resources Management Journal* (25:1), pp. 21-37.

Appendix B

Service Recovery Literature

To gather articles, we searched three literature databases of Scopus, ABI/Inform, and Google Scholar. We looked for all that contained service outcome keywords, such as “service recovery” and “service failure,” and recovery action keywords, such as “apology” and “compensation.” We then narrowed our focus to include scholarly articles, excluding articles in the popular and practitioner media. From this group, we collected all empirical studies of service recovery published over the last 10 years. The list of target journals is shown in Table B1 and the articles are shown in Table B2.

Table B1. List of Journals Included in Background Literature Search

Marketing	Management	Information Systems
Journal of Consumer Research Journal of Marketing Journal of Marketing Research Journal of Retailing Journal of the Academy of Marketing Science Marketing Science	Academy of Management Journal Academy of Management Review Administrative Science Quarterly Decision Sciences Journal of Business Journal of Business Venturing Journal of Management Journal of Management Studies Journal of Operations Management Journal of Organizational Behavior Journal of Product Innovation Management Leadership Quarterly Management Science Operations Research Organization Science Organization Studies Strategic Management Journal	Decision Support Systems European Journal of Information Systems Information & Management Information Systems Journal Information Systems Research Journal of Information Technology Journal of Management Information Systems Journal of the Association of Information Systems MIS Quarterly

Table B2. Literature Review of Service Failure

Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Baker et al. (2008)	Individual	Racial discrimination, emotion-theoretic lens	X	X	Satisfaction, repurchase intention, word of mouth	Online panel quasi-experimental survey using scenario	1,314 members of panel	Scenario	Positive relationship between recovery effort (apology and compensation) and satisfaction, repurchase intention, and word of mouth. Black customers may perceive service failure to be more severe and require greater compensation.
Beverland et al. (2010)	Individual			X		Grounded theory	52 interviews, variety of occupations	Scenario	Conflict style moderates the relationship between failure and recovery effectiveness.
Bonifield and Cole (2008)	Individual	Social comparison theory		X	Exit complaint, Negative word of Mouth (NWOM), third party complaint propensity	Two 2 x 2 experiments	100 undergraduate students, 207 undergraduate students	Scenario (video vignettes)	Comparisons to other social groups and compensation offers are not additive in recovery. However, social comparison works when compensation is low or non-existent.
Bradley and Sparks (2012)	Individual	Attribution theory, justice theory	X	X	Satisfaction	Experiment	461 residents of a particular region	Scenario	Customer evaluations are affected by compensation received and the explanation of the source or reason for the failure. Empathy and apology performed better than just an explanation.
Casado et al. (2011)	Individual	Attribution theory, justice theory, appraisal theory	X		Choice of customer response	Logit model	165 regional bank branch customers	Scenario	Study examines double deviation (both the initial service failure and a failed service recovery). Apology and compensation positively affect customer's choice of response and emotional reaction.
Chang and Wang (2012)	Individual	Attribution theoretic lens	X	X	Customer preference for recovery channel	Conjoint and cluster analysis	201 Internet users	Scenario	Customers perceive compensation and apology as among the most critical attributes of effective service recovery.
Chebat and Slusarczyk (2005)	Individual	Justice theory, affect control theory		X	Actual loyalty exit	CATI phone survey	186 bank complainants	Critical incident recall	Compensation mediates both positive and negative emotions by improving justice perceptions.
Du et al. (2011)	Individual	Emotional contagion		X	Emotional contagion	Experiment in lab setting	260 students as restaurant patrons	Pre-failure, post-failure, post-recovery	Emotional displays from staff, coupled with compensating actions, improve recovery efforts by ameliorating negative emotions in customers.
Gelbrich (2010)	Individual	Appraisal theory and Justice theory		X	Negative word of mouth, complaining, support seeking	Quasi experimental survey with scenario, and a field survey	311 undergraduate students, 525 hotel guests recruited by students	Scenario	When customers feel helpless, explanations mitigate negative reactions, e.g., anger, even when no compensation is provided.
Gelbrich and Roschk (2011b)	Individual	Justice theory		X	Satisfaction, loyalty, word of mouth	Literature meta-analysis	87 service failure studies		The positive relation between compensation and satisfaction and word of mouth is moderated by industry and type of customer.

Table B2. Literature Review of Service Failure (Continued)

Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Gelbrich and Roschk (2011b)	Conceptual	Weber-Fechner law and prospect theory		X	Satisfaction	Literature meta-analysis	17 service failure studies		Overcompensation (refund greater than purchase price) has a lower incremental effect on satisfaction than simple compensation (refund equal to purchase price).
Goudarzi et al. (2012)	Individual			X	Post-failure expenditure	Archival analysis of customer purchase patterns	Loyalty card purchase events	Pre- and post-failure	Compensation is not useful if it is not offered quickly. Tardy compensation is counterproductive and costly.
Gregoire et al. (2009)	Individual	Complaint propensity	X	X	Desire for revenge, desire for avoidance	Four stage survey and scenario-based experiment	172 website users, 113 students	Scenario	Compensation and apology reduce desire for revenge. High relationship quality customers are content with an apology and mild compensation. Low quality customers are more prone to revenge and need greater compensation.
Gregoire et al. (2010)	Individual	Appraisal theory and interactional, distributive and procedural fairness		X	Direct revenge, indirect revenge	Two surveys	233 website users, 103 university students	Post-failure	Desire for revenge was negatively affected by procedural and interactional fairness. Failure severity affects anger, revenge and negative word of mouth.
Grewal et al. (2008)	Individual	Attribution theory		X	Repurchase Intentions	Three experiments using scenario-based critical incident technique (CIT)	Undergraduate and graduate students (n = 251, n = 116, n = 218)	Scenario	When the firm is seen as responsible for the failure, compensation affects repurchase intention. Otherwise, customers are satisfied with an explanation.
Harris et al. (2006)	Individual	Disconfirmation		X	Satisfaction, post-purchase intentions	Scenario-based experiment in airline and banking industries	162 participants	Scenario	The positive effect of compensation on satisfaction and post-purchase intention is stronger in offline than online contexts.
Huang (2008)	Individual	Attribution theory		X	Satisfaction	Retrospective experiences (critical incident technique)	352 shoppers at a Taiwanese shopping mall	Scenario	Controllability attribution leads customers to expect compensation to recover from dissatisfaction. Stability attribution and failure severity had no effect on recovery expectations but negatively related to satisfaction.
Huang and Lin (2011)	Individual	Utility expectation		X	Satisfaction, repurchase intention	Between subjects 2 x 2 experimental design	145 university students	Scenario	Contrasts utilitarian (price reduction) and hedonic (free gift) compensation. Customers prefer to receive compensation that matches the affected service (i.e., hedonic compensation for hedonic service).

Table B2. Literature Review of Service Failure (Continued)

Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Hui and Au (2001)	Individual	Culture theory (individualism and collectivism)	X	X	Justice perceptions, post-complaint behaviors	Experiment	University students: n = 175 (China), n = 160 (Canada)	Scenario	Not all groups see compensation in the same way. Compensation has stronger positive effect on justice perceptions and post-complaint behaviors for Canadian than Chinese customers.
Kim and Uldago (2012)	Individual			X	Satisfaction, repurchase intention	Experiment	292 university students	Scenario	Contrasts immediate and delayed compensation. Perceived severity of failure moderates effect of compensation on satisfaction and repurchase intention. In severe failure, immediate compensation has stronger positive effect on satisfaction and repurchase intention.
Li et al. (2012)	Individual	Culture theory	X	X	Complaint intention, fairness perceptions, perceived attainability of overcompensation	Two quasi-experimental studies	Undergraduate students (n = 95, n = 36)	Scenario	Overcompensation reduced post-recovery complaint tendency among "loose" (tolerant) customers but not "tight" (intolerant) customers. Either compensation or apology may improve dissatisfaction and complaint intention for loose customers, tight customers preferred apology over compensation.
Liao (2007)	Individual	Justice theory	X		Satisfaction, repurchase intention	Field study, laboratory experiment	568 surveys collected by 45 graduate students, 395 surveys collected by 32 graduate students	Scenario	Apology positively affects satisfaction and repurchase intention by improving justice perceptions. Failure severity and frequency reduce effectiveness of recovery procedures.
Lee and Lee (2012)	Individual	Equity theoretic lens		X	Satisfaction, trust, word of mouth, repurchase intention	2 x 2 between subjects factorial design	273 university students	Scenario	Compensation expressed in dollar terms is perceived as fair for a high price product. Compensation expressed in percentage terms is perceived as more fair for a low price product. Customers who are satisfied with recovery exhibit higher trust, word of mouth and repurchase intention.
Mattila (2006)	Individual	Equity theoretic lens, attribution theory		X	Tipping behavior, fairness perception	3 x 2 between subjects experiment. Participants viewed six videos of service failure.	188 undergraduate college students	Scenario (restaurant vignette)	Compensation has better justice outcomes than no compensation. Offering an explanation can also reduce incorrect attribution.
Mattila (2009)	Individual	Trust-theoretic lens	X	X	Trust, attitude to service provision, behavioral intention	Experiment	143 undergraduate students	Scenario (hypothetical newspaper article)	Apology can ameliorate negative effects of public relations disasters, for both intentional and external causes.

Table B2. Literature Review of Service Failure (Continued)									
Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Mattila (2010)	Individual	Emotion centric lens		X	Satisfaction	Between subjects quasi-experimental design	195 attendees at a US arts festival	Scenario	Females are more satisfied than males with compensation when they can choose between compensation alternatives.
Mattila and Cranage (2005)	Individual	Equity theory	X	X	Satisfaction	2 x 2 between subjects experimental design	280 undergraduate students	Scenario	Compensation and apology positively affect perceptions of fairness, which is positively related to satisfaction. Combined apology and compensation improves interactional fairness.
Mattila and Patterson (2004)	Individual	Attribution theory and culture		X	Perceived effort, satisfaction, problem handling	Quasi experimental survey with scenario	Undergraduate students, n = 150 American, n = 139 Thai, n = 132 Malay	Scenario	Compensation, perceived effort and explanation positively affected post-recovery satisfaction. Response varied between cultures.
Maxham and Netemeyer (2002)	Individual	Perceived, distributive and procedural justice		X	Recovery satisfaction, firm post-satisfaction, word of mouth intention, purchase intention	Two survey studies, with one post-failure and two post-recovery rounds in each.	Bank customers (n = 692 and n = 339)	Post-failure and post-recovery	Service repair used to compensate customers to return them to original position. Justice perceptions were positively related to satisfaction. Procedural justice was positively related to purchase intentions in both studies.
Morrison and Huppertz (2010)	Individual	Justice theory		X	Satisfaction	2 x 2 between subjects quasi experimental survey design	808 university students	Scenario	Membership of a loyalty program has no effect when both focal and referent customers receive equal compensation. When the referent customer received greater compensation, respondents were very dissatisfied with the outcome. They were less dissatisfied if the referent customer was a loyalty program member.
Noone (2012)	Individual	Equity theoretic lens		X	Fairness perceptions, negative word of mouth	Laboratory experiment	Participants recruited at two hotels (n = 81, n = 85) and an airport (n = 85)	Scenario	Cash-based overcompensation yielded higher perceptions of fairness than full compensation or credit-based overcompensation.
Orsingher et al. (2010)	Individual	Justice theory		X	Intentions to return, word of mouth and satisfaction	Meta-analysis	50 research papers about satisfaction with complaint handling		Distributive, Interactional and procedural justice positively affect satisfaction.
Park et al. (2008)	Organization	Justice theory	X	X	Distributive, procedural, and interactional justice	Qualitative analysis using textual coding and Critical Incident Technique	346 Service experience narratives of family travelers from online public customer complaint websites	Post-failure and post-recovery	Complaint rates and compensation effects on justice perceptions vary between industries. Justice perceptions vary between industries, possibly because different industries exhibit different failure types.

Table B2. Literature Review of Service Failure (Continued)

Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Patterson et al. (2006)	Individual	Justice theory, culture theory	X	X	Post-recovery satisfaction, fairness perceptions	Experiment	Undergraduate students in Thailand (n = 246) and Australia (n = 241)	Scenario	Eastern and Western culture types may affect service recovery response. Higher perceptions of justice are positively related to post-recovery satisfaction.
Prasongsukarn and Patterson (2012)	Individual	Justice theory, culture theory		X	Post-recovery satisfaction, fairness perceptions	Experiment	1,098 undergraduate students	Scenario	Perceptions of recovery are likely affected by the timing of recovery actions. Providing information about recovery mechanisms affects satisfaction with compensation.
Roggeveen et al. (2011)	Individual	Justice theory and expectation disconfirmation		X	Satisfaction, Repurchase Intention	Four experiments with failure scenarios	University students n = 79, n = 111, n = 87, n = 168	Scenario	Customer involvement improves recovery for severe failures. Compensation assists for severe, but not non-severe failures.
Sparks and McColl-Kennedy (2001)	Individual	Justice theory		X	Satisfaction, future intentions	2 × 2 × 2 × 2 between-subject experimental design using video vignettes	420 members of business and community groups	Scenario (hotel setting)	Higher satisfaction with services when a partial refund was given if the provider was seen to be following policy. For token (minor) compensation, respondents showed higher satisfaction if they felt the provider was doing them a favor.
Vazquez-Casielles et al. (2012)	Individual	Attribution theory, emotion-theoretic lens		X	Satisfaction, repurchase intention, positive and negative word of mouth, third party complaint propensity	2 × 2 × 2 between-subjects experimental design	432 customers at a Spanish airport	Scenario (travel setting)	Financial compensation and social comparison are positively related to behavioral intentions.
Voorhees et al. (2006)	Individual	Equity theory		X	Repeat purchase intentions, negative affect, regret, negative word of mouth	Survey using critical incident technique	530 university students	Scenario	Non-complainers are less likely to repurchase than customers who (a) complain and receive satisfactory recoveries or (b) do not complain but receive recovery
Wang and Mattila (2011)	Individual	Culture theory, justice theory	X		Post-failure satisfaction, loyalty intentions	Between-subjects experimental design	286 undergraduate students	Scenario	Different cultures perceive failure explanations in different ways. Taiwanese participants saw apology as more just. Fairness was positively related to satisfaction and intention.
Wirtz and Mattila (2004)	Individual	Equity theory, attribution theory	X	X	Negative word of mouth (NWOM), repatronage intention, post-recovery satisfaction	2 × 2 × 2 between-subject factorial experiment	187 working adults	Scenario	Compensation and apology affect post-recovery satisfaction. Compensation alone does not improve satisfaction with a poor recovery process. Post-recovery satisfaction fully mediated service recovery and behavioral intentions.

Table B2. Literature Review of Service Failure (Continued)

Reference	Unit of Analysis	Theory Frame	Apology	Compensation	Dependent Variables	Method	Data	Timing	Findings
Wirtz et al. (2010)	Individual	Justice theory		X	Perceived fairness, opportunistic claiming, satisfaction	Five studies: observation, interviews and three experiments (lost baggage scenario, catering scenario, catering scenario).	500 claim documents, 17 interviews, n = 360 students, n = 261 employees, n = 82 employees	Scenario, post-recovery	Customers were more opportunistic for low or unfair compensation, low employee concern and inconvenience. Greater opportunism for one time rather than continuing relationships. Opportunistic claimants were not more satisfied.
Wong (2004)	Individual	Culture theory	X	X	Repurchase intentions, word of mouth	3 × 2 between-subjects design	Three university student samples: USA (n = 253), Australia (n = 192), Singapore (n = 71)	Scenario	Compensation improves repurchase intention and word of mouth in the US sample, but not the Singaporean or Australian groups. Apology improves satisfaction in Singaporean and Australian but not US group.
Worsfold (2007)	Individual	Justice theory		X	Satisfaction, repatronage intentions, and complaint intentions	2 × 2 × 2 independent groups factorial design	Undergraduate students (n = 180, n = 179)	Scenarios (DVD hire store, restaurant)	Compensation and rapport were most effective when losses were non-financial or failure was negligible. Proactive rapport-building may offset failure perceptions.

Note: Unit of analysis was classified as conceptual, artifact, individual, organization, or social.

References

- Baker, T. L., Meyer, T., and Johnson, J. D. 2008. "Individual Differences in Perceptions of Service Failure and Recovery: The Role of Race and Discriminatory Bias," *Journal of the Academy of Marketing Science* (36:4), pp. 552-564.
- Beverland, M. B., Kates, S. M., Lindgreen, A., and Chung, E. 2010. "Exploring Consumer Conflict Management in Service Encounters," *Journal of the Academy of Marketing Science* (38:5), pp. 617-633.
- Bonifield, C., and Cole, C. A. 2008. "Better Him than Me: Social Comparison Theory and Service Recovery," *Journal of the Academy of Marketing Science* (36:4), pp. 565-577.
- Bradley, G., and Sparks, B. 2012. "Explanations: If, When, and How They Aid Service Recovery," *Journal of Services Marketing* (26:1), pp. 41-50.
- Casado, A. B., Nicolau, J. L., and Mas, F. J. 2011. "The Harmful Consequences of Failed Recoveries in the Banking Industry," *International Journal of Bank Marketing* (29:1), pp. 32-49.
- Chang, D. S., and Wang, T. H. 2012. "Consumer Preferences for Service Recovery Options after Delivery Delay When Shopping Online," *Social Behavior and Personality* (40:6), pp. 1033-1044.
- Chebat, J. C., and Slusarczyk, W. 2005. "How Emotions Mediate The Effects of Perceived Justice on Loyalty in Service Recovery Situations: An Empirical Study," *Journal of Business Research* (58:5), pp. 664-673.
- Du, J., Fan, X., and Feng, T. 2011. "Multiple Emotional Contagions in Service Encounters," *Journal of the Academy of Marketing Science* (38:3), pp. 449-466.
- Gelbrich, K. 2010. "Anger, Frustration, and Helplessness After Service Failure: Coping Strategies and Effective Informational Support," *Journal of the Academy of Marketing Science* (38:5), pp. 567-585.
- Gelbrich, K., and Roschk, H. 2011a. "Do Complainants Appreciate Overcompensation? A Meta-Analysis on the Effect of Simple Compensation vs. Overcompensation on Post-Complaint Satisfaction," *Marketing Letters* (22:1), pp. 31-47.
- Gelbrich, K., and Roschk, H. 2011b. "A Meta-Analysis of Organizational Complaint Handling and Customer Responses," *Journal of Service Research* (14:1), pp. 24-43.
- Goudarzi, K., Borges, A., and Chebat, J. C. 2013. "Should Retailers Pay To Bring Customers Back? The Impact of Quick Response and Coupons on Purchase Outcomes," *Journal of Business Research* (66:5), pp. 665-669.
- Gregoire, Y., Laufer, D., and Tripp, T. M. 2010. "A Comprehensive Model of Customer Direct and Indirect Revenge: Understanding the Effects of Perceived Greed and Customer Power," *Journal of the Academy of Marketing Science* (38:6), pp. 738-758.
- Gregoire, Y., Tripp, T. M., and Legoux, R. 2009. "When Customer Love Turns into Lasting Hate: The Effects of Relationship Strength and Time on Customer Revenge and Avoidance," *Journal of Marketing* (73:6), pp. 18-32.

- Grewal, D., Roggeveen, A. L., and Tsiros, M. 2008. "The Effect of Compensation on Repurchase Intentions in Service Recovery," *Journal of Retailing* (84:4), pp. 424-434.
- Harris, K. E., Grewal, D., Mohr, L. A., and Bernhardt, K. L. 2006. "Consumer Responses to Service Recovery Strategies: The Moderating Role of Online Versus Offline Environment," *Journal of Business Research* (59:4), pp. 425-431.
- Huang, W. H. 2008. "The Impact of Other-Customer Failure on Service Satisfaction," *International Journal of Service Industry Management* (19:4), pp. 521-536.
- Huang, W. H., and Lin, T. 2011. "Developing Effective Service Compensation Strategies: Is a Price Reduction More Effective than a Free Gift?," *Journal of Service Management* (22:2), pp. 202-216.
- Hui, M. K., and Au, K. 2001. "Justice Perceptions of Complaint-Handling: A Cross-Cultural Comparison Between PRC and Canadian Customers," *Journal of Business Research* (52:2), pp. 16-173.
- Kim, N., and Ulgado, F. M. 2012. "The Effect of On-the-Spot Versus Delayed Compensation: The Moderating Role of Failure Severity," *Journal of Services Marketing* (26:3), pp. 158-167.
- Li, C., Fock, H., and Mattila, A. S. 2012. "The Role of Cultural Tightness-Looseness in the Ethics of Service Recovery," *Journal of Global Marketing* (25:1), pp. 3-16.
- Liao, H. 2007. "Do It Right This Time: The Role of Employee Service Recovery Performance in Customer-Perceived Justice and Customer Loyalty after Service Failures," *Journal of Applied Psychology* (92:2), pp. 475-489.
- Lee, Y., and Lee, M. 2012. "The Joint Effects of Compensation Frames and Price Levels on Service Recovery of Online Pricing Error," *Managing Service Quality* (22:1), pp. 4-20.
- Mattila, A. S. 2006. "The Power of Explanations in Mitigating the Ill-Effects of Service Failures," *Journal of Services Marketing* (20:7), pp. 422-428.
- Mattila, A. S. 2009. "How to Handle PR Disasters? An Examination of the Impact of Communication Response Type and Failure Attributions on Consumer Perceptions," *Journal of Services Marketing* (23:4), pp. 211-218.
- Mattila, A. S. 2010. "Do Women like Options More than Men? An Examination in the Context of Service Recovery," *Journal of Services Marketing* (24:7), pp. 499-508.
- Mattila, A. S., and Cranage, D. 2005. "The Impact of Choice on Fairness in the Context of Service Recovery," *Journal of Services Marketing* (19:5), pp. 271-279.
- Mattila, A. S., and Patterson, P. G. 2004. "The Impact of Culture on Consumers' Perceptions of Service Recovery Efforts," *Journal of Retailing* (80:3), pp. 196-206.
- Maxham III, J. G., and Netemeyer, R. G. 2002. "Modeling Customer Perceptions of Complaint Handling Over Time: The Effects of Perceived Justice on Satisfaction and Intent," *Journal of Retailing* (78:4), pp. 239-252.
- Morrisson, O., and Huppertz, J. W. 2010. "External Equity, Loyalty Program Membership, and Service Recovery," *Journal of Services Marketing* (24:3), pp. 244-254.
- Noone, B. M. 2012. "Overcompensating for Severe Service Failure: Perceived Fairness and Effect on Negative Word-of-Mouth Intent," *Journal of Services Marketing* (26:5), pp. 342-351.
- Orsingher, C., Valentini, S., and De Angelis, M. 2010. "A Meta-Analysis of Satisfaction with Complaint Handling in Services," *Journal of the Academy of Marketing Science* (38:2), pp. 169-186.
- Park, Q. J., Lehto, X., and Park, J. K. 2008. "Service Failures and Complaints in The Family Travel Market: A Justice Dimension Approach," *Journal of Services Marketing* (22:7), pp. 520-532.
- Patterson, P. G., Cowley, E., and Prasongsukarn, K. 2006. "Service Failure Recovery: The Moderating Impact of Individual-Level Cultural Value Orientation on Perceptions of Justice," *International Journal of Research in Marketing* (23:3), pp. 263-277.
- Prasongsukarn, K., and Patterson, P. G. 2012. "An Extended Service Recovery Model: The Moderating Impact of Temporal Sequence of Events," *Journal of Services Marketing* (26:7), pp. 510-520.
- Roggeveen, A. L., Tsiros, M., and Grewal, D. 2011. "Understanding the Co-Creation Effect: When Does Collaborating with Customers Provide a Lift to Service Recovery?," *Journal of the Academy of Marketing Science* (40:6), pp. 771-790.
- Sparks, B. A., and McColl-Kennedy, J. R. 2001. "Justice Strategy Options for Increased Customer Satisfaction in a Services Recovery Setting," *Journal of Business Research* (54:3), pp. 209-218.
- Vazquez-Casielles, R., Iglesias, V., and Varela-Neira, C. 2012. "Service Recovery, Satisfaction and Behavior Intentions: Analysis of Compensation and Social Comparison Communication Strategies," *Service Industries Journal* (32:1), pp. 83-103.
- Voorhees, C. M., Brady, M. K., and Horowitz, D. M. 2006. "A Voice From The Silent Masses: An Exploratory and Comparative Analysis of Noncomplainers," *Journal of the Academy of Marketing Science* (34:4), pp. 514-527.
- Wang, C., and Mattila, A. S. 2011. "A Cross-Cultural Comparison of Perceived Informational Fairness with Service Failure Explanations," *Journal of Services Marketing* (25:6), pp. 429-439.
- Wirtz, J., and Mattila, A. S. 2004. "Consumer Responses to Compensation, Speed of Recovery and Apology After a Service Failure," *International Journal of Service Industry Management* (15:2), pp. 150-166.
- Wirtz, J., and McColl-Kennedy, J. R. 2010. "Opportunistic Customer Claiming During Service Recovery," *Journal of the Academy of Marketing Science* (38:5), pp. 654-675.
- Wong, N. Y. 2004. "The Role of Culture in the Perception of Service Recovery," *Journal of Business Research* (57:9), pp. 957-963.
- Worsfold, K., Worsfold, J., and Bradley, G. 2007. "Interactive Effects of Proactive and Reactive Service Recovery Strategies: The Case of Rapport and Compensation," *Journal of Applied Social Psychology* (37:11), pp. 2496-2517.

Appendix C

Constructs and Survey Items

Table C1 lists the survey items used in the study.¹

Table C1. Relevant Constructs and Survey Items for Round 1 and Round 2	
Items Used in Round 1	
Expected Compensation	A month of free network membership for all customers is obvious if the console network is breached.
	I expect that Sony gives customers free downloadable content if the network is breached.
	I expect to get a new console if the console network gets hacked.
Items Used in Round 2	
Experienced Compensation	A month of free network membership for all customers was obvious when the console network was breached.
	As expected, Sony gave customers free downloadable content when the network was breached.
	As expected, I got a new console when the console network got hacked.
Items for Outcome and Control Variables (Identical in both data collection rounds)	
Service Quality	Sony's customer services are of high quality.
	Sony's customer services are always functional.
	The performance of Sony's customer services is very reliable.
	The customer service of Sony is not good quality. *
Continuance Intention	I intend to continue playing online games on the console network.
	I want to continue playing online games on the console network rather than discontinue.
	I predict I will continue playing online games on the console network.
	I plan to continue playing online games on the console network.
Repurchase Intention	I intend to continue purchasing products from Sony.
	All things considered, I will purchase products from Sony over the next 12 months.
	Chances are high that I will continue purchasing products from Sony.
	I don't intend to repurchase products from Sony in future.*
Intrinsic Motivation	I find playing online games on the console network enjoyable.
	The actual process of playing online games on the console network is pleasant.
	I have fun playing online games on the console network.
	I find it unenjoyable playing online games on the console network.*
Extrinsic Motivation	When I play online games on the console network, I always try to reach a high score.
	I play online games on the console network as it allows me to compete with other players.
	I want to gain achievements games when playing online games on the console network.
	I play online games on the console network to get higher in the rankings.
Habit	Playing online games on the console network has become automatic to me.
	Playing online games on the console network is natural to me.
	I play online games on the console network as a matter of habit.
	I do not play online games on the console network habitually. *

All items were measured using a seven-point Likert scale (1 = strongly disagree...7 = strongly agree).

*reverse-coded items

Reference

Petter, S., Straub, D., and Rai, A. 2007. "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly* (31:4), pp. 623-656.

¹All constructs are conceptualized as reflective even though it is clear that "Expected Compensation" and "Experienced Compensation" are formative. Fortunately, according to Petter et al. (2007), there is likely not a Type I or Type II problem when exogenous variables such as these are mis-specified.

Appendix D

Tests for Sample Selection Bias

All survey research involves the possibility of sample selection bias. This sample selection bias can occur when one group contributes more than others because they feel particularly passionate about the phenomenon under study. Ordinarily, this sample bias is difficult to gauge and only approximations can be made (Wagner 2012). However, the two-stage survey method applied in this research allows us to assess the differences between those who responded in round 1 but did not respond in round 2.

We adapted a technique from Whitehead et al. (1993) and Dubin and Rivers (1989), and used a binary logistic regression to compare demographic indicators of round 1 respondents against round 2 respondents. This technique allows for contingent dependencies between both rounds and is robust to shared or dependent error terms between rounds. The dependent variable was set equal to 1 if they participated in round 1 only, and to 2 if they participated in both rounds. We included purchase date, income, weekly use, and gender as independent variables. Table D1 shows the results of this testing.

	B	S.E.	Wald	Sig.	Exp(B)
Purchase Date	.126	.088	2.034	.154	1.134
Income	.055	.039	2.012	.156	1.057
Weekly Use	-.068	.054	1.578	.209	.934
Gender	-.159	.217	.536	.464	.853
Constant	-253.273	177.052	2.046	.153	.000
Cox & Snell R ²	.013				
Nagelkerke R ²	.019				

Table D1 shows that no variables were significant predictors of participation in the second round of the survey. Wald statistics for all variables were not significant, which suggests that they have low or no explanatory power (Agresti 1990). Both the Cox & Snell R² and Nagelkerke R² were low, indicating low model explanatory power.

We also ran a non-parametric Mann-Whitney U test on the same variables. The advantage of a non-parametric test is that it is robust to variable skewness and kurtosis. We obtained similar results from these non-parametric tests.

References

- Agresti A. 1990. *Categorical Data Analysis*, New York: John Wiley and Sons.
- Dubin, J. A., and Rivers, D. 1989. "Selection Bias in Linear Regression, Logit and Probit Models," *Sociological Methods and Research* (18:2/3), pp. 360-390.
- Wagner, J. 2012. "A Comparison of Alternative Indicators for the Risk of Nonresponse Bias," *Public Opinion Quarterly* (76:3), pp. 555-575.
- Whitehead, J. C., Groothuis, P. A., and Blomquist, G. C. 1993. "Testing for Non-Response and Sample Selection Bias in Contingent Valuation: Analysis of a Combination Phone/Mail Survey," *Economics Letters* (41:2), pp. 215-220.

Appendix E

Respondent Demographics

Table E1. Respondent Demographics for Study 1					
Demographic	Category	Study 1			
		Round 1		Round 2	
		n	%	n	%
Gender	Men	369	66.25	91	63.19
	Women	184	33.03	53	36.81
	No response	4	0.72	0	0
Annual Salary	Less than US \$12,500	115	20.65	23	15.97
	US \$12,500 - US \$24,999	86	15.44	24	16.67
	US \$25,000 - US \$37,499	113	20.29	30	20.83
	US \$37,500 - US \$49,999	65	11.67	20	13.89
	US \$50,000 - US \$62,499	60	10.77	14	9.72
	US \$62,500 - US \$74,999	30	5.39	8	5.56
	US \$75,000 - US \$87,499	25	4.49	7	4.86
	US \$87,500 - US \$99,999	18	3.23	7	4.86
	US \$100,000 or more	19	3.41	6	4.17
Prefer not to say	26	4.67	5	3.47	
Age (years)	Less than 20	51	9.16	6	4.17
	20-25	209	37.52	45	31.25
	26-30	141	25.31	42	29.17
	31-35	79	14.18	22	15.28
	36-40	36	6.46	10	6.94
	41-50	31	5.57	15	10.42
	Older than 50	7	1.26	4	2.78
	No response	3	0.54	0	0.00