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Impact of Service Characteristics on Rational and Emotional Components of Information Systems Service Evaluations

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IMPACT OF SERVICE CHARACTERISTICS ON RATIONAL AND EMOTIONAL
COMPONENTS OF INFORMATION SYSTEMS SERVICE EVALUATIONS

by

Colin Gabriel Onita

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ABSTRACT

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Information systems (IS) research and practice have recognized the need to move the IS field to a more service oriented paradigm. This requires a good understanding of how IS services are evaluated and the factors that influence the perceptions of service performance. Measures of IS service quality have provided an insight into the rational/technical factors that influence the evaluation of IS services. Recently, the need for the investigation of additional factors that influence IS service evaluations has been recognized. One such factor that can influence the evaluation of an IS service is the emotional response that the IS service elicits in a recipient. Emotional responses play a major role in building attitudes, beliefs and behavioral intentions. However, IS service research has focused more on the rational aspects of these phenomena while largely ignoring the emotional aspects when explaining IS service evaluations. This research seeks to provide a better understanding of how individuals evaluate IS services by focusing on the salient characteristics of the IS service that can influence these evaluations. To achieve this, the research focuses on two research objectives: (1) to investigate the how the individual components of IS service evaluations – the emotional and rational evaluation components – impact various behaviors associated with the IS service and (2) to investigate how specific, theory driven service characteristics impact the emotional and relational components of IS service evaluation. A controlled experiment is used to investigate IS service evaluations and the characteristics of IS services that influence them. Results suggest that both emotional and rational components

of IS service evaluations have significant impacts on behavioral intentions associated with the IS service. Furthermore, findings indicate that while the specificity of service output impacts both the emotional and rational evaluations of the IS service, the complexity of the service task only influences the emotional component by increasing the level of emotional evaluations associated with the service. Proximity between service provider and service recipient was found to have no significant impact on the emotional evaluation of the service.

Preface

The dissertation includes a survey tool validation study (Onita & Dhaliwal, 2010) as part

of the Research Methodology Chapter, Scale Validation Study section, which was

published in the 2010 International Conference on Information Systems, St. Louis (ICIS

2010).

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Chapter 1

Introduction

Recent developments in Information Systems literature have highlighted the need to redefine IS output in terms of service. Concepts such as software-as-a-service (Spohrer & Riecken, 2006) have shown that what traditionally was considered a product or technical artifact can now been refashioned as a service to specific clients. Such developments have led to a need to better understand how individuals evaluate IS services and what the salient factors are that influence these evaluations. Literature, particularly from marketing and operations management, has advocated the development of better theories regarding service (Vargo & Lusch, 2004, 2008). Current research recognizes the fact that many of the products manufactured and developed today contain a large service component (Gustafsson & Johnson, 2003; Vargo & Lusch, 2004, 2008). Products themselves are just a means for delivering a service, which, most of the time, includes a significant information component (Vargo & Lusch, 2004, 2008). As a discipline, IS needs to also recognize this "servitization" trend and contribute to the debate with conceptualizations of IS services that lead to an understanding of the role of IS in the service constellation.

Software Testing Services

One of the important services rendered by IS departments to their business constituents is the development of software (Spohrer & Riecken, 2006; Yang, Onita, Dhaliwal, & Zhang, 2011). Business organizations spend a large portion of their IT budgets on software acquisition activities (Kelly & Siegel, 2008), with a significant proportion of those resources being squandered on failed projects and missing

functionality (Gartner, 2003). Because of these realities, the testing of developed or acquired software is an important service rendered by testing professionals to software developers, business users and other stake-holders (Dhaliwal, Onita, Poston, & Zhang, in press; Elbert & Dumnke, 2007; Onita & Dhaliwal, 2010; Yang et al., 2011). For this reason, this research focuses on better understanding and improving the service of software testing, by implementing an experiment that uses the result of a testing activity – a testing defect report – to investigate how the recipients of the testing service (software developers) evaluate the testing report received.

Service Evaluations

An important task in better theorizing any service is to understand how the service is evaluated by service recipients and measuring perceptions about its performance. Literature on measuring service performance comes mainly from marketing where Parasuraman, Zeithaml, and Berry (1988, 1991) developed the SERVQUAL measurement tool for quantifying the perceived quality of a service. IS literature adapted the SERVQUAL measure to the IS context (Jiang, Klein, & Carr, 2002; Kettinger & Lee, 2005) and also to the Web context (Loiacono, Watson, & Goodhue, 2007). Other important measures of service performance are the perceived satisfaction with the service (Jiang, 2002), its perceived usefulness (Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003) or the internal climate of the service provider (Schneider, White, & Paul, 1988). These measures generally represent a rational evaluation of the service or its output.

In the process of evaluation, two evaluative components play an important role – a rational component and an emotional component (Lazarus, 1991; Lowenstein, Weber,

Hsee, & Welch, 2001). Therefore, an important dimension of service evaluation is the emotional response an individual has to a service they have received. Identifying whether emotions influence the evaluations of an IS service and the process through which emotions work to influence the evaluation of a service are important for providing a complete picture of service evaluation processes (Lowenstein et al., 2001). Organizations themselves are "emotional arenas" where emotion plays an important role in the decisions taken (Fineman, 1993). Emotions now play a central role in explanations of social judgment (Forgas, 1995), employee performance appraisal (Forgas & Tehani, 2005), risk perception (Loewenstein et al., 2001), and everyday thoughts and decision making (Clore & Huntsinger, 2007; Zajonc, 1980). Most important for the present discussion, researchers now further maintain that "the impact of cognitive evaluations on behavior is mediated, at least in part, by affective responses (cognitive evaluation gives rise to feelings that in turn affect behavior)" (Loewenstein et al., 2001, p. 271). The appraisal theory of emotions (Lazarus, 1991; Schachter and Singer, 1962,) describes the process through which emotions arise in response to stimuli. This theory suggests that the evaluation/appraisal of a stimuli/event is composed of a rational evaluation of the event/stimuli which in turn leads to an emotional response and a corresponding state of arousal (Lazarus, 1991; Schachter and Singer, 1962). When dealing with IS services the appraisal of the service can be viewed through the lens of appraisal theory. The event or service encounter leads to a rational appraisal of the encounter on the part of the service recipient which in turn influences the emotional response to the encounter. This service appraisal process further influences the behavioral intentions exhibited by the service recipient.

Furthermore, in IS literature, emotions are starting to be accepted as a potential explanatory variable. For example, Parboteeah, Valacich, and Wells (2009) look at emotions to explain consumers' urge to buy impulsively in an online environment, while Beaudry and Pinssoneault (2010) investigate emotional influences on technology adoption. Even given these new trends in emotion research in IS, there still is a need for better understanding the influence of emotions on IS phenomena, especially in the area of IS service evaluations where emotions may play a very important role. Therefore, the first research goal proposed by this thesis is *to understand how emotional and rational components play a role in forming IS service evaluations.*

The second goal of this research is the identification of salient characteristics of the service which influence the emotional and rational components of service evaluations. A survey of prior literature on service and emotions identifies a host of service characteristics which can influence the nature of the assessment of a service recipient with the service received. Mehrabian (1991) proposes *proximity* – defined as the relational and spatial distance between service recipient and service provider – as an important driver of emotions in a personal service encounter. He suggests that services that require close proximity are more likely to engender an emotional response from the service recipient. In the same vein, Forgas (1995) proposes the Affect Infusion Model (AIM) which suggests that the *complexity* of a task – defined as a function of the number of distinct task related acts and the number of distinct information cues about the attributes and characteristics of the task (Wood, 1986) – leads to a higher reliance on emotional cues when assessing the tasks requirements and outcomes. Finally, Nadkrani and Gupta (2007) also propose *specificity* of the service output – defined as the clarity of

the service output – as an important antecedent of satisfaction with the service. Thus, the second research goal is *to investigate how specific service characteristics (complexity, proximity and output specificity) impact the emotional and relational components of IS service evaluation.*

Importance of Research

The focus of this study is on how individuals evaluate IS services and specifically how software developers evaluate the software testing services that they receive. This research is important in two ways – 1. the research proposes and tests a theoretical framework for understanding and measuring IS service evaluations and; 2.the research provides practical and actionable implications for industry.

First, the research builds and tests theoretical propositions regarding software testing service evaluation by implementing an experiment that varies salient, theory driven characteristics of the testing service and measures the corresponding evaluations of the service recipient. Software development and testing are important components of an organizations IS portfolio, but the process through which individuals evaluate these activities are not well understood. This research will shed light on the process of testing service evaluations and on which characteristics of the testing service are important to testing service recipients.

Second, this research will provide actionable insight about how testing services can be improved. By understating how software developers evaluate the testing service received, and by showing which characteristics of the testing service are most important to software developers, this research will allow IS managers to tailor and customize their testing service offering to the specific needs of their developers. This research will also

draw attention to a previously ignored component of service evaluation – the emotional component – which, if dealt with properly, can increase the overall satisfaction of testing service recipients.

Organization of the Manuscript

The dissertation is structured as follows. The next chapter presents the theoretical foundation for IS services, rational and emotional components of IS service evaluations, and the antecedents of IS service evaluation. The third chapter develops the hypotheses to be tested. Chapter four describes the research method employed and presents several pilot studies used to refine the emotional measures used in this research. Chapter five describes the experimental investigation and results of the data analysis. Finally chapters six and seven discuss the findings and present conclusions, limitations and directions for future research.

Summary of the Chapter

This chapter provided an introduction to the reasoning behind this research. The focus of the research is on understanding how individuals evaluate IS services and specifically software testing services. This research proposes an IS service evaluation framework built around a model of rational and emotional evaluations and the characteristics of the IS service which are likely to influence these evaluations. Finally, this chapter describes why this research can have important implications for academia and industry.

Chapter 2

Literature Review

Introduction

      This chapter provides an overview of IS service evaluations by introducing the components of service evaluations – rational and emotional. First, a reasoning for the focus on IS services is provided. Next, rational and emotional components of IS service evaluations are discussed. The next section provides an overview of salient, literature driven service characteristics that have an influence on the emotional and rational components of service evaluations. Finally, the chapter introduces a host of potential behavioral outcomes that result from the appraisal process and presents a framework that integrates the antecedents, components and outcomes of the IS service evaluation process in a comprehensive explanatory model.

Information Systems Services

      The value of IS services is an important construct as well as an important metric for any IS service providing business function (DeLone & McLean, 2002, 2003; Tallon, Kraemer, & Gurbaxani, 2000). One of the ways to view this value of IS services is as value in use (Vargo & Lusch, 2004). This view of customer value is a result of the shift from the traditional Goods-Dominant (G-D) logic to the new Service-Dominant (S-D) logic proposed by Vargo and Lusch (2004). S-D logic is a new way of looking at the exchange of value. In S-D logic, goods (offerings) simply serve as vehicles for service provision, there is no value until an offering is used and therefore the user is always part of the value proposition by consuming the service.

S-D customer value stems from the idea of value in use rather than the traditional value in exchange. A customer obtains value from a good or service when and only when the good or service is used, thus value is "defined by and co-created with the customer" (Vargo & Lusch, 2004, p.6). In this view, the satisfaction with a service is the "value created by experiences" (Prahalad 2004, p. 172).

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┌─────────────────────────────────┐
│          IS Service             │
└─────────────────────────────────┘
┌──────────────────┐ ┌──────────────────┐
│  Inward Facing   │ │  Outward Facing  │
│   IS Services:   │ │   IS Services:   │
│                  │ │                  │
│ Systems Development│ │ Web and Online  │
│ Systems Maintenance│ │External Client Support│
│Internal Client Support│ │ Communication  │
│   IT Training    │ │   Interface      │
│Communication and Networking│ │   Billing  │
│  Data Assurance  │ │     …            │
│     Payroll      │ │                  │
│     Logistic     │ │                  │
│Decision Support Systems│ │              │
│    Database      │ │                  │
│       …          │ │                  │
└──────────────────┘ └──────────────────┘
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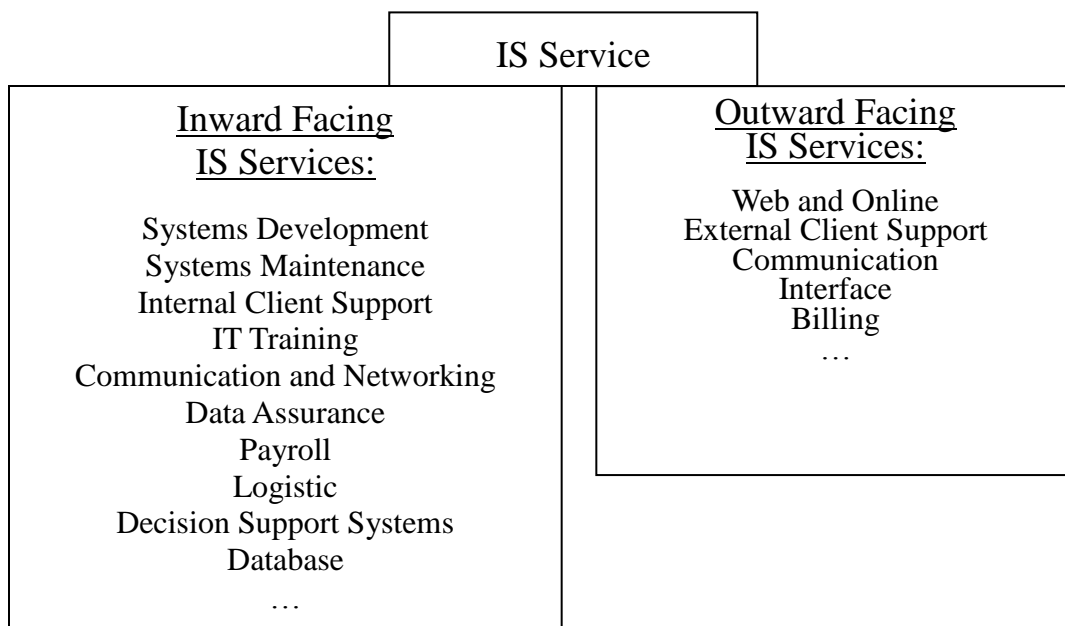
Figure 1. Types of IS Services

In IS research too, there is a move towards a service oriented philosophy regarding the products of IS. Ideas such as software-as-a-service (Spohrer & Riecken, 2006) show that IS is no longer construed to be only related to the product of information or technology but is, in a large part, a service to customers. While a comprehensive categorization of IS services is not available in the literature we can, in general,

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categorize the services provided by IS into inward facing services – for internal clients of the organization and outward facing services – for clients outside of the organization. Figure 1 describes these two types of IS services.

Other developments such as the use of Service Oriented Architectures (Schroth, 2007) and the development of service level agreements in many IS organizations show the shift in paradigm for IS from a support organization to a service organization.

While outward facing services (services served to external customer) are very important for IS service companies such as online retailers, IS service providers, software companies, etc., other organizations may offer only limited IS services to external customers. Also, research on external IS services is better represented in the IS literature than literature on inward facing IS services (e.g., Parboteeth, et al. 2010; Pullman & Gtross, 2004; etc.). This research focuses on inward facing IS services, given the relative paucity of research in this area, and the importance of internal IS services in creating business value. Most modern organizations employ at least one form or another of internal IS services, and many of them rely heavily on internal IS services to conduct their core, day-to-day activities. For example, while not all organizations build their own, customized, in-house software, most organization use some form of payroll, communication or logistics IS service. Some organizations, on the other hand, even if they do not have IS services as a core product, rely heavily on in-house, custom built software and other IS services to conduct their day-to-day business operations.

Software Testing as a Service to Software Developers

In the category of inward facing IS services, software development and testing are important aspects of an organization's IS portfolio and strategy (Kelly & Siegel, 2008).

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Software testing ensures that the software developed meets the requirements of business and provides the functionality and quality necessary for the organization to accomplish its goals. By providing software validation and verification services, software testing can be construed to be a service provided by software testers to software developers (Onita & Dhaliwal, 2010; Spohrer & Riecken, 2006; Yang et al., 2011). As a service, software testing will be subject to the evaluation of the software developers and is therefore a good context for the investigation of IS service evaluation processes.

IS Service Evaluations

Information systems success has been defined as the effectiveness of information systems to support organizational goals and the impact information systems have on the organization (DeLone & McLean, 1992, 2002, 2003). IS success has been an important topic in IS research for at least two decades (DeLone & McLean, 1992; 2002; 2003). An important variable in the success of any IS activity has been the satisfaction of the user with the IS and its output (DeLone & McLean, 1992, 2002, 2003) which is a surrogate measure for the evaluation or appraisal that an individual has regarding an IS system or service. As antecedents to this evaluative component of success, DeLone and McLean (1992) proposed initially two components – system and information quality – and later added on a third component (DeLone & McLean, 2002, 2003) – service quality – to describe the service component of the IS offering. In addition to these components, usefulness of the IS that predicts satisfaction and use intentions (Davis, 1989; DeLone & McLean, 2002, 2003; Venkatesh et al., 2003,).

Following the IS success framework of DeLone and McLean (2002, 2003), this research employs information quality and usefulness as part of the rational component of IS service evaluations.

In the case of software development and testing, the output of testing services describes defects, errors or improvements of components of a system, therefore the system is going to be constant, but the quality of the output may differ. In describing the evaluation process of IS testing services, and following DeLone and McLean's (1992, 2003) framework, this research looks at information quality and usefulness of a software testing defect report as variables of interest.

In addition to the rational components of evaluation, emotional responses to the IS service are also important in creating the overall evaluation of the IS service. Research in psychology suggests that "the impact of cognitive evaluations on behavior is mediated, at least in part, by affective responses (cognitive evaluation gives rise to feelings that in turn affect behavior)" (Loewenstein, Weber, Hsee, & Welch, 2001, p. 271). Emotions act as interceding variables between rationality and behavioral intentions (Lazarus, 1991; Schachter & Singer, 1962) by a process through which an event stimulates a rational appraisal of the event, which in turn results in an emotional response and a specific state of arousal in an individual with regard to the observed event. The evaluation of an IS service encounter is composed of both rational and emotional responses which, in turn, influence behavioral intentions related to the service outcome. The evaluation process described in this research usually starts with an event. The event – an IS service encounter – leads to a rational appraisal of the encounter – described by DeLone and McLean's (2002, 2003) IS success model - which in turn influences the emotional

response to the encounter. Finally, this holistic service appraisal process further influences the behavioral intentions exhibited by the service recipient (Lazarus, 1991; Schachter & Singer, 1962).

This research proposes an integrated framework of IS service evaluations which describes both the rational and emotional components of evaluation and their impact on the behavioral intentions associated with the service encounter.

IS Service Evaluations – Rational Components

This section discusses the rational components of IS service evaluations. These components have been used as proxies in IS research to investigate the majority of questions related to IS service evaluations. Four important measurements of the rational components of evaluation – service satisfaction, service quality, information quality and perceived usefulness – are discussed below.

Service Satisfaction. The idea of service satisfaction was developed originally in marketing and was later adopted by the IS literature (Jiang et al., 2002; Westbrook, 1980; Walker, 1995). Literature on service satisfaction has dealt with the components of service satisfaction as well as with the various dimensions of the service received. For example, Jiang et al. (2002) looked at aspects such as the relationship between recipients of IS service and IS staff, the attitude IS staff have towards those requesting service from them, and the quality of information provided. The satisfaction with an IS product, be it technology, information or process, has been an important IS success factor (DeLone & Mclean, 1992; 2003) and is usually one of the dependent variables investigated in many IS studies (e.g., Kettinger & Lee, 1995; Rai, Lang, & Welker, 2002; Saarinen, 1993). User satisfaction is still an important topic for IS (Aladwani, 2003; McLean, 1990;

Whitten, 2004, 2005). This is an important success factor especially for a service oriented function, since the satisfaction of service recipients with the service received is a clear measure of how the service provider performs. Measuring the service performance is paramount in quantifying the success with which a business function performs its duties.

Satisfaction was defined by Oliver (1997) as the pleasurable level of consumption of a product or service which is related the fulfillment of needs, goals or desires. This view of satisfaction relies on the confirmation and disconfirmation of expectations of a consumer with their consumption experience (Oliver, 1989; Stayman, Alden, & Smith, 1992). In the expectation-disconfirmation paradigm of Oliver (1980) satisfaction arises as the result of a comparison between expectations (beliefs about desired attributes of a service or product), and an actual, realized consumption experience. Additionally, pre-expectance comparisons standards influence the expectations of consumers of products and services (Howard & Sheth, 1969; Oiashavsky & Miller, 1972; Wilton & Tse, 1983; Woodruff, Cadotte, & Jenkins, 1983). The last factor that influences consumption satisfaction is the actual performance of a service or product (Churchill & Suprenant, 1982; Cronin & Taylor, 1992; Tse & Wilton, 1988).

In IS research, the confirmation-disconfirmation view of satisfaction has been employed to investigate user satisfaction and its antecedents (e.g., Bhattacherjee, 2001). Satisfaction with a service was found to be an important antecedent of acceptance, diffusion and assimilation of IT services and artifacts in organizations (Cronin & Taylor, 1992; Rogers, 1983). In outsourcing, satisfaction as confirmation of expectations, was shown to be important in the evaluation of an outsourcing partner (Teng, Cheon, & Grover, 1995). Satisfaction has been found to influence customer retention rates (Rust,

Zahorick, & Keiningham, 1995), repurchase intentions and continuance intentions (Anderson & Sullivan, 1993; Au et al., 2009; Bhattacherjee, 2001), as well as customer retention (Bolton, 1998),

The expectation-disconfirmation component of an experience is an important influencing factor of the emotions that arise from the service consumption experience, which, in turn influences behavioral intentions regarding the service encounter (Oliver, 1997). By meeting or exceeding expectations regarding a service, service providers are likely to engender positive evaluations and emotions in the recipient of the service.

Research in satisfaction with IS services has focused primarily on the rational components of the service confirmation-disconfirmation concept (e.g., Bhattacherjee, 2001) and has largely ignored the emotional aspect of the consumption experience, which is an important component of the evaluation of a service. This emotional response is a multi-layered construct that may consist of many different positive and negative emotions which need to be further investigated in order to provide a more complete picture of IS service evaluation and satisfaction.

Service Quality (SERVQUAL). Measuring the quality of services provided was initially proposed in marketing literature in the format of the SERVQUAL measurement (Parasuraman, Zeithaml, & Berry, 1991) to describe the components which can influence the perceptions of service recipients about the performance of the service received. The literature on service quality was initially developed by Grönroos (1982, 1984) who defined service quality in terms of functional quality and technical quality. Later, Parasuraman, Zeithaml, and Berry (1988, 1991) developed five distinct components of a service resulting from what they called a "service encounter" – the interaction between

the service recipient and service provider. These components of service quality were tangibles, reliability, responsiveness, empathy, and assurance (Parasuraman et al., 1988, 1991). These dimensions are defined as: tangibles - physical facilities, equipment, and appearance of service personnel; reliability – the ability of service staff to perform the promised service dependably and accurately; responsiveness – the willingness of service personnel to help and provide prompt service; assurance – the knowledge and courtesy of service personnel and their capability to provide a feeling of trust and confidence to their customers, and empathy – providing customized care and attention to all service recipients. Parasuraman et al. (1988,1991) developed the SERVQUAL instrument as a measurement of gaps between customer expectations and the services received and showed that the SERVQUAL measurement was universal in its interpretation. Customers use basically the same dimensions when evaluating the service quality of a service they receive regardless of the type of service received. SERVQUAL is to date considered one of the most complete and widely-utilized measurement instrument for assessing service recipients' perceptions of service quality (Nyeck, Morales, Ladhari, & Pons, 2002).

In the IS literature, SERVQUAL has been used to investigate e-service quality (Zeithaml, Parasuraman, & Malhotra, 2002), online service quality (Geffen, 2002), and website service quality (Liu & Arnett, 2000; Loiacono et al., 2007; Yoo & Donthu, 2001). Following Parasuraman et al. (1994), Kettinger and Lee (2005) developed a IS based service quality measure that measured the gap between the desired service and the minimum service acceptable. They named this gap a zone of tolerance which can be used to diagnose and improve IS services.

Information Quality. Information quality pertains to the quality of the informational output of an information system. Information quality is a multifaceted construct which has been studied extensively by IS researchers (e.g., Bailey & Pearson, 1983; DeLoan & McLean, 1992, 2002, 2003; Doll & Torkzadeh, 1988; Larker & Lessig, 1980; Munro & Davis, 1977; Zmud, 1978). This is an important quality concept for a discipline that deals in information and it usually caters to the perception of goodness or quality of the information received from an IS artifact be it technological or service oriented.

Information quality has been strongly associated with system use and benefits resulting from the use of information systems (D'Ambra & Rice, 2001; DeLone & McLean, 1992, 2002, 2003; Elezadi-Amoli & Earhoommad, 1996; Molla & Licker, 2001; Wixom & Watson, 2001) and is a strong driver of satisfaction with an IS artifact (DeLone & McLean 1992, 2002, 2003).

Information quality has been measured in many ways, but a consensus emerged on measuring this concept as a multidimensional construct with the following components (DeLone & McLean 1992, 2002, 2003): completeness – the level of comprehensiveness of coverage of the topic provide by the information; ease of understanding – how clear and easy to understand is the information provided; personalization – how customized is the information to the individual receiving it; relevance – how applicable is the information to the task at hand; security – how secure and trustworthy is the information; and currency – how up-to-date is the information, regarding the task or topic of relevance. There are some variations on these main components of information quality, especially when the concept is being applied to a

specific context (for examples in the e-commerce context please see D'Ambra & Rice, 2001; Elezadi-Amoli & Earhoommad, 1996; Molla & Licker, 2001), but, for the purpose of this research, the main components presented above have been preserved.

Perceived Usefulness. The perceived usefulness of an IS artifact or service to an IS user is another well-established construct used to measure the value of IS to an individual (e.g., Beaudry & Pinnsoneault, 2010; Davis et al., 1989; Venkatesh et al., 2003). Perceived usefulness is defined as the degree to which a person believes that an IS artifact or service will enable the achievement of certain goals, the successful completion of certain tasks and will increase the individual's overall job performance (Davis et al., 1989; Venkatesh et al., 2003). The foundations of perceived usefulness as an important driver of IS success and value (via adoption and use of an IS artifact or service) are to be found in two widely accepted psychological theories – the theory of planned behavior (Ajzen 1991) and the theory of reasoned action (Fishbein & Ajzen, 1975). These two theories describe how an individual's perceptions of an event, situation, artifact or person are the primary drivers of attitudes and behaviors. In IS, these two theories have been adapted mainly in technology acceptance research through developments such as the technology acceptance model (TAM; Davis et al., 1989) and the unified theory of acceptance and use of technology (UTAUT; Venkatesh et al., 2003) as well as the decomposed theory of planned behavior(DTPB; Taylor & Todd, 1995). These theories suggest that IS adoption behaviors as well as other behaviors are influenced by rational evaluations of salient characteristics of the IS artifact or service such as their usefulness and ease of use (Davis et al., 1989; Venkatesh et al., 2003). Prior research shows that perceived usefulness has been one of the most important drivers of behaviors related to

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use, reuse and evaluations (Bhattacherjee, 2001; Davis et al., 1989; Sussman & Siegel, 2003; Venkatesh et al., 2003).

IS Service Evaluations – Emotional Components

Emotions have historically been construed to have a detrimental biasing and negative impact on evaluation and decision making activities and behaviors (Forgas, 2000). This historical view on emotions, came from the fact that most of these activities and behaviors are assumed to be of a rational nature (Loewenstein & Lerner, 2003). Emotions, on the other hand, were considered to be more disruptive and irrational (Ketelaar & Clore, 1998; Scherer, 1984).

More recent research shows that cognition, rationality and emotions are closely interrelated where rationality is influenced by and, in turn, influences emotions to create complex behaviors and responses (Dalgeish & Power, 1999; Forgas, 2000; Lowenstein, 2001). Also, purely rational processes suffer from what Simon (1976) called "bounded rationality" (March & Simon, 1958; Simon, 1976) as humans are limited in their information processing, cognitive activities when faced with complex situations. In such complex situations, humans tend to rely more on emotional cues and heuristics (Forgas, 1995). Finally, research on the interaction between emotions and evaluation and decision processes shows that emotions can be beneficial or detrimental depending on the intensity and the quality of the emotion involved and the complexity of the situation (Loewenstein & Lerner, 2003).

An Integrated Framework of Emotions

Emotions, or valenced emotional states, describe the intrinsic attractiveness (positive valence) or aversiveness (negative valence) of an event, object, or situation (Frijda, 1986).

Research shows that valenced emotional states (e.g., affective reactions and moods) influence judgment and decision making (J/DM) in many complex ways and serve as a companion to pure rational processes (Pham, 2007). However the issue of valenced emotional states has only recently received rigorous research attention. This has been primarily attributed to early psychologists' low level of interest in valenced affective effects (Finucane, Peters, & Slovic, 2003). Research in the fields of behavioral psychology, cognitive psychology and economics considered valenced emotional states as a sort of aberration in rational and calculated J/DM processes (Peters, Vastfjall, Garling, & Slovic, 2006). However, the modern treatment of valenced emotional states in current theory is changing the way emotions are treated in research. Valenced emotional states now play a central role in explanations of social judgment (Forgas, 1995), employee performance appraisal (Forgas & Tehani, 2005), risk perception (Loewenstein et al., 2001), and everyday thoughts and decision making (Clore & Huntsinger, 2007; Zajonc, 1980). Furthermore, valenced emotional states are no longer attributed an exclusively biasing role in the J/DM process, rather, several researchers suggest that they serve a facilitator role under certain conditions (Finucane et al., 2003).

In psychology research, valenced emotional states are now accepted as an explanatory mechanism where rationality influences valenced emotional states, or the reverse; the existence of these effects is regarded as eliciting little debate in the research

literature (Loewenstein et al., 2001). Most important for the present discussion, researchers now further maintain that "the impact of cognitive evaluations on behavior is mediated, at least in part, by affective responses (cognitive evaluation gives rise to feelings that in turn affect behavior)" (Loewenstein et al. 2001, p. 271). While some researchers posit that emotions are precursors to rational interpretations and behavioral outcomes (e.g, Cannon-Bard theory of emotions; Cannon, 1927) the view of emotions as an interceding variable between rationality and behavioral intentions has gained a large acceptance in psychology literature. This view of emotions is based on the appraisal theory of emotions (Figure 2; Lazarus, 1991; Schachter & Singer, 1962). The appraisal theory of emotions describes the process through which an event stimulates a rational appraisal of the event, which in turn stirs an emotional response and a specific state of arousal in an individual with regard to the observed event (Lazarus, 1991; Schachter & Singer, 1962). An IS service encounter is a specific service event that is evaluated by a service recipient. This evaluation is composed of both a rational and an emotional response which, in turn, influence behavioral intentions. When dealing with IS services, the appraisal of the service can be viewed through the lens of appraisal theory. The event – service encounter – leads to a rational appraisal of the encounter on the part of the service recipient which in turn influences the emotional response to the encounter. This service appraisal process further influences the behavioral intentions exhibited by the service recipient (Lazarus, 1991; Schachter & Singer, 1962).

Given the modern interest in emotions research (Izard 1991), many new theories and knowledge about emotions have recently been developed. Most of the research in valenced emotional states defines emotion as a complex phenomenon involving many

components and subsystems such as cognitive and physiological components, motor and

facial expression, behavioral tendencies, and subjective feeling (Frijda, 1994; Izard,

1991; Roseman, 1984; Scherer, 1984). All these taken together are often grouped under

the term of the componential model of emotion (Scherer, 2000).

EVENT ┄┄▶ THOUGHT ┄┄▶ EMOTION
                    ┄┄▶ AROUSAL

Figure 2. Appraisal Theory of Emotions (Lazarus, 1991; Schachter & Singer, 1962)

The componential theories of emotion (Ellsworth & Scherer, 2003; Roseman,

1984; Scherer, 1984; Smith & Ellsworth, 1985) represent a body of research that focuses

on the cognitive components of emotion. Research in this stream shows that cognition,

rationality and emotion are interdependent in that emotional responses are a result of an

individual's subjective evaluation of a goal or need centered event. Emotions are direct

results of the appraisal process elicited by an individual's exposure to a stimuli

represented by an event, object, person, etc. Each of these exposures and subsequent

appraisals lead to a different emotional response from the individual. This can potentially

led to a very large number of emotional responses (Scherer, 1984, 1994). Even so, all of

these different emotional responses can be categorized in general families of emotions

that are commonly exhibited by individuals (Scherer, 2000). Scherer (2000) groups the

different families of emotions under the generic term of modal emotions. Some of the

important characteristics on which emotions can be differentiated are their valence

(positive or negative); the degree to which the emotion refers to a specific stimulus –

integral emotions which arise from the appraisal of a clear and definite stimulus and

incidental emotions, which do not have a particular stimulus focus and may have an

unknown cause; the duration or dynamism of the emotion; and the impact that the

emotion has on behavior (Bodehausen, 1993; Frijda, 1986; Lazarus, 1991; Scherer, 1984,

2005)

Modal emotions are defined as the prototypical outcomes of frequently occurring

combinations or patterns of appraisal (Scherer, 1994, 2000; Scherer & Ellsworth, 2001).

Modal emotions are to be distinguished from mood and affect due to their more dynamic

and integral nature (Scherer, 2000). Modal emotions are episodic and dynamic. They

have a beginning and an end, and are of a relatively brief duration (Ekman & Davidson,

1994; Frijda, 1994; Scherer, 1996). Modal emotions are also integral to a stimulus (i.e.,

event/person/object specific; Bodehausen, 1993; Lazarus, 1991), and usually have a clear

cause and a cognitive component (Forgas, 1991). Modal emotions also have specific and

focused impacts on actions and behaviors (Frijda, 1986; Ketelaar & Clore, 1998).

Table 1 describes an integrated framework of valenced emotional states that have

been identified in the emotions literature.

Affect, as distinguished from modal emotions is incidental in nature (i.e., not

event/person/object specific) (Bodehausen, 1993) and can refer to either feelings

implying pleasantness or unpleasantness in a broad sense (Frijda, 1994), a personality

trait (Diener, Smith, & Fujita, 1995; Watson, Clarck, & Carey, 1988), or an attitude

(Scherer, 2000).

Finally, mood is also an incidental (i.e., no particular object of focus of the emotions, sometimes even with an unknown cause) type of valenced emotional state which is low in intensity, diffuse and relatively long-lasting (Ekman, 1994; Forgas, 1991; Frijda, 1994; Izard, 1991). In comparison with modal emotions, mood is less intense, and longer lasting (Barsade, 2001; Kelly & Barsade, 2001).

Table 1
Valenced Emotional States

Valenced emotional states (Cummings et al., 1985; Frijda, 1986)	Integral (Bodehausen, 1993)	Modal Emotions (Scherer 2000, 2005)	Positive (Scherer 1984, 2005)	High Control (Scherer 1984, 2005)	Pride
					Elation
					Joy
					Satisfaction
				Low Control (Scherer 1984, 2005)	Relief
					Hope
					Interest
					Surprise
			Negative (Scherer 1984, 2005)	High Control (Scherer 1984, 2005)	Envy
					Disgust
					Contempt
					Anger
				Low Control (Scherer 1984, 2005)	Sadness
					Fear
					Shame
					Guilt
		Affect	Feelings (Frijda, 1994)	Pleasant	
				Unpleasant	
			Attitude (Scherer, 2000)	Positive	
				Negative	
	Incidental (Bodehausen, 1993)	Affect	Personality trait (Diener, Smith, and Fujita, 1995; Watson et al., 1988)		
		Mood (Forgas, 1991; Frijda, 1994; Izard, 1991)	Positive		
			Negative		

Emotions in Marketing Literature

Much of the research on services and service evaluations comes from marketing literature. Borrowing from psychology, marketing science has also investigated the influence of emotions on various service related phenomena.

Marketing literature has investigated emotions as antecedents in purchase behavior and persuasion advertisements with romantic, fear or scarcity appeals (Bagozzi & David, 1994; Belk, Ger, & Askegaard, 2003; Grisevicius et al., 2009; Passyn & Sujan, 2006), and advertisements with loss versus gain messages (Keller et al., 2003). Consumers were found to prefer advertisements with improving emotions over the duration of the advertisement (Labroo & Ramanathan, 2007). Emotions also play an important role in health choices where the graver the choice, the more emotional cues are used to define and make the choice (Agrawal, Menon, & Aaker, 2007; Botti, Orfali, & Iyengar, 2009). Literature also investigated the process of gaming emotions whereby a party may misrepresent their current emotional state in order to further their own goals (Andrade & Ho, 2009). This was found to work only if subjects believed that the misrepresented emotions were credible (Andrade & Ho, 2009). In the same stream, Henning-Thurau, Groth, Paul, and Gremler (2006) found that displays of positive emotions, if interpreted as genuine can improve the perceived satisfaction of consumer with the service received.

Emotions play a role in the attitude towards television commercials (Bosmans & Baumgartner, 2005; Lau-Gesk & Meyers-Levy, 2009) and advertised products when emotions are used to assess the emotional claims of the advertisement or product (Kim, Park, & Schwartz, 2010).

The influence of age and time on emotions was investigated in an experiment with advertisements which focused on avoidance of negative emotions which were recalled more and for a longer time by older audiences (Williams & Drolet, 2005). Dube and Morgan (1996) also found that retrospective judgments on emotions are a function of the increase or decrease of emotions over time. Gender was also conceptualized as an important antecedent of different emotions and males were found to have lower emotional responses to socially desirable emotional advertising (Fisher & Dube, 2005).

Research in satisfaction with consumption found that the emotional content of consumption can influence satisfaction (Westbrook & Oliver, 1991). Price, Arnould, and Tierney (1995) found that perceived service performance is also linked to the duration of the wait, affective content of the service and interaction as well as the spatial proximity between the service provider and the consumer. On the other hand, when it comes to service satisfaction and behavioral intentions regarding a service provider, Knowles, Grove, and Pickett (1999) found that emotions (as mood) play a less significant role then the nature of the service itself.

Another major area that dealt with emotional responses was service recovery. This research looked at the impacts of emotions and trust (DeWitt, Nguyen, & Marshall, 2008), perceived injustice (Schoefer & Diamantopulos, 2008) and fairness (Mccoll-Kennedy & Sparks, 2003) on loyalty and post-recovery behavior. Loyalty was also investigated by Johnson, Hermann, and Huber (2005) who found that loyalty intentions are initially a function of rational value evaluations, but over time, loyalty is influenced by more emotional attitudes toward the brand.

In the realm of product adoption, Wood and Moreau (2006) found that emotions can influence product evaluations above and beyond the traditional cognitive processes.

Emotions also result from coping with tradeoff choices (Chitturi, Raghunathan, & Mahajan, 2007; Drolet & Luce, 2004; Garg, Wansing, & Inman, 2007; Hedgcook & Rao, 2008; Luce, 1998) or as a result of purchase or abstaining to purchase a product or service (Mukhopadhyay & Johar, 2007). Emotions as mood can also impact other psychological variables that affect decision making (Hill & Ward, 1989). Lee, Amir, and Ariely (2009) shows that greater reliance on emotional cues increases preference consistency and reduces cognitive noise.

Research also shows that individuals try to maintain positive emotions over short periods and change negative emotions over the long term (Labroo & Mukhopadhyay, 2009) and that the intensity of complex mixed emotions is misestimated over time (Aaker, Drolet, & Griffin, 2008). Also, persuasion appeals that make use of mixed, conflicting emotions lead to less favorable attitudes in individual with a low propensity to accept duality (Williams & Aaker, 2002)

Another interesting area that has not had much research is the emotional evaluations of a product or service based on the country of origin. Research finds that country of origin influenced evaluations only when anger emotions were involved and when human control was high (Maheswaran & Yi, 2006).

Emotion measurement instruments were also proposed such as in the case of measuring discrete emotions when coping with stress and negative emotions (Duhachek, 2005) or comparing different emotion scales (Richins, 1997).

Finally, emotions were construed to create an organizational climate that fosters

motivation for certain behaviors (Tyagi, 1982). At the organizational level, Homburg,

Grozdanovici, and Kalarmann (2007) have introduced the idea of a rational and

emotional organizational system. They found that the rational organizational system lead

to an organization that is more responsive to competitors, whereas an emotional

organizational system fosters customer responsiveness.

Emotions in Information Systems Literature

IS research has largely ignored valenced emotional states in its explanation of IS

behaviors and phenomena (Beadury & Pinsoneault, 2010). Some IS research

acknowledged the influence of other structures rather than only intellectual/rational

structures in explaining IS phenomena. Structuration theory (Jones & Karsten, 2008;

Orlikowski, 1993; Orlikowsi & Robey, 1991) and Adaptive Structuration Theory

(DeSanctis & Poole, 1996) introduce social elements in their explanation of IS

phenomena. The purpose of this section is to review the relevant IS literature that deals

with valenced emotional states as a salient phenomenon.

Studies of the technology adoption model acknowledge influences above and

beyond cognitive or rational motivations – social influence (Venkatesh & Davis, 2000),

and cognitive absorption (Agrawal & Karahanna, 2000). Also, many of the studies that

investigate technology adoption employ constructs that have emotional components. For

example, Davis et al. (1989) define attitude as "An individual's positive or negative

feelings about performing the target behavior". Similarly, Venkatesh et al. (2003)

stipulates that "attitude toward using technology is defined as an individual's overall

affective reaction to using a system." Such examples show that even though emotional

concepts have been used in defining many IS phenomena, their actual implementation through operationalization and measurement mainly focused on the rational aspects of these phenomena, with only a few IS studies both defining and measuring the emotional components (e.g., Beaudry & Pinsoneault, 2010). This shows that while emotions have been looked at for quite some time in IS studies, their treatment was not entirely accurate.

Other research that used emotions as explanatory variables is related to online behavior. This research has investigated non cognitive influences on decisions taken on commercial websites by individual users. Such research looked at issues of trust arising from identity disclosure and the effect of personalization on online behavior (Tam & Shuck, 2005). Studies in knowledge management found that non-rational motivation such as altruism (there is still debate on whether or not altruism is rational) influence individuals in their decision to share knowledge on electronic knowledge repositories (Kankahali, Tan, & Wei, 2005; Wasko & Faraj, 2005). Furthermore, IS studies have extensively investigated the influence of personality and cognitive style on J/DM, usage and acceptance (Devraj, Easley, & Crant, 2008; Huber, 1983; etc.), but have generally ignored valance emotional states as a potential influencing factor in J/DM, adoption or use of IS artifacts.

Only a limited number of IS articles have investigated the influence of valenced emotional states on IS phenomena. To present a complete picture of valenced emotional states in IS, a comprehensive search of the top MIS journals was conducted. For each individual journal, the search was begun from the first edition of the journal to the present. For some journals, this period covered more than 20 years. Appendix A shows the results of the literature search and represents a comprehensive picture of how

emotions have been treated in IS research. Based on the definitions of emotions presented

above, and the three main types of valenced emotional states (modal emotions, affect and

mood), the IS literature was further categorized by the type of valenced emotional states

and whether valenced emotional states are treated as a dependent or independent variable.

To help in structuring the stream of research in which a certain article falls, the long

version of the Sidorova et al., (2008) IS research categorization scheme was used. This

categorization scheme identifies thirteen major streams of research in IS. These streams

are presented in Table 3 and they cover 98% of the IS articles investigated by the authors.

Table 2
IS research themes (adapted from Sidorova et al. 2008)

Theme	Definition
IS Development	Developing new IT systems
IT Management	Managing the IT function
Value of IT	Measuring the contribution of IT to the business
IT Adoption and Use	Adoption and use of IT by individuals
IT and Markets	The influence of IT on online transactions, customer service etc
IT for Group Support	Use of IT in supporting group interaction
Measurement Instruments	Measuring the impacts of IT and outcomes of IT use
IS Discipline Development	Core developments of the IS discipline
Decision Support Systems	IT for decision support
HR Issues in IS	Training and hiring issues in IT
Virtual Collaboration	IT support for virtual teams
Project and Risk Management	Project and risk management issues regarding IT
IT Use by Individuals	Learning and education regarding IT issues

To identify gaps and areas of potential fruitful IS research that deals with valenced emotional states, Table 4 on page 30 maps emotions related IS articles on the 13 categories identified by Sidorova et al. (2008).

Table 3

Mapping of Valenced emotional states IS literature on Sidorova et al. (2008) IS theme categories (the numbers represent articles from Appendix A).

Theme	Affect in MIS Literature
IS Development	12. Emotional connections (NIS) 15. Framing effects
IT Management	**Gap**
Value of IT	**Gap (covered in this research)**
IT Adoption and Use	1. Emotions 2. Fear 5. Playfulness, Anxiety 6. Group mood 8. Socio- Emotional results 9 Affective reward 14. Attractiveness (expectancy theory) 18. Positive mood
IT and Markets	12. Emotional connections (NIS)
IT for Group Support	6. Group mood 8. Socio-Emotional results 9 Affective reward
Measurement Instruments	**Gap (covered in this research)**
IS Discipline Development	**Gap (covered in this research)**
Decision Support Systems	15., 21. Framing effects 16. Negative Emotions elicited by the content of a communication 17, 18. Positive mood 20. Regret reduction
HR Issues in IS	3. Emotional display norms 13. Desires and satisfaction disconfirmation
Virtual Collaboration	4. Empathy 10. Negative Emotions 16. Negative Affect elicited by the content of a communication, 19. Affect as information 22., 23. Anxiety and Emotional arousal
Project and Risk Management	11. Feelings that exists between two parties to a relationship
IT Use by Individuals	**Gap**

Current IS literature usually treats valenced emotional states as just one of a host of antecedents to, or the results of, other variables of interest. Authors that use valenced emotional states as outcome variables have investigated the impact of use (Hwang & Kim, 2007; Kelly & Bostrom, 1998), media (Jurgen, 2006; Norman, Cooper, & Chin, 2009a) and communication characteristics (Jurgen, 2006; Norman, Cooper, & Chin, 2009b) on valenced emotional states during interaction with an IT artifact.

Much more prevalent is the situation where valenced emotional states are treated as an antecedent to continuance or adoption of an IT artifact (De Guinea & Markus, 2009; Venkatesh, 2000), job exhaustion (Rutner & Hardgrave, 2008), performance of the collaborative relationship (Paul, McDaniel, &Reuben, 2004; Norman et al., 2009a, b) and virtual interaction (Johnson, 2008; Kern & Wilcocks, 2002), customer loyalty (Pullman & Gross, 2004), cognitive effort while performing a decision task as well as the accuracy of the decision taken (Djamsabi & Loiacono, 2008).

In general, the treatment of valenced emotional states in IS is non-systematic. There is no differentiation between the three types of valenced emotional states – direct (modal emotions) as the dynamic response to a topical stimuli; indirect (mood), emotion not directly related to the stimulus; and affect – the longer term valenced state stemming from salient individual and topical characteristics. Valenced emotional states are generally construed to be a source of bias or negative influence on IS related decision processes. There are few research papers that consider valenced emotional states as a viable source of usable information in an IS context (e.g., Kiesler, Lee, & Eccles, 1985). Even fewer articles deal with mood as a source of information (e.g., Djamsabi & Loiacono, 2008; Nomran et al., 2009a, b). In IS service satisfaction and evaluation

research, valenced emotional states have also been largely ignored. Understanding how emotions influence service evaluation and satisfaction is required to provide a more comprehensive understanding of how IS as a service adds value to a service philosophy (for further details about the treatment of valenced emotional states in IS please see Appendix A).

The lack of interest in valenced emotional states as information and the treatment of emotions as perhaps an aberration of the J/DM process (Peters et al. 2006) stems, in part, from the fact that the theories that were the basis for much of the IS valenced emotional states research were cautious in assigning informational value to valenced emotional states (Finucane et al., 2003; Peters et al., 2006). Indeed, traditional views in psychology and economics viewed valenced emotional states as a bias for J/DM and used valenced emotional states as controls for investigating other salient variables (Finucane et al., 2003; Peters et al., 2006). This traditional view of emotions has taken a turn in current psychology literature, whereas valenced emotional states are viewed now as important explanatory variable and are seen as facilitators of decision making (Finucane et al., 2003).

Given these new developments in the treatment of valenced emotional states, IS research needs to also acknowledge emotions as an important source of information often overlooked in explanatory IS models. An integrated model of both direct and indirect emotional states would help better understand the influence of valenced emotional states on IS phenomena and elucidate the influence of emotions in service evaluations.

This research answers this need and addresses three of the gaps identified by Table 3 on page 30. First, this research investigates how IS services provide value to the

organization by shedding light on how individuals evaluate the IS services they receive. To accomplish this, this research proposes a set of theory driven IS service characteristics that are posited to influence the evaluations of the IS service by service recipients. This research further proposes that IS service recipients will use both rational and emotional evaluations of the IS service to build an overall evaluation of how the IS service received met their needs. Finally, this research proposes a set of measurements, especially in the area of measuring emotions, which will enable practitioners and academics to better understand the perceptions of individuals regarding the IS services they receive.

Modal Emotions for Measuring IS Service Evaluations

When evaluating an IS service, in addition to a rational component, individuals will also use an emotional component to evaluate the event (Loewenstein et al., 2001) which, in the case of this research is the IS service encounter.

This emotional component poses a significant difficulty given the inherent fuzziness and definitional chaos that plagues emotional research (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). To properly assess the emotional component, a comprehensive and pragmatic approach to measuring emotions has to be employed (Scherer 2005).

Modal Emotions. Scherer (2005) defines emotions as a component process (Scherer 1982, 1984, 2001), where emotions exhibit distinct components in a processual fashion. Scherer (2005) defines these component or modal emotions as "an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism" (pp. 697). The main characteristics of modal

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emotions, as opposed to other types of valenced emotional states such as moods, attitudes or feelings is that they are event focused, appraisal driven, they require a response synchronization which has a behavioral impact, but are of relatively short duration, high intensity and exhibit a high rate of change (Ekman & Davidson, 1994; Forgas, 1991; Frijda, 1986; Lazarus, 1991; Scherer, 2005).

Modal emotions are event focused, because they are related or connected to specific events, persons or objects that are significant enough to trigger a response (Scherer, 2005). Modal emotions are appraisal driven given that the consequences of the eliciting event are of relevance or importance to the individual through a process of transactional appraisal (Lazarus, 1991). This process of transactional appraisal enables an individual to assess the eliciting events and their outcomes in relation to the goals, needs and desires of the individual. This means that modal emotions are usually relatively intense as opposed to the more diffuse and less intense type of emotion such as moods or preferences (Scherer, 2005). Given the relative importance of the eliciting event to the individual, another important characteristic of modal emotions is the response that results from the emotion. Emotions help prepare an appropriate response to the event based on the importance of the eliciting event and the ensuing subjective evaluation of the event by the assessor (Scherer, 2005). These response patterns usually manifest themselves in actual behavioral patterns of the individual, and can sometimes lead to the reevaluation of goals and plans based on the emotional assessment of the eliciting stimulus (Scherer, 2005). Finally, given their intensity and need for a response, modal emotions are relatively of short duration so as not to over-use the physical and neural resources of the individual experiencing the emotion and also change rapidly based on new stimuli and/or

information that leads to the reevaluation of the circumstances and stimuli (Scherer, 2005).

Modal emotions are well suited to describe the affect elicited by a service encounter given that service encounters are usually of a relatively short duration, they require an assessment of resulting information and also require the recipient to take some action based on how the service encounter is developing. Additionally, since most of the services internal to an organization are important to the completion of organizational task, the result of a service encounter is usually salient to the recipient and can result in intense responses (especially in the case of a negative service outcome).

Emotional IS Service Framework

To provide a better understanding of the role of emotions in the process of evaluating an IS service encounter, this research proposes three salient characteristics of a service that can influence the components of the evaluation. These three characteristics of service are drawn from literature and are proximity (Mehrabian, 1991), specificity of service output (Nadkarni & Gupta, 2007) and the complexity of the IS service (Forgas, 1995).

IS Service Proximity. Proximity is defined as the distance between service provider and service recipient. Proximity can be relational, which is related to the personal relationship between service e provider and service recipient, and spatial, which describe the actual physical distance between service provider and service recipient. Proximity, both relational and spatial, is an important factor that influences the emotional response to an encounter (Mehrabian, 1991). Proximity to a service provider produces feelings of attachment to the service experience and also facilitates the perceptions of

trustworthiness associated with a service provider. Close proximity between service recipient and service provider was shown to produce positive feelings and mood and also increase the attentional arousal of the service recipient in regard to the service received (Patterson, Powell, & Lenihan, 1986). Indeed proximity research posits that spatial proximity positively influences the evaluations of service encounters (Hornick, 1992; Price et al., 1995). Research in media richness shows that encounters that are close in their relational content as well as those which are spatially close lead to more frequent and richer interactions and communications (Daft, Lengel, & Trevino, 1987). Similarly, knowledge management research suggests that close proximity between parties and close relational ties increase knowledge exchange and build shared language and understanding (Preston, 2004).

IS service encounters may be remote or distant, with the recipient and provider of a service only communicating via phone or emails. On the other hand, IS service encounters may be close, with the service recipient perceiving the service to be customized to them through both close spatial proximity and a close relation and contact between service provider and recipient. Close IS service encounters help build trust and understanding between parties and lead to a more personal, customized and affect laden IS service experience which influences the perceived satisfaction and evaluation of a IS service recipient with the received service.

IS service complexity. Another important aspect of the service encounter is its complexity. The complexity of the service encounter is directly related to the complexity of the task related to the service provided.

Task complexity has been studied extensively in decision-making research, where it has been operationalized as the number of alternatives and attributes (Olshavsky, 1979; Payne, 1976; Payne, Bettman, & Johnson, 1988). When making a choice, cognitive capabilities are used to retain each potential option and the individual's preferences. Therefore, when there are a large number of alternatives and/or attributes, the decision task is more complex than one with fewer alternatives and/or attributes. Hence, the number of alternatives and attributes directly impact the complexity of the task (Swait & Adamowicz, 2001).

Wood (1986) defines task complexity as a function of the number of distinct task related acts and the number of distinct information cues about the attributes and characteristics of the task that an individual has to process in order to accomplish the task. Campbell (1988) posits that task complexity is related to the information load, diversity and rate of change experienced by an individual when processing a task. Furthermore, Nadkarni and Gupta (2007) propose three components to complexity, component complexity, which refers to the similarity/dissimilarity between information cues and the density of cues, coordinative complexity, which refers to the range and relationship between information cues, and dynamic complexity, which refers to the level of ambiguity of the information cues.

The task performance of an individual increases with the task complexity as long as the cognitive demands of the task are lower or equal to the cognitive capacity of the individual (Schroder, Driver, & Streufert, 1967). Beyond this threshold, individuals tend to rely more on emotional cues rather than rational inputs (Forgas, 1995). In what may be a counterintuitive proposition, Forgas's (1995) Affect Infusion Model (AIM) provides

that "the extent of affect infusion into cognition and social behaviors should be greater in circumstances that require more open, elaborate processing and so allow mood-primed associations to be incorporated into planning and executing a response" (p. 272). As such, according to the AIM (Forgas, 1995), complex decisions may be particularly prone to emotional infusion because of the extensive information processing recruited during the process. Finally, we follow the general proposition of the AIM (e.g., Forgas, 1995; Forgas & Tehani, 2005) in suggesting that the effect of valenced emotional states (i.e., emotional infusion) should increase with increasing levels of cognitive elaboration (complexity) of the evaluation target.

IS service output specificity. Service output specificity refers to the clarity of the IS service output, as perceived by the service recipient (Nadkarni & Gupta, 2007). The less ambiguous and vague the output of the IS service is about what the IS service performed the more likely it is for the IS service recipient to positively evaluate the IS service. Emotions research shows that when faced with uncertain or ambiguous information (especially when involved in decisions regarding trade-offs) individuals tend to exhibit more negative emotions toward the source of the information (Chittur, Raghunathan, & Mahajan, 2007; Drolet & Luce, 2004; Hedgecook & Rao, 2008). Similarly, when faced with an ambiguous IS service output, it is more likely that the IS service recipient will exhibit more negative rational and emotional evaluations regarding the IS service than if the IS service output is clear and unambiguous.

Depending on the type of IS service provided and on the levels of specificity, proximity and complexity that the service exhibits, emotions will have a higher or lower impact on the evaluation of the IS service by the service recipient (Forgas, 1995;

Meharabian, 1991). Thus there will be a continuum where emotional infusion takes place

from a low level of emotional infusion for simple services with high specificity and low

proximity between service provider and service recipient, to a high level of emotional

infusion for complex services with specific output and where there is close proximity

between the service provider and recipient.

This emotion/service framework can be used to identify services with high

emotional infusion which require a better understanding of how emotions impact service

satisfaction in an IS setting.

In addition to the service characteristics presented above, other characteristics

such as the salience of the IS service to the service recipient, the nature of the IS service,

(support, core, etc.), the duration of the service relationship and of the service encounter,

as well as other considerations may influence how the IS service is evaluated. The three

characteristics examined by this research do not represent a comprehensive set of

potential characteristics, but have been shown have an impact on emotional and rational

evaluations of events and objects.

IS Service Outcome Behavioral Intentions

This section discusses potential behavioral intentions resulting from the

evaluation process. For example, if the result of the service encounter is not favorable,

individuals will engage in some behavior to redress the failed, or below expectation

service outcome. Depending on the results of the service encounter and the voluntariness

of IS service use, service recipients may opt out of using the service, and may start

talking, positively or negatively, about the service provider. While the following is not an

exhaustive representation of potential coping behavior, the two behavioral intentions presented below have been shown to be important evaluation based outcomes.

Continuance. We define continuance of an IS service as a pattern of repeating behavior that involves the reuse of a previously consumed IS service. Prior literature has shown that the significant antecedent variables for IS continuance differ from the antecedents relevant to IS adoption (Limayem, Hitt, & Cheung, 2007). Indeed, much of the IS adoption research shows that for continued use, the salient adoption antecedents are no longer significant (e.g., Karahanna, Straub, & Chervany, 1999; Venkatesh et al., 2002). Salient aspects that set continuance apart from initial use of an IS service are the recurring nature of continuance (Limayem, Hirt, & Cheung, 2007), and the importance of prior-usage (Venkatesh et al., 2002).

To mitigate the explanatory shortcomings of technology acceptance models, IS research turned to a related theory from psychology and consumer behavior research, namely expectation – confirmation theory (ECT) (Oliver, 1980). ECT was initially proposed for the consumer and service industries (e.g., Patterson, Johnson, & Spreng, 1997; Swan & Trawick, 1981) and holds that reuse intentions are based primarily on the satisfaction with the prior use of the service or product (Oliver, 1980). Based on ECT, Bhattacherjee (2001) proposes a model of IS continuance that links satisfaction and perceived usefulness to the intention of an IS user to continue using the IS. In concordance with ECT, satisfaction is central to Bhattacherjee's (2001) model of IS continuance. This satisfaction is based on the expected outcome an IS service user expects from the service encounter. This expected outcome is then confirmed or disconfirmed by the actual outcome of the service encounter. According to Bhattacherjee

(2001) positive outcomes and evaluations of the service encounter lead to more satisfied service consumers, which in turn leads to a higher likelihood of the consumer continuing to use the service (Bhattacherjee, 2001).

Word of Mouth. Word-of-mouth refers to a service recipient's intention to recommend the service to others (Reichheld, 2003). Word-of-mouth is considered one of the most important dedication-based outcomes in product and service research (Gefen, 2002; Homburg and Giering, 2001; Srinivasan, Lilien, & Rangswamy, 2002). In particular, Bendapudi and Berry (1997) posit that advocacy behavior (e.g., providing referrals to others) is one of the most distinctive dedication-based outcomes. The reason for this is that the very act of referring someone puts the actor's social image at risk, and therefore word-of-mouth would not occur without the recipient's trust and dedication, or loyalty (Reichheld, 2003). Consistent with these arguments, much research demonstrates that the greater the degree of dedication a customer has to an IS service, the more likely he or she is to say positive things about the service to others (Gefen, 2002; Reichheld, 2003, Srinivasan et al., 2002). Overall, we expect that loyal service recipients are willing to use the service repeatedly (i.e., continuance intention) or say positive things about the service (i.e., word-of-mouth) based on a rational belief that the service will continue to offer an excellent value.

Summary of the Chapter

This chapter reviews the literature and prior work on IS services, valuation of IS, rational and emotional components of evaluations and behavioral outcomes of the evaluation process. First, an overview of IS services and software testing services is discussed with a view to understanding how information systems is starting to adopt a

service oriented approach to its offering. Next the two IS evaluation components –

rational and emotional – are presented and implications regarding their treatment in

marketing and information systems are discussed. Finally, a framework that integrates the

antecedents, components and behavioral outcomes of the IS evaluation process is

presented and discussed.

Chapter 3

Research Model and Hypotheses Generation

Introduction

This chapter discusses the research model investigated by this research and proposes a set of hypotheses designed to understand the process of IS service evaluation, its antecedents, and its behavioral outcomes. This research focuses on the components of IS service evaluations and proposes two major categories – rational and emotional evaluations – that make up the evaluation construct. Next, this research proposes a set of antecedents that are posited to influence the way individuals evaluate IS services. Furthermore, the evaluation constructs are linked to behavioral outcomes of importance to organizations.

Conceptual Research Model

Information systems development is a core aspect of the information systems discipline. IS development involves activities related to software coding, infrastructure building, communications, business-IT integration, etc. IS development can be considered as a service performed by an IS unit of an organization, in collaboration with other business functions (Yang et al., 2009). This service is provided by the IS unit to various organizational or business users. Similarly, within IS development, software development plays an important role which is crucial to IS as a whole (Kelly & Siegel, 2008). An important aspect of software development is the validation and verification activities that take place to ensure that the software being written meets organizational needs and is as defect free as effectively possible.

This research focuses on this specific aspect of IS development – verification and validation services, collectively labeled under software testing services – which pertains to the interaction between software development and software testing. The research, more specially, investigates the evaluation mechanisms that influence the perceptions of software developers regarding IS testing services provided by software testers. All testing services have at their core an encounter between a testing service provider and a testing service receiver – usually a software developer or user.

Testing service encounters are the object of an evaluation by the testing service recipient. This evaluation of the IS service leads to outcomes such as: perceptions of usefulness (Venkatesh et al., 2003), satisfaction with the IS service (Jiang et al., 2002), usage behaviors related to the IS service (Bhattacherjee, 2001; Limayem et al., 2007; de Guinea & Markus, 2009; Venkatesh et al., 2003), word of mouth regarding the IS service provider (Reichheld, 2003).

The evaluation of an IS service encounter has two principal components – a rational component (where rational stimuli and characteristics of the service encounter are evaluated); and an emotional component (where emotional stimuli and characteristics of the service encounter are evaluated) (Lazarus, 1991; Lowenstein et al., 2001).

Following DeLone and McLean (1992, 2002, 2003) the rational evaluation of the IS service is represented by two well established constructs that depict a form of "mental calculation" about the service. First, this research looks at information quality, which represents the perception of the IS service user about the goodness of the information received (Bailey & Pearson, 1983; DeLoan & McLean, 1992, 2003; Doll & Torkzadeh, 1988; Zmud, 1978). Second, perceived usefulness (Beaudry & Pinnsoneault, 2010;

Davis et al., 1989; Venkatesh et al., 2003) is a mental perception about how the IS service received is helping the IS service consumer achieve their job related goals.

The emotional components of the IS service evaluation are represented by Scherer's (2002, 2005) modal emotions, specifically positive and negative modal emotions, that, by virtue of their nature, are well suited in describing emotions arising from a dynamic, salient and behavior oriented event such as an IS service encounter.

Understanding the rational and emotional components of evaluation is the core purpose and model of this research. This element of the research relies on DeLone and McLean's (2002; 2003) IS success model and Lzarus's (1991) appraisal theory of emotions (Lazarus, 1991; Schachter & Singer, 1962) which describes how a salient event results in a rational evaluation of the event, which leads to an emotional appraisal, both of which, in turn lead to a behavioral intention/action (Lowenstein et al., 2001).

Furthermore, this research introduces a host of service characteristics that can impact this core rational/emotional evaluation of the IS service encounter. Depending on these IS service characteristics, the level of emotional impact in the evaluation process will change. This research proposes a set of three salient characteristics – complexity of the task, proximity of service provider to the service recipient and specificity of the service output – that are hypothesized to influence the IS service evaluation process. As such, high levels of complexity of the IS service will lead to greater levels of emotional infusion (Forgas, 1995). Similarly, proximity and specificity of the IS service will impact the emotional evaluation of the IS service (Hornick, 1992; Nadkarni & Gupta, 2007).

Figure 2 depicts the integrated conceptual model of service evaluations. Following prior emotions research (e.g., Lowenstein et al., 2001) we posit that, when

receiving a service – in the case of this research, a software testing service – a service

recipient will evaluate said service on a rational and emotional basis. These components

of the assessment process will be influenced by various service characteristics as

presented above. Based on these evaluation, the IS service recipient will build an

evaluation of the service's performance and the level to which the service meets his or

her needs, which in turn will influence future behaviors regarding the service.
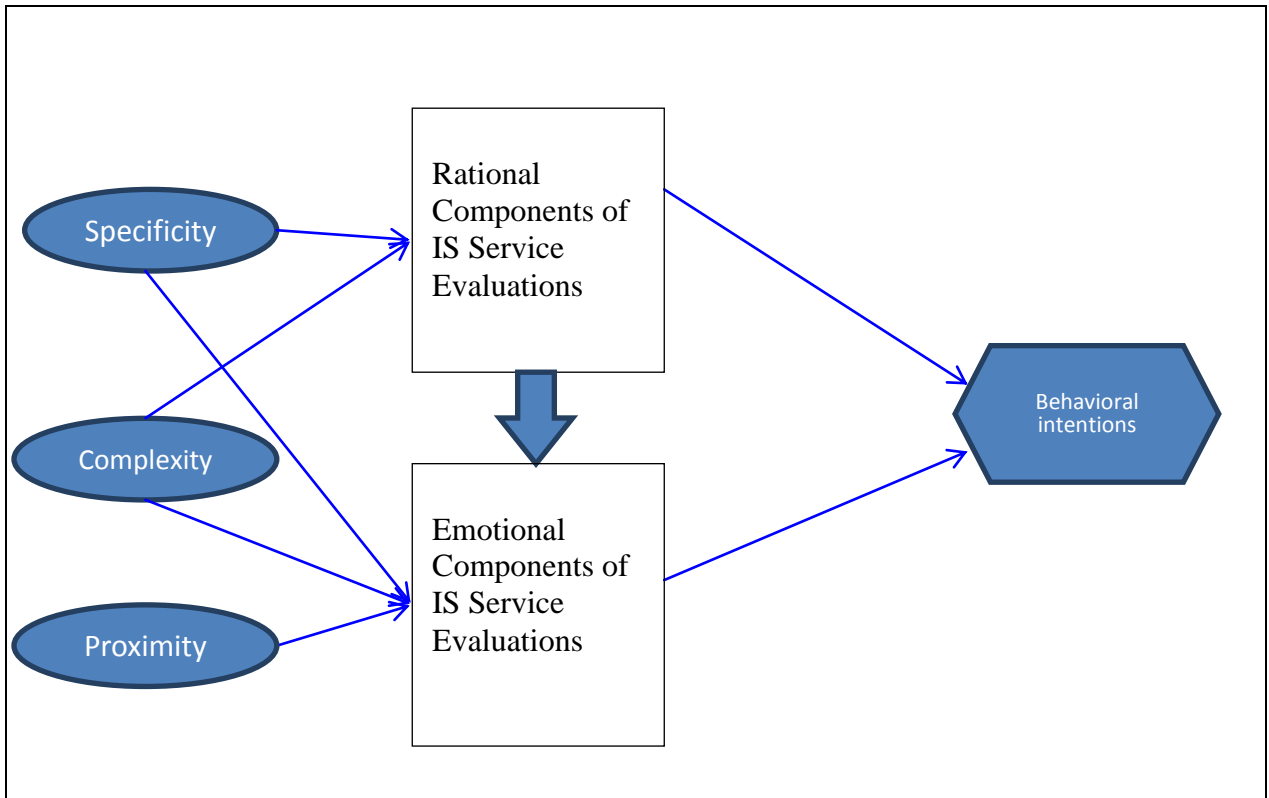
Figure 3. Integrated Conceptual Model

Hypotheses Generation

The consumption of a service will have emotional and rational implications for the service recipient (Lazarus, 1991; Lowenstein et al., 2001; Oliver, 1997; Westbrook & Oliver, 1991). Evaluations of an event, person or object, increase with positive experiences and decrease with negative experiences (Westbrook & Oliver, 1991). Furthermore, the evaluations will have behavioral impacts (Lazarus, 1991), thus we posit that emotional and rational evaluations will have an influence on potential behaviors associated with the IS service. This study investigates two important behavioral outcomes related to IS service evaluations: continuance (Bhattacherjee, 2001), and word-of-mouth (Gefen, 2002; Reicheld, 2003). As evaluations of an IS service are more positive, the intention of the individual to engage in positive behaviors (such as continuing the use of the service, and speaking positively about the service provider) associated with the IS service increases (Bhattacherjee, 2001; Gefen, 2002; Oliver, 1999; Reicheld, 2003; Yang & Peterson, 2004).

On the rational side of IS service evaluation, we posit that high levels of perceived information quality and usefulness will positively influence continuance and positive word of mouth behaviors. There is a large body of research that shows the influence of these two rational evaluation constructs on behaviors (e.g., Davis, 1989; Delone & McLean, 2002, 2003; Venkatesh et al., 2003).

If a testing service user receives a favorable service in their encounter with a testing service provider, then they are more likely to make use of that testing service again. When individuals receive a service that has a high level of quality, and provides them with quality information pertinent to their job which meets or exceeds their

expectations, they are likely to use that service and service provider again (Bhattacherjee 2001). Similarly, given a positive service experience, the service recipient is more likely to engage in advocacy or positive word-of-mouth behavior in order to reward the service provider and also maintain a good service relationship (Bendapudi & Berry, 1997; Gefen, 2002; Reicheld, 2003).

Thus we propose:

H1a: Perceived information quality will positively influence the intentions of an individual to engage in advocacy, or positive word-of-mouth behaviors associated with the IS service.

H1b: Perceived information quality will positively influence the intentions of an individual to engage in continuance behaviors associated with the IS service.

Similarly to the above, the usefulness of the service will have an influence on continuance and advocacy behaviors. As the perceived usefulness of the service increases, the service recipient is more likely to reuse the service (since the expectations associated with the service have been met or exceeded) and also is more likely to praise the service provider to other individuals in his professional community.

Thus we posit:

H2a: Perceived usefulness will positively influence the intentions of an individual to engage in continuance behaviors associated with the IS service.

H2b: Perceived usefulness will positively influence the intentions of an individual to engage in advocacy, or positive word-of-mouth behaviors associated with the IS service.

Service encounters will also have emotional implications for the service recipient which will result in an emotional evaluation of the IS service (Lazarus, 1991; Lowenstein et al., 2001; Westbrook & Oliver, 1991). We posit that a service recipient will experience a set of affective states – modal emotions – when consuming a service (Izard, 1977; Westbrook, 1987; Westbrook & Oliver, 1991). These emotions can be of a positive or negative nature (Scherer, 1984; 2005) and will have behavioral impacts that are designed as coping mechanisms focused on dealing with the implications of the service event (Lazarus, 1991). A high emotional evaluation (high positive emotions and low negative emotions) associated with the service encounter is likely to result in positive behavioral intentions on the part of the service recipient (Lazarus, 1991; Oliver, 1997; Westbrook & Oliver, 1991). Indeed, if the service recipient is "happy" (a catch all label for all positive emotions) about the IS service received, then they are more likely to reuse the service, and speak highly about the service provider.

When service recipients experience positive emotions associated with a service encounter, then they are more likely to try to recreate that service experience and thus reuse the service. Similarly, if the service recipient has positive emotions about the service received, they are more likely to engage in positive word-of-mouth regarding the service provider.

Thus we posit:

H3a: Positive emotions associated with an IS service encounter will positively influence the intentions of an individual to continue using the IS service.

H3b: Positive emotions associated with an IS service encounter will positively influence the intentions of an individual to engage in positive word-of-mouth behaviors.

On the other hand, when a service recipient experiences negative emotions as a result of a service encounter, then they are more likely to try to avoid that experience, and also redress the situation. If possible, service recipients will try to discontinue using the service or switching to a different service provider. Also, a way in which individuals deal with negative emotions associated with a person, object or event is to complain, or engage in negative word-of-mouth, regarding the source of their negative emotions.

Thus we hypothesize:

H4a: Negative emotions associated with an IS service encounter will negatively influence the intentions of an individual to continue using the IS service.

H4b: Negative emotions associated with an IS service encounter will increase the likelihood of the individual engaging in negative word-of-mouth behaviors regarding the service encounter.

Finally, the rational aspects of service evaluations are, in part mediated by the modal emotions that they elicit from the consumer of the IS service (Loewenstein et al., 2001). Since positive experiences lead to positive affective reactions, we posit that positive rational evaluations of the IS service will increase the levels of positive emotions whereas low levels of rational evaluations are more likely to lead to negative emotional responses (Lazarus, 1991). Positive experience resulting from having received a high quality service, which provides the right information for the job and is generally useful to

the individual receiving the service, will engender positive emotions in the individual receiving the service.

Thus we hypothesize:

H5a: Perceived information quality will increase the level of positive emotions associated with the IS service received.

H5b: Perceived information quality will decrease the level of negative emotions associated with the IS service received.

Similarly, the perceived usefulness of the service will influence the levels of positive and negative emotions associated with the service encounter. When service recipients have a high perception of the usefulness of the service to their task, then they will likely feel more positive emotions and less negative emotions associated with the service encounter.

Thus we posit:

H5c: Perceived usefulness will increase the level of positive emotions associated with the IS service received.

H5d: Perceived usefulness will decrease the level of negative emotions associated with the IS service received.

To provide an understanding of the influence of specific service characteristics on the rational and emotional components of the service this research further proposes an integrated framework of service evaluations, service characteristics and associated behaviors.

The next three hypotheses employ the three salient characteristics of services identified by the Emotion/Service Framework to investigate how proximity, complexity, and specificity impact the emotional response to an IS service.

Proximity influences the emotional response to a service encounter by increasing the attachment and trust that a service recipient exhibits when consuming a service (Mehrabian, 1991), by increasing the richness and frequency of the interaction (Daft et al., 1987) and by creating shared understanding between the parties to the service encounter (Brown, 1999; Preston, 2004). Prior research has shown that close service encounters exhibit higher level of satisfaction for all parties involved (Hornick, 1992; Price et al., 1995).

Given the relational and spatial proximity of the service encounter, we posit that emotional responses to a service encounter are less intense for remote encounters then for close encounters (Daft, 1987; Mehrabian, 1981; Preston, 2004). Therefore, when the level of proximity between the service provider and service recipient is high, then the service recipient is more likely to feel more positive emotions and less negative emotions regarding the service provider. Therefore:

H6a: Proximity between service provider and service recipient will increase the positive emotions associated with the service encounter.

H6b: Proximity between service provider and service recipient will decrease the negative emotions associated with the service encounter.

The second important characteristic of the service encounter is its complexity. Research shows that the as task complexity increases, individuals tend to use more emotional cues in their decision making processes (Forgas, 1995). As the information

load, diversity and rate of change of cues relevant to a task increase (Campbell, 1988), individuals may experience cognitive overload and will rely more on emotional heuristics to evaluate and complete the task (Schroder et al., 1967; Simon, 1976).   Therefore, when the complexity of a service encounter increases, the service recipient is more likely to use emotional heuristics when evaluation the success of and satisfaction with the service encounter. When the complexity of the service related task increases, the emotional evaluations (both positive and negative) will also increase.

H7a: The perceived level of complexity of the task to which the IS service refers will increase the level of positive emotional evaluations of the IS service.

H7b: The perceived level of complexity of the task to which the IS service refers will increase the level of negative emotional evaluations of the IS service.

The third IS service characteristic identified by the framework is IS service output specificity. The more specific (clear, unambiguous) the output of the IS service is, the easier it is for the recipient to evaluate the IS service and the more likely they are to exhibit positive evaluations (both rational and emotional) of the IS service (Nadkarani & Gupta, 2007). When individuals are presented with uncertain or ambiguous information, their assessment of it tends to be unfavorable, give the difficulty of interpreting and using such ambiguous information (Chitturi et al., 2007; Drolet and Luce, 2004; Hedgecook & Rao, 2008). Therefore, when the level of specificity of the IS service output increases, individuals that use the IS service are more likely to perceive that the IS service provides higher information quality and is more useful. Similarly, since the output is specific and clear, service recipients are more likely to feel positive emotions rather than negative emotions related to the service encounter.
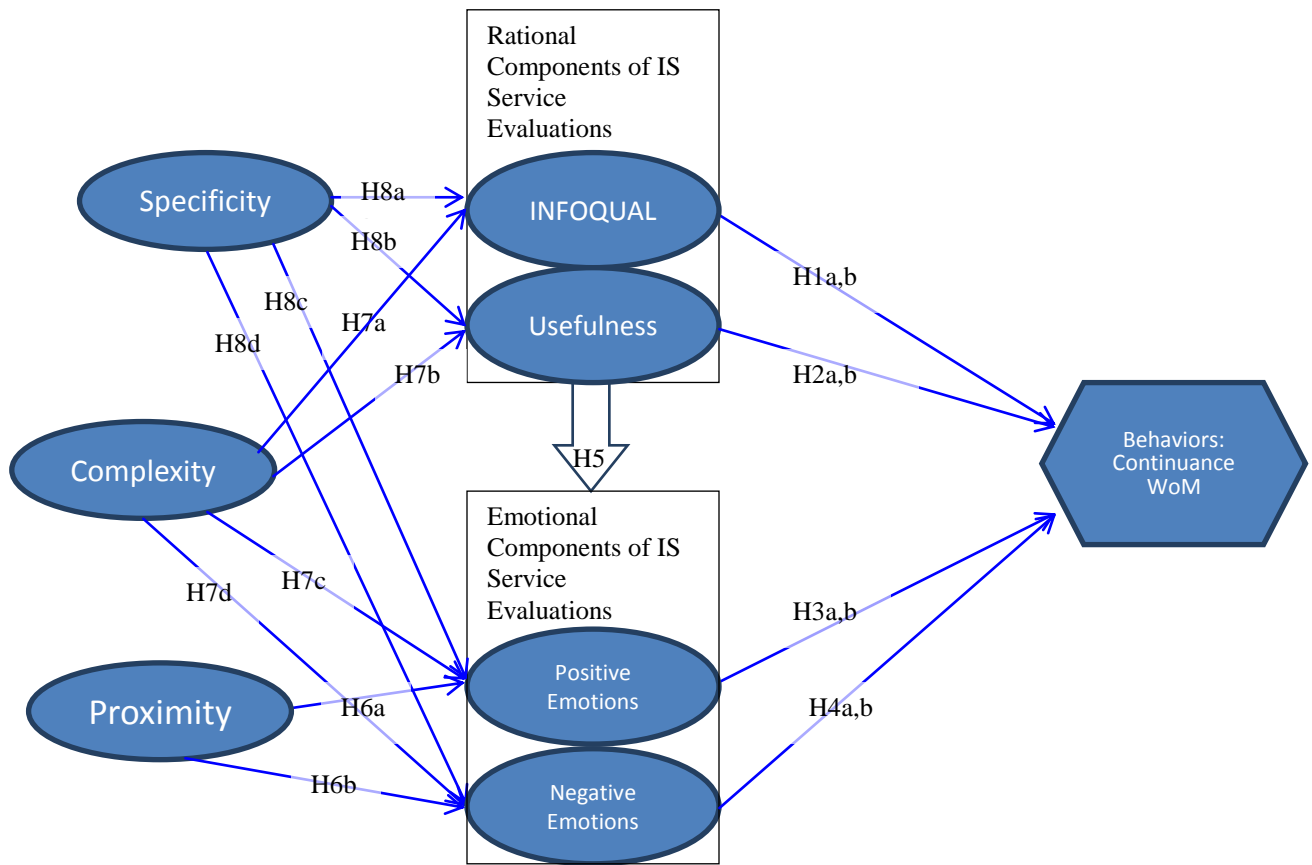
Figure 4. Research Model

Therefore we posit:

H8a: IS service specificity will positively influence perceptions of information quality.

H8b: IS service specificity will positively influence perceptions of usefulness regarding the IS service.

H8c: IS service specificity will result in increased positive emotions associated with the IS service.

H8d: IS service specificity will result in decreased negative emotions associated with the IS service.

Figure 3 presents the complete research model as described by the hypotheses discussed above.

Summary of the Chapter

This chapter describes and justifies the eight major hypotheses investigated by this research. First, the evaluation element of the study is presented by describing the rational and emotional components of evaluation – represented by information quality and usefulness on one the rational side, and positive and negative emotions on the emotional side. Second, the influence of the evaluations of the IS service on behavioral intentions (continuance of the IS service and word-of- mouth) are presented. Finally, antecedents of evaluation (proximity between service recipient and provider, complexity of the IS task involved and specificity of the IS service output) and their influence on the evaluative process are discussed.

Chapter 4

Research Methodology

Introduction

This chapter describes the research methodology employed to test the hypotheses described in the previous chapter. The chapter starts with a description of the participants in the experiment and a discussion of the number of participants necessary to conduct the appropriate statistical analyses. Next, the chapter describes three distinct pilot studies that were conducted in order to refine and validate the experimental materials and measures used in the course of this research. The chapter then goes on to discuss the experimental materials used during the experiment – decision matrix and defect reports – and how they were delivered to the participants. The research design and treatments are presented next. The research design is a 2x2x2 between subjects, randomized, full factorial design with the treatments being complexity, proximity and specificity of the testing service. The chapter concludes with a description of the dependent variables and controls employed in the experiment.

Research Setting - Testing as a Service

This research focuses on the concept of testing as a service for software developers. The research contends that software testing, in the context of software development and engineering is similar to a service performed by testers for developers (Yang et al., 2009). This service entails verification and validation activities related to software code written by developers (Black, 2002). Testers perform a variety of testing services related to the core verification and validation activities of testing. Such testing services include, unit code testing, module testing, integration testing, systems testing,

usability testing, alpha and beta testing, etc. (Black, 2002). The quality of testing services is paramount not only for the success of software development activities, but also for the overall success of organizational strategies (Dhaliwal et al., in press; Onita & Dhaliwal, 2010). If the developed software does not meet business needs and does not perform efficiently and effectively, the entire organization stands to suffer.

The following sub-sections will detail the experiment, participants, materials and treatments, as well as measurements and procedures employed to ensure the rigor of the research methods.

Experiment Participants

The participants for the study were chosen to closely resemble the population targeted by the research. The experiment deals with specific IS services – software testing services – which are performed for software developers. The respondents for the experiment were chosen from a pool of professionals that have experience with software development and testing. The participants are individuals who are active on an online micro-sourcing website dedicated to providing organizations and individuals with a marketplace of highly skilled individuals available for micro-projects that do not entail a long term commitment. To ensure that the respondents are familiar with software development and testing issues, only individuals with software development and testing experience were selected to participate in the experiment. This was implemented via the online vetting and qualification system provided by the micro-sourcing website, as well as by the initial description of the experiment that was presented to participants. To encourage participation and seriousness of responses, the researchers offered the participants a one-time cash payment of 50 cents conditional to the successful completion

of the experiment. This cash payment was also linked to the amount of time a participant took to complete the experiment. With an average time of 12.5 minutes for completion (about 5 minutes for a simple task and around 20 minutes for a complex task) any participants who took less than 5 minutes were disqualified as being not fully engaged with the experimental materials and task. Participants were randomly assigned to each cell via a random link generator Java script that was imbedded in the online materials provided to the respondents.

To identify the number of participants required a power analysis was conducted. To ensure a power of 90% and assuming an estimated population medium effect size of $R^2=0.15$, 20 participants are required for each of the 8 cells in the experiment for a total of 160 participants (Cohen & Cohen, 1983). The experimental design is described in the Research Design section of this chapter.

Pilot Studies

To ensure the validity and applicability of the experimental materials and measures employed, several pilot studies were conducted. First, a pilot study of the emotional measurements was conducted in an organizational setting (a detailed description of this study is provided in the next section – Pilot Study 1). This study confirmed the viability and applicability of the emotional measures employed in a real setting. Second, the experimental materials were created and refined by using actual software testing defect reports provided by a large Fortune 500 organization. These materials were further revised and refined with domain experts from academia and industry and were finally pilot tested in a paper based experiment. Twenty-four industry participants were provided with a pen and paper version of the experiment, were asked to

complete it, provide suggestions for improvements and feedback on the realism, accuracy, and understandability of the experimental materials and measures. They were also timed, to provide a baseline of how long the overall experiment was likely to take. The average response time for this pilot experiment was of 15 minutes, with a minimum of about 7 minutes and a maximum of about 20 minutes. After analyzing the results of this second round of pilot tests, minor adjustments were made to the wording of the materials and measurements. Additional information was introduced in the experimental materials for clarity. This information pertained to the assumptions made about the scenario such as a stable and equivalent test and production environment for the code being written, a clarification about workflow before and after the developer receives the defect report, and other minor clarifications of the experimental materials. Once this second stage of pilot testing was complete, a third and final stage entailed the design and implementation of an online version of the experiment. This online version was pilot tested with 26 more industry participants. The participants were sent a priming email asking them to participate in the research. A URL was provided for them to follow, which presented them with the online version of the experimental materials. The respondents were asked to complete the experiment, and provide feedback regarding the experimental materials. Of the 26 emails sent 9 responses were collected (for a response rate of 34%). The responses did not cover all 8 cells, but all respondents did not have any major concerns or changes regarding the experimental materials and measures.

The following subsection describes the first pilot study regarding the validation of the measurements of emotions.

Scale Validation Study

To ensure the applicability and reliability of the emotional measures used in this study, a validation study of the emotional measures adapted from Scherer (2002, 2005) was conducted. This study introduced the emotional measures in a nomological network as presented below.

This validation study was conducted in the context of the continuance of an IS service, which is an important aspect of a successful IS service (Bhattacherjee 2001; de Guinea & Markus 2009; Kettinger et al., 2009). Indeed, recent studies have shown that the continued use of an IS artifact is at least "equally important to attaining information technology implementation" (Limayem et al., 2007, 706). For an IS service, the continuance behavior is even more essential (as in the case of online service providers) (Bhattacherjee, 2001; Parthasarathy & Bhattacherjee, 1998) given that the reuse of the IS service is usually the main reason for the existence of many IS service providers. In a recent article, Kettinger et al. (2009) specifically investigate continuance of IS services in an internal (intra-organizational) setting and also find that satisfaction, in addition to the perceived IS service value, are important drivers of IS service continuance.

Research model used by validation study one. Expectation-confirmation theory (Oliver, 1980) as extended by Bhattacherjee (2001) suggests that IS continuance intentions are driven primarily by the evaluations of the service by an individual in a current/prior service encounter. This argument is built on the finding that current or prior evaluations of IS service encounters lead an individual to form certain assessments of the service provided which, in turn will affect his or her intention to reuse the IS service (Bhattacherjee, 2001; Oliver, 1980). These opinions that are formed based on the

confirmation or disconfirmation of an expected outcome are driven by multiple factors

which include a rational decision based on rational calculations of benefits and costs

(usefulness of the IS service) and an emotional component that is influence by emotional

responses to past and current encounters, coupled with long standing attitudes and

personality traits (Bhattacherjee, 2001; de Guinea and Markus, 2009; Oliver, 1980).

Rational evaluations are based on the assessment of the quality of the service encounter

(such as accuracy of information provided, promptness of the service, participation in the

service decision making, etc.) (Jiang et al., 2002). The higher the perceived quality of this

service the more likely a service recipient is to continue using that service.   Thus we

posit:

> *Validation Study H1: Higher levels of the rational evaluations will positively*
>
> *influence IS service continuance intentions.*

Rational evaluations are mediated in part by the emotional response a service

recipient has to a service encounter (Lowenstein et al., 2001). These emotions can be of a

positive or negative nature (Scherer 1984, 2005) depending on the quality and outcome of

the service encounter. Given the nature of evaluations and satisfaction with a service,

which increase with positive experiences and decrease with negative experiences

(Westbrook & Oliver, 1991), we posit that a positive assessment of the service encounter

will positively influence the emotions felt in relation to the service encounter (as in it will

give rise to positive emotions), whereas a negative assessment of a service encounter will

negatively influence the emotions related to the service encounter (i.e., give rise to

negative emotions).

VS H2a. Higher levels of rational evaluations of a service will positively

influences the positive emotions associated with the IS service encounter.

VS H2b: Higher levels of rational evaluations of a service will negatively

influences the negative emotions associated with the IS service encounter.
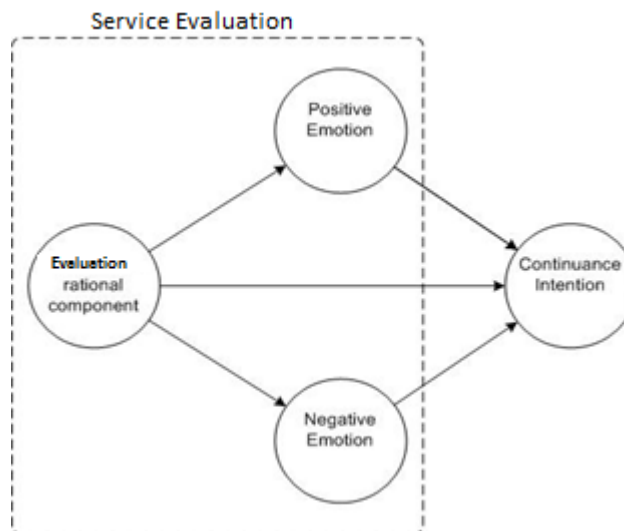
Figure 5. Research Model for Pilot Study 1

Finally, the link between evaluations of a service and continued use of a service or artifact (Bhattacherjee, 2001; Limayem et al., 2007) is investigated. Higher (positive) evaluations lead to intentions to continue using an IS service/artifact and thus, we posit that the emotional component of satisfaction will significantly influence the decision of an individual to continue using an IS service. More specifically, positive emotions associated with the service encounter will positively influence the intentions to continue the use of an IS service, while negative emotions will negatively influence the continuance intentions.

VS H3a: Positive emotions associated with an IS service encounter will positively

influence IS service continuance intentions.

VS H3b: Negative emotions associated with an IS service encounter will

negatively influence IS service continuance intentions.

Research methodology employed by pilot study one. To empirically test the

relationships proposed in Figure 4, a field study using the survey methodology was

employed. Following Straub (1989), where possible, we used scales that were adapted

from previously validated scales. The rational evaluation of the service is measured (as

satisfaction) and continuance were measured using previously validated scales proposed

by Jiang et al. (2002) for rational evaluations and Bhattacherjee (2001) for continuance

intentions. To measure the emotional response to the IS service encounter, we employed

an adapted version of Scherer's (2005) Geneva Emotion Wheel with sixteen emotional

items (eight for positive emotions and eight for negative emotions) as follows: positive

emotion items used were enjoyment, amusement, pride, joy, interest, hope, satisfaction

and relief, while negative emotion items were sadness, worry, embarrassment,

disappointment, envy, repulsion, contempt, and irritation (for a list of the items as well as

their factor loadings, please see Appendix B). Respondents were presented with an

introductory text stating that they should think about their most recent IS service

encounter and go through each label depicting an emotion and indicate the strength with

which they felt that emotion related to the IS service encounter. The emotions were

measured on a scale of 1 to 7, with 1 being labeled as "Emotion not felt', while 7 being

labeled as "Emotion strongly felt". To establish content validity an extensive literature

review was conducted. The results of the literature review were presented to a panel comprised of domain experts from academia and industry.

The survey was administered to the employees of a large Mid-south utility company that relies heavily on IS to conduct its business. Participants were drawn from employees that have used the internal IS services provided by the IS department of the organization. The IS department of the organization was divided into multiple IS service provisioning sub-units. There were three main service types provided by these subunits. The first of these service types, that was % 35of the performed services dealt with access to IS resources such as providing and resetting passwords and other rights to users. The second type of IS service, that were % 33of total IS services focused on software issues such as updates, installations, patches and software error resolution. The third service type pertained to hardware issues such as hardware upgrades, installations and error resolution. The differences between these three services on satisfaction, emotional response and continuance were not statistically different ($p = .05$) which permitted us to pool all services together and obtain a stable solution for our model. In order to ensure the voluntariness of continuance, we stressed in the questionnaire the fact that the individual has a choice in whether to continue receiving the service from their current service provider or switch to a different service provider (another internal unit). The survey questions for continuance as well as the introduction to the continuance section of the questionnaire clearly stated that respondents should answer these questions for a scenario where their use of the IS service was voluntary. The survey was hosted online on the intranet of the target organization (the survey instrument is presented in Appendix C). A total of 450 emails were sent to individuals who have received a service from an

internal provider in the two months prior to conducting this research. 211 responses were received of which 157 contained usable data for all constructs of interest (for a response rate of %34).

Data analysis for pilot study one. To test the measurement model and the structural relationships proposed in Figure 5, we used partial least squares (PLS) data analysis technique. SmartPLS (Ringle, Wende, & Will, 2005) was chosen because of its robustness in regard to assumptions and requirements for data analysis. To validate our measurement model, we followed the recommendations of Straub (1989) and Straub, Boudreau, and Gefen (2004), particularly as they pertain to validity of the constructs and measures.

To examine construct validity – i.e., how well measures correlate with a theoretical construct they purport to measure, we inspected two specific aspects: convergent and discriminant validity. Convergent validity is achieved when measurement items exhibit significant loadings on their respective latent constructs (Gefen & Straub 2005). The t-values were estimated using a nonparametric bootstrapping procedure using 500 samples (Chin, 1998) and the results showed significant loadings for all items and constructs (loadings uniformly over .7 at a significance level of $\alpha = 0.05$). Further, each construct was investigated in relation to its reliability of measures. To investigate reliability, both composite reliability and Cronbach's Alpha was used (Chin, 1998; Gefen & Straub, 2005). Table 4 shows that both composite reliability and Cronbach's Alpha are well above accepted limits for reliability (Chin, 1998; Nunally, 1978). Table 4 also exhibits the variance explained (R squared) by the proposed model in each of the endogenous constructs.

Table 4
Latent Variables Quality Metrics

	Composite Reliability	R Square	Cronbach's Alpha
Continuance	0.98	0.35	0.97
Negative Emotions	0.98	0.10	0.97
Positive Emotions	0.93	0.30	0.92
Satisfaction	0.95		0.95

Table 5
Latent Variable Correlation Matrix

	Continuance	Negative Emotions	Positive Emotions	Satisfaction
Cont	**.97**			
Neg	-0.41	**.92**		
Pos	0.24	-0.14	**.81**	
Sat	0.52	-0.31	0.55	**.80**

Discriminant validity is established by investigating the latent construct correlations and square root of their respective Average Variance Extracted (AVE). AVE describes the variance explained by the latent construct in the measurement item. Gefen and Straub (2005) stipulate that the "square root of the AVE for each construct should be much larger than the correlation of the specific construct with any of the other constructs in the model". Table 5 displays the square root of the AVE for each construct (boldface on the diagonal) and also the correlation between constructs. The data suggest that these conditions are met and thus suggest appropriate discriminant validity.
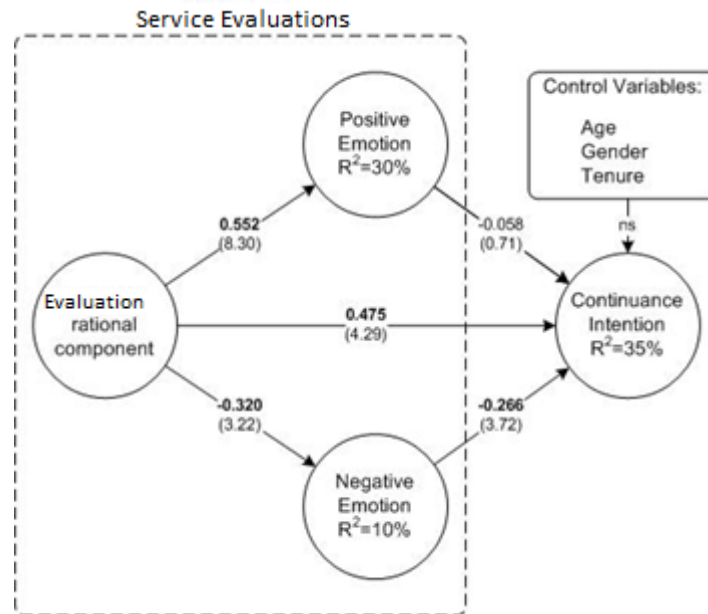
Figure 6. Rational and Emotional Components of IS Service Evaluation

The analysis of the data shows that both components of rational evaluations are significantly related to the IS service continuance intentions of individuals. The structural analysis shows that the rational evaluation component is positively related (.475, $p <$ 0.001) to IS service continuance intentions. Similarly, the paths between the rational component of evaluation and positive (.552, $p < 0.001$) and negative emotions (-0.320, $p <$ 0.001) are both significant. Interestingly, while the path between the negative emotions (-0.266, $p < 001$) felt by an individual related to a service encounter and the IS service continuance intentions of that individual is, as expected, negative, the relationship between the positive emotions (-0.058, $p =$ ns) associated with an IS service and IS service continuance was found to be insignificant. Thus, all hypotheses with the exception of H3a were supported.

While the posited mediation (partial mediation) of emotions between the rational component of IS service evaluations and the intention to continue the IS service still exists, it appears that negative emotions are more important than positive emotions in assessing the IS service and in constructing intentions to continue using the IS service.

Discussion of pilot study one results. This first pilot study demonstrates the viability and applicability of the emotion measurement scale proposed by Scherer (2005) in an IS service setting. In addition to testing the measurement scale, this pilot study also shows the viability of using emotions in the investigation of IS service evaluations. While it may be somewhat counterintuitive to consider emotions as an important predictor of any behavior associated with an IS service, this pilot study showed that emotions, and specifically negative emotions can and do have an impact on behavioral intentions associated with an IS service.

Experimental Materials

The following section describes the experimental materials used in this research. The research involved conducting an online quasi experiment involving software development professionals. The experimental materials used are comprised of the coding of a decision matrix and a defect report associated with the coding task.

Experimental task – decision matrix. Decision matrixes are used to model simple and complex logic that involve multiple states or conditions of variables and actions associated with the different states of the variables. In business software development, decision matrixes are often used to depict business processes logic that involves multiple decisions that are based on various conditions being met.

Given the focus of this research on understanding the way individuals evaluate

software testing services, the experimental task was selected based on its similarity with

tasks found in real organizations. To ensure a high level of realism, access was secured to

a Fortune 500 organization that engages in extensive software development activities.

This organization has as its main activity the shipping of packages and mail nationally

and internationally. Prior to the selection of the task, the researcher had interactions with

professionals from the organization. Many of the software development tasks involved

had to do with establishing the shipping charges for packages the organization shipped.

Many examples of such process were examined, along with their associated decision

matrix. With input from professionals within the organization a task and decision matrix

was created that would vary on two levels of complexity. The task was further tested via

pilot studies to make sure that other individuals not working with the Fortune 500

organization would have no trouble understanding the task and decision matrix.

Suggestions regarding wording and clarifications about the task and decision matrix were

followed-up on subsequent to the final two pilot studies.

The experimental task requires the calculation of shipping charges based on a set

of parameters (please see Appendix D for a comprehensive description of the

experimental materials). The respondent is shown a decision matrix composed of a set of

conditions/courses of action. These conditions have business rules associated with them.

In turn, each rule has an action associated with it. For example, in the case of the low

complexity experimental condition, the decision matrix is composed of only two

conditions whereby a package is to be sent to US zip-codes between 000000 and 4999999

or to US zip-codes between 500000 and 999999. Depending on which condition a certain

package fulfills, the action for that package (shipping charge associated with the package) will either be $5/pound or $5.50/pound.

Each respondent is presented with a scenario where he or she are responsible for coding the above-mentioned decision matrix. The scenario only deals with this decision matrix and informs the respondent that any other associated code, testing and production environments, graphical user interfaces, etc. are beyond the scope of the scenario. The concept of the decision matrix and how to read it is explained and the respondents are asked to take a moment to read and understand the decision matrix and think about the software code required to it. After having read the decision matrix, the respondents are informed that the hypothetical code they wrote for this decision matrix was sent to a tester for quality control. They are also informed that, after having tested their code, the tester has prepared a defect report which is depicted next in the experimental materials. For the purpose of the experiment, the complexity treatment is controlled via the decision matrix presented to respondents.

Defect report. Given the focus of this research on understanding how individuals evaluate IS services, and taking into account the need for external and face validity of the experimental materials, a simulated defect report was designed to implement the treatments investigated by this research. Software testing can be construed as a service provided by testers to developers (Yang et al., 2010). As part of the testing service provided software testing defect reports are important components of the overall software development offering and are paramount in providing software developers with the information they need to improve and correct their code (Callahan, Katsuriya, & Hefner, 1998; Runeson, Alexandresson, & Nyholm, 2007). Software testing defect reports are

one of the main tools used by testers to communicate with developers regarding the software code that has been tested (Callahan, Katsuriya, & Hefner, 1998; Runeson, Alexanderssson, & Nyholm, 2007). Defect reports are standardized reports that contain information about the type and importance of defects found in the code, the location of the defects (software component, module, line of code, etc.), as well as detailed information about what the defects are and the symptoms and possible causes of the defects. To increase the external validity of the defect report used during the experiment, actual defect reports were provided to the researcher by contacts in the aforementioned Fortune 500 organization. These defect reports varied in their complexity, level of detail, severity, language etc.. After designing a usable defect report, focus groups were conducted with subject matter experts regarding its readability, authenticity, content, and language. The defect reports to be used were further tested during the second and third pilot studies, where additional clarifications about assumptions and content were added.

Below is a description of a standard, generic defect report and its content. For a complete listing of the defect reports used during the experiment, please see Appendix D.

The defect reports used were designed to represent hypothetical feedback from a tester who had tested the code sent by the participant. Participants were informed, that the code they had written based on the decision matrix presented to them had been sent to a tester for quality control. Next, the participants were shown the actual defect report prepared for them by the tester. Finally, the participants were asked to rate the defect report based on its quality and usefulness to them as the developer of the software code. Participants had access to both the decision matrix and the defect report at all times

during the experiment, and during the period in which they responded to the survey questions.

Table 6
Standard Defect Report Components

Heading	This is a short title that serves as a quick description of the defect
Product	This is the software product containing the defective code
Component	This describes a specific component or module of the software product containing the defective code
Defect Type	This field classifies how the defect actually departs from the requirements the software is supposed to meet. The defect type can be functionality, performance, usability, security, etc.
Priority	This field describes the level of importance that should be given to the defect
Severity	This describes how the defect impacts the overall software product
Environment	This describes the environment in which the software code was run and the defect found
Steps	This is a detailed description of the steps taken to uncover the defect, as well as the symptoms of the defect
Attachments	Any attachments (screen shots, partial code, print-out, etc.) that can help the developer fix the defect
Comments	Additional comments regarding the defect, or contact information for the tester

Research Design

The following section describes the experimental procedures, research design and measures, treatment checks and control variables used in this study.

Experimental procedures. To implement the experiment, a website was designed and published on the researcher's university intranet (please see Appendix E for screenshots of the website). The website displayed a description of the scenario, the decision matrix related to the coding task (2 conditions for complexity were implemented via the decision matrix – high and low task complexity), as well as the defect report

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prepared by the hypothetical tester for the participant (the defect report was used to implement the other two conditions – low and high specificity of output and low and high proximity between service recipient and service provider). Given the focus on emotions and evaluations, the website was designed to provide a neutral experience – by using neutral colors (black font on white backgrounds) and by subjecting all participants with the same format, font and colors. Since the researcher had no control over the environment in which the participants engaged with the experiment, the participants were asked to make sure that they had at least 20 minutes of uninterrupted time to complete the experiment. Also, the experiment was designed to time out after 35 minutes (via the survey system and website design) and incomplete answers were not accepted.

An important consideration in experimental designs is the random assignment of participants to cells. To ensure a thorough randomization a java script was implemented in the website design. The java script employed a randomization function that randomly displayed one of the eight treatment conditions to incoming participants.

Once the participants had familiarized themselves with the coding task (decision matrix) and the defect report, a link was provided for them to begin their evaluation of the testing service. To implement the survey, an online survey service was retained (SurveyGizmo – surveygizom.com) which provides standard and advanced features for survey administration.

Once a participant commenced the evaluation survey, they still had access to the task and defect report (the website was designed to open the survey in a new window). To ensure a better engagement of the participants in the experimental task, before answering evaluation questions, the participants were asked to write down the steps they

would take to fix the defect based on the assigned task and the defect report they had

received. This step of the experiment was designed to provide a higher degree of realism

during the experiment, and to make sure the participants were engaged with the

experimental materials. After completing the essay the participants were directed on to

the evaluative part of the experiment which is comprised of Likert-type and multiple

choice questions.
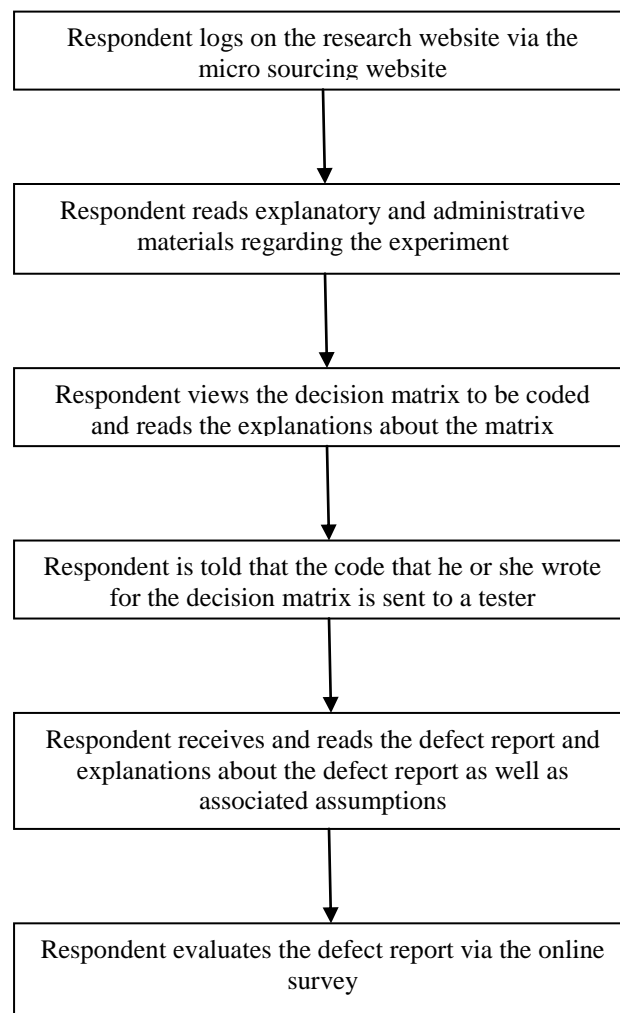
Figure 7. Diagram of the flow of activities through the research website

Research design. The research design (Table 7) is a 2x2x2 between subjects, randomized, full factorial design with the treatments being complexity, proximity and specificity as follows:

The respondents in each group were presented with the same scenario where a software developer receives feedback from the testing group (or a specific testing individual, when proximity is varied) regarding a specific task (the task itself will be the same for all groups in order to control for task effects). As described above, the task addresses the remediation of certain defects in a hypothetical software code. The respondent first reads the task, and then is presented with hypothetical feedback related to the code written to remedy the defect. The original code is not be presented to the respondent.

Table 7
Research Design

Low Complexity case:

Treatment	Specificity Low	Specificity High
Proximity Low	G11	G12
Proximity High	G13	G14

High Complexity case:

Treatment	Specificity Low	Specificity High
Proximity Low	G21	G22
Proximity High	G23	G24

Treatments and manipulation checks. The following section describes the treatments for each cell which vary as follows (an example of an actual treatment for the low complexity case is provided in Appendix D).

Informational cues are only those that would provide the developer with useful information about how to go about fixing the defect, thus information about the priority and severity of the defect are not considered as informational cues for the purpose of this exercise and are therefore kept constant throughout the experiment.

To test H6a and b described in Chapter 3, the perceived proximity between the service recipient and service provider was operationalized in the experimental materials by varying the level of interpersonal involvement present in the feedback (Hornick, 1992; Mehrabian, 1991; Price et al., 1995) – such as using phrases like "your code" as opposed to "the code", identifying by name the tester who provides the feedback, use of more personal words, etc. Spatial proximity is controlled by implying that the tester is located in the vicinity of the developer or at a distant location. The Comments section of the defect report contained impersonal communication patters (as depicted in Table 8), while participants in the high proximity condition were provided with a Comments section that provided them with a closer experience making use of first names, personalized emails, and information regarding spatial proximity and a willingness of the tester to meet face to face in order to address the defect. To test the efficacy of the proximity treatment a treatment check comprised of a three item Liker- type scale measurement was employed. This measurement was adapted from prior literature on proximity and its impacts on service evaluation and emotions (e.g., Hornick, 1992; Mehrabian, 1991; Price et al., 1995).

Table 8

Independent Variables and Operationalizations

Independent Variable	Conditions	Operationalization
Complexity	High	Decision matrix with 15 Conditions/Courses of Action and 8 Action Stubs
	Low	Decision matrix with 2 Conditions/Courses of Action and 2 Action Stubs
Specificity	High	The amount of informational cues regarding the defect report is high. For each component of the defect report, the cues are as follows: Heading – 1 Product – 1 Component – 4 Defect type – 0 Priority – 0 Severity – 0 Environment – 1 Steps – 17 Attachments – 1 Comments – 2 Total = 27 information cues
	Low	The amount of informational cues regarding the defect report is low. For each component of the defect report, the cues are as follows: Heading – 1 Product – 1 Component – 1 Defect type – 0 Priority – 0 Severity – 0 Environment – 1 Steps – 2 Attachments – 0 Comments – 0 Total = 6 information cues
Proximity	High	The comment section contains the following proximity cues: - Use of first names - Friendly tone and writing style - Personal email address of the tester - Willingness and ability to meet face to face for the resolution of the defect
	Low	The comment section contains the following proximity cues: - Use of impersonal appellation - Impersonal writing style and tone - Impersonal email address of testing organization - Unwillingness and inability to meet for the resolution of the defect

To test H7a, b, c, and d described in Chapter 3, complexity is operationalized as the quantity of information presented in the coding task – decision matrix (Olshavsky, 1979; Payne, 1976; Payne et al., 1988). This is done by increasing the amount of information (addressing more complicated issues) needed to be taken into account during the decision making process and by providing multiple informational cues about the decisions that needed to be implemented in the software code. Participants in the low complexity treatment condition received a decision matrix composed of only 2 conditions/courses of action and 2 action stubs. Participants were required to read and understand the decision matrix and think of the code required to implement it. Participants in the high complexity treatment condition received a decision matrix composed of 15 conditions/courses of action and 8 action stubs. To verify the validity of the complexity condition, a treatment check measure was implemented via a 3 item Likert-type scale adapted from the literature (e.g., Speier & Morris, 2003; Wood, 1986).

To test H8a, b, d, and d from Chapter 3, specificity of the service output was operrationalized by varying the level of precision and completeness of the feedback provided by the defect report (Nadkarni & Gupta, 2007). To do this, the experimental materials provide the participants with a differing number of informational cues about the defect detected by the tester. In the low specificity condition, participants receive a vague description of the defect via only 6 information cues spread amongst the different components of the defect report. In the high output specificity condition, the participants receive a much more comprehensive and precise description of the defect and of the steps needed to obtain the error during the testing process. The total number of informational cues provided in the high specificity condition participants is 27. To ensure the validity of

the specificity treatment, a treatment check was implemented via a 5-item Likert-type scale measurement adapted from Nadkarni and Gupta (2007).

Dependent Variables.

The purpose of this research is to understand how individuals evaluate IS services, and specifically, IS testing services (Yang et al., 2010). Given this focus, and the two main components of IS service evaluation (rational evaluations and emotional evaluations) (Lazarus, 1991; Loewenstein et al., 2001), this research has as main dependent variables the rational evaluation component and the emotional evaluation component.

Rational evaluation measurement. In concordance with prior research on IS success (DeLone & McLean, 1992, 2003) and IS service success (Geffen, 2002; Liu & Arnett, 2000; Loiacono et al., 2007; Kettinger & Lee, 2005; Yoo & Donthu, 2001; Zeithaml et al., 2002) two constructs were chosen to represent the rational evaluation of the IS service – information quality and usefulness.

Information quality describes the quality of the information presented in the service output. Information quality is measured by a scale with 20 items adapted from the literature (e.g., DeLone & MacLean, 2002, 2003).

Usefulness of a service is another important success factor used in IS research. This dependent variable is designed to measure the perceived utility associated with the IS service. Usefulness of the IS service is measured via a 3 item Likert-type measurement scale adapted from literature (Davis et al,. 1989; Venkatesh et al., 2003).

Emotional evaluation measurement. The second dependent variable investigated is the emotional response elicited by the testing service encounter. This

dependent variable is designed to measure the emotional aspects of the IS service evaluation. The emotions felt as a result of the service encounter will change based on the characteristics of the testing service performed. The emotional response to the IS service is measured by employing a survey tool designed to measure modal emotions.

To measure modal emotions, a convergent measurement of all emotional components is required to provide the researcher with a clear and pragmatic understanding of the emotion elicited by an event (Scherer, 2005). A verbal descriptor (such as one of the modal emotions provided in an emotion measuring scale) can better distinguish different emotional states then other methods of measuring emotions because of the intuitive understanding provided by natural language labels (Scherer, 2005). Based on Russell's (1983) division of emotions by valance (positive and negative) and arousal (active/passive), this research uses a scale measurement for modal emotions adapted from Scherer (2005). Thus, mapping on the goal oriented nature of modal emotions and the facility to engage in patterned behavior, modal emotions are split into positive vs. negative emotions (Scherer, 2005) for a total of 20 distinct emotions labels used by this research. This inventory covers all of the components and facets of modal emotions and also facilitates the systematic assessment of the emotions felt, as well as the interpretability and communicability of the emotional state (Scherer, 2005).

The comprehensive treatment of modal emotions as well as the ease of interpretability and communicability of the survey instrument makes the modal emotion inventory proposed by Scherer (2005) a viable and useful tool for investigating the emotional component of service evaluations.

Dependent variables. Evaluations have been linked to certain behaviors regarding the event, object or person being evaluated (Lazarus, 1991; Scherer, 2002; 2005). To capture the full picture of IS service evaluations, this research proposes a set of behavioral measures that investigate the potential behavioral intentions that an individual may have regarding the IS service performed. These behavioral intentions are operationalized by employing previously established measures from the literature.

Continuance of the IS service measures the intentions of an individual to continue using the IS service, given the outcomes the IS service encounter. Both rational and emotional evaluations of the IS service will influence this important behavioral outcome. To measure continuance behaviors, a three item measure has been adapted from Bhattacherjee (2001).

Finally, word-of-mouth describes the likelihood that a service recipient will engage in approving or disapproving communication about the received IS service. This is important given that an internal employee cannot switch service providers, and word of mouth is one of the most convenient ways of expressing approval or disapproval of a service encounter. Word of mouth is measured by a 3-item Likert-type scale adapted from literature (Gefen, 2002; Homburg & Giering, 2001; Srinivasan et al., 2002, Reichheld, 2003).

Control Variables

A host of control variables were employed to ensure that the most likely exogenous influences on the variables of interests will be controlled for. As such, given that emotions and evaluations were involved, gender and age are important issues to consider (Newell & Simon, 1972). Experience with software development and with a

work setting can also influence the way individuals evaluate services related to their work, hence familiarity with defect reports, familiarity with software development and testing, as well as tenure with company were measured.

Summary of the Chapter

This chapter provided an overview of the research methodology used to investigate the research questions proposed by this study. The chapter described the sample and goes on to discuss three pilot studies that were conducted in order to refine and validate the experimental materials and measurement tools used by this research. Next, the chapter described the experimental procedures and materials used during the experiment and presented the operationalization of each individual treatment and measures. Finally, the chapter presented the research design and controls used in the experiment.

Chapter 5

Data Analysis and Results

Introduction

This chapter describes the analytical procedures used in this research and the results of the data analysis. The chapter starts by describing the participants in the experiment, followed by an analysis of the various manipulation checks. This is followed by an MANCOVA analysis to test one set of hypotheses presented in Chapter 3. Next, the psychometric properties of the measures used are investigated and a structural model designed to test the hypotheses presented in Chapter 3 is described. The chapter concludes with a discussion of the hypothesis testing that yielded the findings.

Descriptive Data about Participants

Participants to the experiment were recruited through a micro-sourcing website (Mechanical Turk by Amazon.com) that specializes in providing individuals as well as small and medium organizations with access to a large pool of specialized individuals who can provide skilled labor for small and medium projects. This website allows a requester to design a job that is then published on the work-force marketplace. These jobs can have specific requirements that would allow only a certain category of worker with specific skills to accept the job. Once a worker commences a job, they have a specific time interval (requester specified) in which to accomplish the task assigned to them. Once the task is complete the work is recorded and sent to the requester. The requester can either accept or reject the work, depending on various quality criteria. If the work is accepted, the micro-sourcing website debits the requester and credits the worker for the previously agreed upon amount. Many of the projects on the micro-sourcing website

were software development oriented and the website was frequented by many experienced software developers and testers. These individuals are representative of the target population required for this research. Finally, for the purpose of this research, only completed experiments were accepted.

The experiment was allowed to run on the public micro-sourcing web marketplace for two weeks. In this period 250 attempts were registered, out of which only 153 were complete. Since incomplete answers were not accepted, the resulting response rate is 61%. Data for the incomplete hits is not released to the requester, therefore no non-response bias analysis was conducted.

Participants willing to engage in the experiment were first asked whether or not they had software testing and development experience and were instructed to continue only if the answer was affirmative. Furthermore at the end of the questionnaire, the respondents were asked again about their software development experience. A summary of these results is presented in Table 10 below.

The time limit set on the experiment, via the micro-sourcing website, was of 30 minutes. The average time taken to complete the experiment, across all cells was 10. 3 minutes. This is consistent with the average time observed during the pilot studies and therefore provides an indication as to the seriousness of those engaging with the task.

To investigate whether the participant pool was homogeneous, a host of control variables were captured. Since the focus of this experiment was to understand how individuals evaluate software testing services, the following control variables were deemed to be of interest: 1) age of the participant, 2) gender of the participant, 3) participant's familiarity with defect reports, 4) participant's level of software

development experience, 5) participant's software testing experience, and 6) participant's

tenure with the organization. Any additional systematic differences among the treatment

conditions are expected to be controlled via the randomized assignment of participants to

treatment conditions.

Table 9
Chi-square tests for control variables across treatments

Treatment	Control Variable	Age	Gender	Defect Report Familiarity	Develop Experience	Testing Experience	Tenure
Complexity		.23, (*df* = 2, *p* = .89)	1.81, (*df* = 1, *p* = .18)	1.24, (*df* = 3, *p* = .74)	4.07, (*df* = 3, *p* = .25)	.85, (*df* = 3, p = .84)	.506, (*df* = 3, p = .92)
Specificity	*Chi-square*	1.32, (*df* = 3, *p* =. 72)	1.99, (*df* = 1, *p* =. 16)	3.78, (*df* = 2, *p* = .15)	3.13, (*df* = 3, *p* = .37)	3.35, (*df* = 3, *p* = .34)	.29, (*df* = 3, *p* = .96)
Proximity		1.15, (*df* = 3, *p* = .76)	.35, (*df* = 1, *p* = .55)	.61, (*df* = 2, *p* = .74)	2.78, (*df* = 3, *p* =. 43)	.61, (*df* = 3, *p* = .89)	3.81, (*df* = 3, p = .28)

Chi-square tests were conducted to further ensure that no significant difference

existed across treatments on the control variables described above. The chi-square test is

a non-parametric evaluation that does not require the data to meet particular assumptions

regarding its distribution. The only assumptions of the chi-square test are a random

sample and no more than 20% of the categories having counts of less than five data

points (Yates, Moore & McCabe, 1999). The chi-square tests indicated no significant

differences on age, gender, familiarity with defect reports, level of software development and testing experience, or tenure with the organization, across all of the treatments (for the results of the chi-square tests please see Table 9).

The participants had the following demographic characteristics: with regard to their tenure with the organization for which they work, 30.7% had less than 1 year of job tenure, 45.8% had between 1 and 4 years of tenure, 13.75 had between 4 and 8 years and 9.8% had more than 8 years tenure; with regard to their experience with software development, 24.8% had entry level experience, 41.2% had intermediate level experience, 28.8% had senior level experience and 5.2% had executive level experience; with regard to their software testing experience, 25.5% of participants had entry level experience, 42.5% had intermediate level experience, 25.5% had senior level experience and 6.5% had executive level experience. Furthermore, 73.9% of respondents were male, while 26.1% were female; 83.7% of respondents were between 18-24 years of age, 11.7% were between 25-43 years of age, and 4.6% were above 55 years of age. With regard to the respondent's familiarity of respondents with defect reports, 15.1% of respondents had a low familiarity, 39.5% had average familiarity and 45.4% had a high level of familiarity.

Manipulation Checks

First, face validity tests were conducted with subject experts from academia and industry to ensure the realism and applicability of the manipulations. During the second and third pilot tests, simple mean differences were computed to verify that the manipulations held in the expected directions (the pilot samples were too small for any statistical checks).

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Once the data for the research were collected, manipulations checks were performed on complexity, specificity of the output and proximity between service provider and service recipient. Each manipulation was varied on two levels – high and low. To implement the manipulation checks, three item constructs for complexity, specificity and proximity were adapted from literature. The responses for these constructs were averaged and t-tests for equality of means were used to compare the responses to these questions between treatment conditions. Table 10 presents the results of the t-tests for equality of means for each of the treatment conditions. As expected, the means of the treatments between treatment conditions are significantly different from each other thus indicating that participants to the experiment perceived the treatments to be sufficiently different from each other to make the manipulations adequate for further statistical analysis.

Table 10
Manipulation checks

Treatment	Means	Direction Expected	t-test	p-value
Complexity	High = 4.4	High>Low	-3.51	.001
	Low = 3.3			
Proximity	High = 5.4	High>Low	-3.82	.000
	Low = 4.6			
Specificity	High = 5.1	High>Low	-3.29	.001
	Low = 4.2			

Statistical Data Analysis Methods

To test the hypotheses presented in Chapter 3, two distinct statistical analysis methods were used. The first method employed was multivariate analysis of covariance

(MANCOVA) (for H6 through H8) which is an extension of analysis of covariance (ANCOVA). MANCOVA is appropriate in cases where there is more than one dependent variable and multiple predictors and covariate variables. MANCOVA was used to examine the influence of the treatment variables on the emotional and rational evaluations of the IS service. The second data analysis technique used employed a structural equation modeling (SEM) approach via partial least squares (PLS) to investigate the path model presented in Chapter 3.

Multivariate analysis of covariance. MANCOVA is useful in understanding the impacts of manipulated experimental variables on other variables of interest. For this research, the manipulated variables have been the complexity of the IS service task, the specificity of the IS service output and the proximity between service provider and service recipient. The dependent variables of this analysis are the rational and emotional components of IS service evaluations. Summated scores for information quality, perceived usefulness of the IS service as well as positive and negative emotions regarding the IS service were used in the statistical analysis.

One of the assumptions of the MANCOVA data analysis method is the homogeneity of covariances which can be tested by the Box's test of equality of covariance matrices (Hair et al., 1998). The Box test for the covariance matrices of dependent variables is not statistically significant ($F = 1.22$, p>.05) therefore the assumption of homogeneity of covariances is met for this dataset.

Another assumption required for MANCOVA analysis is the Levene's test for equality of error variances (Hair, Anderson, Tathman, & Black, 1998). The Levene's test was not significant for any of the dependent variables (Table 11) thus the null hypothesis

of equal variances for each dependent variable across group cannot be rejected, and the assumption of equal error variances is met for all treatments.

Table 11
Levene's Test of Equality of Error Variances

Variable	*F*	*df1*	*df2*	*Sig.*
Information Quality	.901	7	144	.507
Usefulness	.638	7	144	.724
Positive Emotions	1.493	7	144	.174
Negative Emotions	.379	7	144	.914

The results of the MANCOVA analysis are presented in Table 12. The analysis included as covariates defect familiarity, software development and testing experience, tenure with the company, age and gender thus any variance explained by these covariates has been partialed out from the main effects.

The results of the MANCOVA analysis indicate that only the complexity of the service task and the specificity of the service output have any impact on the emotional and rational evaluations of the IS service. The complexity of the service task has a statistically significant impact on positive emotions ($p < .05$) and a partially significant impact on negative emotions ($p < .10$). This means that as complexity increases, the positive emotions and, to a certain extent, the negative emotions associated with the service increase too.

The specificity of the service output has a statistically significant impact on perceptions of information quality ($p < .05$) and perceptions of usefulness of the service ($p < .05$), but no influence on the emotional components.

Proximity between service provider and service recipient has no impact on the emotional components of IS service evaluations.

Table 12
Results of MANCOVA Analysis

Source	Dependent Variable	df	F	Sig.	*Partial Eta Squared*	Observed Power
Complexity	Information Quality	1	.064	.801	.000	.051
	Positive Emotions	1	4.072	.046**	.027	.516
	Negative Emotions	1	3.060	.082*	.022	.430
	Usefulness	1	.007	.934	.000	.051
Specificity	Information Quality	1	4.190	.043**	.036	.634
	Positive Emotions	1	.643	.424	.011	.242
	Negative Emotions	1	.257	.613	.005	.132
	Usefulness	1	6.246	.014**	.055	.823
Proximity	Information Quality	1	.022	.881	.002	.078
	Positive Emotions	1	.236	.628	.002	.091
	Negative Emotions	1	.021	.885	.001	.060
	Usefulness	1	2.017	.158	.006	.149
Complexity * Specificity	Information Quality	1	3.992	.048**	.029	.541
	Positive Emotions	1	.012	.912	.000	.051
	Negative Emotions	1	.094	.760	.001	.066
	Usefulness	1	.752	.387	.006	.148
Complexity * Proximity	Information Quality	1	2.009	.159	.023	.443
	Positive Emotions	1	.311	.578	.006	.148
	Negative Emotions	1	.141	.708	.001	.068
	Usefulness	1	.427	.515	.005	.128
Specificity * Proximity	Information Quality	1	.235	.628	.006	.159
	Positive Emotions	1	.183	.670	.000	.056
	Negative Emotions	1	.807	.371	.004	.114
	Usefulness	1	.382	.537	.006	.149
Complexity * Specificity * Proximity	Information Quality	1	.937	.335	.020	.393
	Positive Emotions	1	1.533	.218	.015	.316
	Negative Emotions	1	.041	.840	.002	.077
	Usefulness	1	.830	.364	.017	.355

Note: ** significant at $p<.05$; * significant at $p<.10$

Only one statistically significant interaction was present between complexity of the service task and specificity of the service output ($p < .05$).

Table 13
Covariate Analysis Results

Covariate	Dependent Variable	F	Sig.	Observed Power
Defect familiarity	Information Quality	12.129	.001***	.933
	Positive Emotions	1.807	.181	.266
	Negative Emotions	.159	.690	.068
	Perceived Usefulness	6.375	.013**	.708
Tenure	Information Quality	.240	.625	.078
	Positive Emotions	.238	.626	.077
	Negative Emotions	.011	.918	.051
	Perceived Usefulness	.467	.496	.104
Software Development Experience	Information Quality	.966	.327	.164
	Positive Emotions	3.609	.060*	.471
	Negative Emotions	.676	.412	.129
	Perceived Usefulness	.221	.639	.075
Software Testing Experience	Information Quality	1.151	.285	.187
	Positive Emotions	.284	.595	.083
	Negative Emotions	9.867	.002***	.877
	Perceived Usefulness	.167	.684	.069
Gender	Information Quality	.019	.890	.052
	Positive Emotions	1.778	.185	.263
	Negative Emotions	.832	.363	.148
	Perceived Usefulness	.351	.554	.091
Age	Information Quality	.841	.361	.149
	Positive Emotions	8.555	.004***	.828
	Negative Emotions	1.634	.203	.246
	Perceived Usefulness	.237	.627	.077

Note: *** significant at p<.01; ** significant at p<.05; * significant at p<.10

The results of the covariate analysis show that defect familiarity has a statistically significant impact on perceptions of information quality ($p < .01$) and perceptions of usefulness of the service ($p <. 05$). Software development experience had a partially significant impact on positive emotions associated with the testing report ($p < .10$), while software testing experience had a statistically significant impact on the negative emotions associated with the IS service ($p < .01$). Finally the age of the participant also had a statistically significant impact on the positive emotions associated with the IS service ($p < .01$). The gender of the participants, and their tenure with the organization, had no statistically significant impact on any of the dependent variables.

Structural Path Analysis with PLS

The second part of the model (hypotheses 1 through 5) was investigated via a structural equation model in PLS. This type of analysis is well fitted to analyzing the relationships between constructs that are measured with multiple items. Furthermore, given the low sample size (and associated lower power) and for the purposes of statistical triangulation, the influence of the treatments was also modeled in the structural model to examine the relationship between the three independent variables (complexity, specificity and proximity) and the rational and emotional IS service evaluation components.

Measurement model analysis. To further analyze participant data and perform a test of the hypotheses proposed in Chapter 3, a structural equation modeling (SEM) approach was used. This approach was chosen because of its proven capability to provide a holistic understanding of models that employ multiple constructs and relationships, as well as because of its holistic handling of error variances across the model (Straub et al. 2004). As a rule of thumb, when dealing with complex constructs and models, a sample

of at least 20 observations per construct is advisable (Hair et al., 1998). The model

proposed in Chapter 3 describes 9 distinct constructs for a grand total of 180 minimum

observations for the entire model. The sample size of the current research is 153 for a

ration of observation to construct of 17-1. Given this somewhat smaller sample size, a

partial least square (PLS) data analysis technique was chosen to analyze the observations.

PLS is very robust in dealing with deviations of statistical assumptions of latent variable

modeling (Cassel et al., 1999; 2000), multicolinearity (Gustafsson & Johnson, 2004) and

sample size restrictions. PLS can provide stable results with samples as low as 100 to 150

observations (Chin & Newsted, 1999). The software chosen to implement the PLS

analysis is SmartPLS (Ringle et al., 2005).

When analyzing SEM models, first the quality of the measurement model has to

be investigated (Straub, 1989; Straub et al., 2004). Validating the measurement model

entails an investigation of the validity of the constructs and the measures that describe

them.

Table 14
Latent Variables Quality Metrics

Construct	Composite Reliability	Cronbach's Alpha	AVE
Complexity	0.94	0.91	0.85
InfoQual	0.90	0.87	0.54
Neg. Emotions	0.92	0.92	0.56
Pos. Emotions	0.92	0.90	0.55
Proximity	0.87	0.80	0.70
Specificity	0.91	0.86	0.79
Usefulness	0.90	0.84	0.76
Word of Mouth	0.92	0.87	0.79
Continuance	0.92	0.88	0.81

First, construct validity was examined. Construct validity investigates how well

measures correlate with a theoretical construct they purport to measure. To examine

construct validity, two components have to be investigated individually – convergent

validity – which describes how well the items converge on their construct and how well

they are related to each other, and divergent validity – which describes how the items that

describe one construct differ from the items that describe other constructs. Convergent

validity is achieved when measurement items exhibit significant loadings on their

respective latent constructs (Gefen & Straub, 2005). To investigate the loadings of items

on their respective construct, t-values were estimated in SmartPLS using a nonparametric

bootstrapping procedure using 200 samples (Chin, 1998). The results of this analysis

showed significant loadings for all items and constructs (loadings over 0.60 at a

significance level of $\alpha = 0.05$) with the exception of one item describing the Information

Quality construct (loading = .55) and one item describing the Positive Emotions construct

(loading =.44). These two items did not exhibit any significant cross-loadings across

other constructs and were therefore preserved in order to maintain construct integrity.

Next, each construct was investigated in relation to the reliability of its measures.

Reliability pertains to the repeatability or consistency of the measurement items. To

investigate reliability, both composite reliability and Cronbach's Alpha were used (Chin

1998, Gefen & Straub 2005). Table 14 displays the results of the reliability analysis for

the modeled constructs and shows that both composite reliability and Cronbach's Alpha

are well above accepted limits for reliability (Chin, 1998; Nunally, 1978). Another test of

convergent validity is to calculate the average variance extracted (AVE). The AVE

describes the variance explained by the latent construct in the measurement items and

should be at least .50 in order to account for more variance than simple chance (Gefen &

Straub, 2005). This condition is met by all constructs and thus the convergent validity

requirement is adequately met by the constructs in the research model.

Once convergent validity has been established, discriminant validity is

investigated to make sure that the items measuring one construct are sufficiently different

from items measuring other constructs. Discriminant validity is investigated by looking at

the latent construct correlations and square root of their respective AVE. According to

Gefen and Straub (2005) in order for a construct to exhibit divergent validity the square

root of its AVE should be larger than any correlations between the specific construct and

other constructs present in the model. Table 15 depicts the correlation matrix of the

modeled constructs as well as the square root of the AVE for each individual construct

(boldface on the diagonal) The results of the correlation matrix suggest that each

construct is sufficiently different from any other construct in order to meet the divergent

validity requirement.

Table 15
Latent Variable Correlation Matrix (SQRT of AVEs for each construct presented in bold)

Construct	Comp	Info	Neg	Pos	Prox	Spec	Use	WoM	Cont
Complexity	**0.92**	0	0	0	0	0	0	0	0
InfoQual	0.12	**0.74**	0	0	0	0	0	0	0
Neg. Emotions	0.20	-0.13	**0.75**	0	0	0	0	0	0
Pos. Emotions	0.33	0.25	0.28	**0.75**	0	0	0	0	0
Proximity	-0.06	0.42	-0.21	0.11	**0.84**	0	0	0	0
Specificity	0.12	0.66	-0.11	0.34	0.22	**0.89**	0	0	0
Usefulness	0.03	0.71	-0.23	0.21	0.26	0.73	**0.87**	0	0
WoM	0.0	0.65	-0.09	0.38	0.43	0.63	0.67	**0.89**	0
Continuance	0.05	0.71	-0.26	0.22	0.40	0.63	0.68	0.77	**0.93**

Furthermore, the factor structure of the measurement model was investigated. Ideally, there should be no cross-loadings between constructs higher than .30. The factor structure exhibited by the investigated research model (Appendix G) does exhibit a number of item cross-loadings especially between the endogenous variables and the dependent variables. Given the discriminant validity analysis presented above, and the fact that none of the cross-loadings are greater than the loadings of the item on their specific constructs, all the items except two were kept in order to maintain construct interpretability. The two items that were dropped were part of the information quality construct and exhibited high cross-loadings and low loading on their own construct.

Structural model analysis. Once the viability of the measurement model had been demonstrated, the structural model and paths were analyzed. To analyze the structural model, SmartPLS modeling was employed by using a path weighing scheme with a maximum of 300 iterations (Ringle et al., 2005). PLS is designed to extract latent factors and investigate the relationships between them while accounting for as much of the observed variation as possible.

Figure 8 depicts the results of the data analysis on the integrated research model described in Chapter 3. Table 17 presents the results of the hypothesis testing based on the PLS analysis.

Furthermore, the control variables were used as distinct predictors of the two dependent variables proposed by the research model – continuance and advocacy behavior (Figure 4, Chapter 3). None of the control variables had any significant impact on these two dependent variables (Table 16).
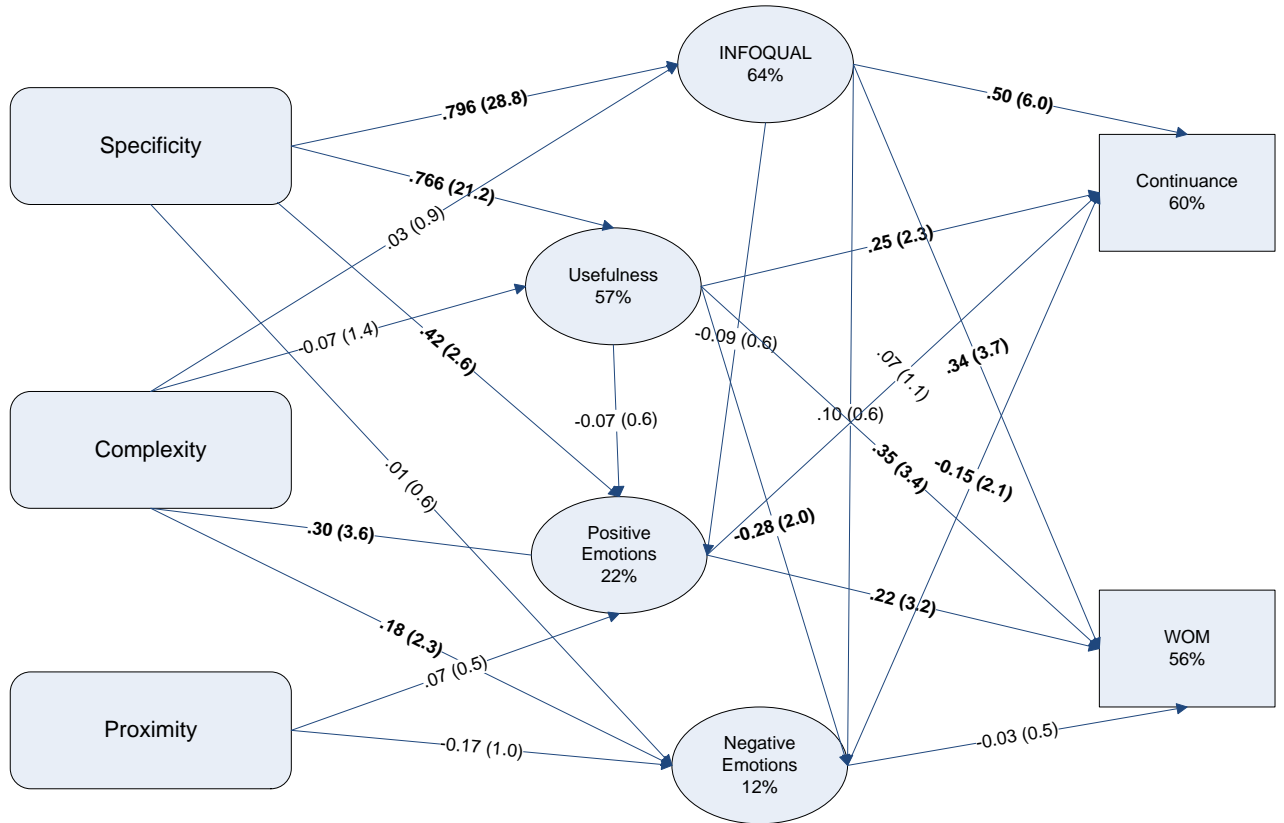
Figure 8: Data Analysis Results (boldface numbers represent significant relationships)

Table 16

Relationship between control variables and dependent variables

Relationship	*t Statistics*
Age -> Word-of -Mouth	0.47, p=ns
Age -> Continuance	0.77, p=ns
Fam -> Word-of -Mouth	1.27, p=ns
Fam ->Continuance	1.24, p=ns
Gender -> Word-of -Mouth	0.46, p=ns
Gender -> Continuance	1.19, p=ns
Development Exp. -> Word-of -Mouth	1.37, p=ns
Development Exp. -> Continuance	0.01, p=ns
Tenure -> Word-of -Mouth	0.72, p=ns
Tenure -> Continuance	0.87, p=ns
Testing Exp. -> Word-of -Mouth	0.31, p=ns
Testing Exp. -> Continuance	0.83, p=ns

Hypothesis testing. Table 17 presents the complete results of the data analysis

and hypothesis testing from both the MANCOVA and PLS analysis. The table describes

the relationship between the variables depicted in the hypothesis, whether the hypothesis

was supported or not (with the associated t-values in parenthesis) and the direction of the

relationship (positive or negative).

Table 17
Hypotheses testing results

Hypothesis	MANCOVA	PLS Results
IS Service Characteristics		
H8a: Specificity > Information Quality	Supported ($p < .05$)	Supported ($t = 28.802$)
H8b: Specificity > Usefulness	Supported ($p < .05$)	Supported ($t = 21.183$)
H8c: Specificity > Positive Emotions	Not Supported	Supported ($t = 2.573$)
H8d: Specificity > Negative Emotions	Not Supported	Not Supported
H7a: Complexity > Information Quality	Not Supported	Not Supported
H7b: Complexity > Usefulness	Not Supported	Not Supported
H7c: Complexity > Positive Emotions	Supported ($p < .05$)	Supported ($t = 3.612$)
H7d: Complexity > Negative Emotions	Supported ($p < .10$)	Supported ($t = 2.378$)
H6a: Proximity > Positive Emotions	Not Supported	Not Supported
H6b: Proximity > Negative Emotions	Not Supported	Not Supported
IS Evaluation Components		
H5a: Information Quality > Positive Emotions	N/A	Not Supported
H5b: Information Quality > Negative Emotions	N/A	Not Supported
H5c: Usefulness > Positive Emotions	N/A	Not Supported
H5d: Usefulness > Negative Emotions	N/A	Supported ($t = -2.094$)
IS Service Outcome Behavioral intentions		
H1a: Information Quality > Word of Mouth	N/A	Supported ($t = 3.728$)
H1b: Information Quality > Continuance	N/A	Supported ($t = 6.077$)
H2a: Usefulness > Word of Mouth	N/A	Supported ($t = 3.452$)
H2b: Usefulness > Continuance	N/A	Supported ($t = 2.379$)
H3a: Positive Emotions > Word of Mouth	N/A	Supported ($t = 3.243$)
H3b: Positive Emotions > Continuance	N/A	Not Supported
H4a: Negative Emotions > Word of Mouth	N/A	Not Supported
H4b: Negative Emotions > Continuance	N/A	Supported ($t = -2.157$)

The first set of hypotheses describes the impact of the emotional and rational

components of evaluation on the two behavioral intentions – continuance of the IS

service and word-of-mouth about the IS service.

Hypothesis H1a investigated whether perceptions of information quality will have a positive impact on continuance behaviors. Perceptions of information quality have a positive impact on continuance behaviors on the part of the service recipient (.50, $p <$ .01), thus H1a was supported.

Hypothesis H1b looked at the impact of perceptions of information quality on word-of-mouth regarding the service provider. The data analysis shows that perceptions of information quality have a positive impact on word-of-mouth intentions on the part of the service recipient (.34, $p < 0.01$) thus H1b was supported.

Hypothesis H2a investigated the impact of the perceived usefulness on continuance behaviors. Perceived usefulness of the software testing service was shown to have a positive influence on intentions to continue using the testing service (.25, $p <$ 0.05), thus supporting H2a.

Hypothesis H2b examined the impact of perceptions of usefulness of the IS service on the intentions of the service recipient to engage in positive word-of-mouth regarding the service provider. The data analysis shows that perceptions of usefulness positively influence word-of-mouth behaviors regarding the service provider (.34, $p <$ 0.05), thus H2b is supported.

Hypothesis H3a examined the impact of positive emotions on continuance behaviors. The data analysis shows that positive emotions have no significant influence on continuance behaviors ($p > 0.1$), thus H3a is not supported.

Hypothesis H3b investigated the impact of positive emotions on word-of-mouth behaviors related to the service provider. The data analysis results show that positive

emotions lead to an increased likelihood of engaging in positive word-of-mouth behaviors related to the service provider (.22, $p < 0.05$), thus H3b is supported)

Hypothesis H4a examined the influence of negative emotions on continuance behaviors related to the received service. The results of the data analysis show that negative emotions negatively influence the intentions of the service recipient regarding their continuance of the IS service (-0.15, $p < 0.05$), thus H4a is supported.

Hypothesis H4b examined the influence of negative emotions on word-of-mouth behaviors. The data analysis shows that negative emotions have no impact on word-of-moth behaviors (p>0.1), thus H4b is not supported.

The second set of hypotheses examines the impact of the rational evaluation component on the emotional evaluation component.

Hypothesis H5a investigated the impact of perceptions of information quality on positive emotions. The results of the data analysis show that perceptions of information quality have no impact on positive emotions ($p > 0.1$), thus H5a is not supported.

Hypothesis H5a investigated the impact of perceptions of information quality on negative emotions. The results of the data analysis show that perceptions of information quality have no impact on negative emotions ($p > 0.1$), thus H5b is not supported.

Hypothesis H5c investigated the impact of perceptions of usefulness of the service on positive emotions. The results of the data analysis show that perceptions of usefulness of the service have no impact on positive emotions ($p > 0.1$), thus H5c is not supported.

Hypothesis H5d investigated the impact of perceptions of usefulness of the service on negative emotions. The results of the data analysis show that perceptions of

usefulness have a significant negative impact on negative emotions (-0.28, $p < 0.05$), thus H5d is supported.

The third and final set of hypotheses examines the impact of the antecedent variables (complexity of the IS service task, specificity of the IS service output and proximity between IS service provider and recipient) on the rational and emotional evaluative components of the IS service.

Hypothesis H6a investigated the impact of perceptions of proximity between service provider and service recipient on positive emotions. The results of the data analysis show that perceptions of proximity between service provider and service recipient have no impact on positive emotions ($p > 0.1$), neither for the MANCOVA analysis, nor for the PLS analysis thus H6a is not supported.

Hypothesis H6b investigated the impact of perceptions of proximity between service provider and service recipient on negative emotions. The results of the data analysis show that perceptions of proximity between service provider and service recipient have no impact on negative emotions ($p > 0.1$), thus H6b is not supported.

Hypothesis H7a investigated the impact of perceptions of task complexity on perceptions of information quality. The MANCOVA and PLS data analysis results show that perceptions of task complexity have no impact on perceptions of information quality ($p > 0.1$), thus H7a is not supported.

Hypothesis H7b investigated the impact of perceptions of task complexity on perceptions of usefulness of the service. The MANCOVA and PLS data analysis results show that perceptions of task complexity have no impact on perceptions of usefulness of the service ($p > 0.1$), thus H7b is not supported.

Hypothesis H7c investigated the impact of perceptions of task complexity on positive emotions associated with the service. The MANCOVA and PLS data analysis results show that perceptions of task complexity have a significant positive impact on positive emotions associated with the service (.30, $p < 0.05$), thus H7c is supported.

Hypothesis H7d investigated the impact of perceptions of task complexity on negative emotions associated with the service. The MANCOVA and PLS data analysis results show that perceptions of task complexity have a significant positive impact on negative emotions associated with the service (.18, $p < 0.05$), thus H7d is supported.

Hypothesis H8a investigated the impact of perceptions of specificity on perceptions of information quality. The MANCOVA and PLS data analysis results show that perceptions of specificity have a significant positive impact on perceptions of information quality associated with the service (.79, $p < 0.01$), thus H8a is supported.

Hypothesis H8b investigated the impact of perceptions of specificity on perceptions of usefulness of the service. The MANCOVA and PLS data analysis results show that perceptions of specificity have a significant positive impact on perceptions of usefulness of the service (.76, $p < 0.01$), thus H8b is supported.

Hypothesis H8a investigated the impact of perceptions of specificity on positive emotions. The data analysis results from the PLS method show that perceptions of specificity have a significant positive impact positive emotions associated with the service (.76, $p < 0.01$), while the results of the MANCOVA analysis show that specificity has no impact on positive emotions thus H8c is partially supported.

Hypothesis H8a investigated the impact of perceptions of specificity on negative emotions. The MANCOVA and PLS data analysis results show that perceptions of

specificity have no significant impact on negative emotions associated with the service (p>0.1), thus H8d is not supported.

Summary of the Chapter

This chapter described the data analysis and hypotheses testing procedures and results used by this research and the results of the data analysis. The chapter described the participants in the experiment, and then presented an analysis of the various manipulation checks. The psychometric properties of the measures used were examined and found to meet the requirements for the structural analysis of the research model. The chapter concluded with a discussion of the results of the hypothesis testing which.

Chapter 6

Discussion of Findings

Introduction

Chapter 6 presents a discussion of the findings as they pertain to the theoretical model described in Chapter 3. The chapter first reiterates the research goals and questions and the shortly describes the major hypotheses investigated by the research. Next, the results of the data analysis are discussed in detail. The chapter continues with a discussion of a potential modification of the model, in light of the data analysis results. Finally, the contributions of this research to theory and practice are presented.

Research Goals and Questions

The main goal of this research was to understand how individuals evaluate IS services, and specifically, IS testing services. To achieve this goal, this research focused on two distinct research questions. The first research questions focuses on understanding the components that make up the IS service evaluation process. Following the literature on psychology, this research proposes a rational and emotional component of evaluation and shows how these two components are related to form the overall IS service evaluation construct. The second research question examines how specific service characteristics (complexity, proximity and output specificity) impact the emotional and relational components of IS service evaluation.

The research model predicted that task complexity and specificity of the service output would have a positive impact on both emotional and rational component of IS service evaluations. Furthermore, proximity between service provider and service recipient was posited to have a positive influence on the emotional component of service

evaluations. The second part of the model examined the interplay between the emotional

and rational components of service evaluation and posited that the rational components

will positively influence emotional components of IS service evaluation. Finally, the

model proposed two behavioral impacts of the evaluation process – IS service

continuance behaviors, and word-of-mouth behaviors. The model posited that both the

emotional and rational components of IS service evaluations will have an influence on

behavioral intentions related to the IS service.

A set of hypotheses was derived from this research model and was tested via an

online experiment. The next section discusses the results of the data analysis described in

Chapter 5 and is followed by an examination of the implications of this research on

theory and practice.

Interpretation of Research Findings

Following the research model, this section first discusses the influence of the

service characteristics on IS service evaluation components, then examines the interplay

between the rational and emotional components of IS service evaluation, and concludes

by discussing the influence of this evaluation on the two behavioral intentions depicted in

the research model.

Influence of service characteristics on the emotional and rational evaluations

of an IS service. The first service characteristic investigated is the proximity between

service recipient and service provider. This characteristic is hypothesized to have a

positive impact on the emotional evaluation component because of the feelings of

attachment proximity engenders and also because of perceptions of service customization

and trustworthiness (Hornick, 1992; Patterson et al., 1986; Price et al., 1995). The results

of the data analysis indicate that, in the case of IS testing services, proximity between service provider and service recipient has no significant influence on the emotional evaluation associated with the service. It is possible that given the technical nature of software development and testing, interpersonal relationships do not play such an important role in the evaluation of the testing service. Indeed, research in the area of outsourcing of software development and testing finds that interpersonal relationships, while still requiring a certain level of management, have less of an influence than more structured and formal relationships between developers and testers (Lee, 2006; Koh, Ang, & Straub, 2004). Since many of the testing services used by organizations can be outsourced, software developers may not place as much emphasis on the more personal interactions between themselves and the software testers.

Task complexity is the next service characteristic that was investigated by this research. In concordance with Forgas's (1995) Affect Infusion Model, task complexity was posited to increase the level of emotional evaluations and decrease the level of rational evaluation. This is because of increased cognitive loads that result from increased complexity (Schroder et al., 1967) which overwhelm the rational resources available to an individual, leading him or her to rely more on emotional, heuristic cues for their evaluation. The results of the data analysis show that complexity does increase the levels of both positive and negative emotions, but has no impact on the rational evaluations of the IS service. Complexity does not have an impact on the rational evaluation of this IS service in this particular setting possibly because of the structured nature of software development and testing services. Software developers and testers are used to breaking down complex structures into rationally manageable modules. Complexity does have an

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impact on the emotional component of testing services evaluations which indicates that, as the complexity of the testing service provided increases, the service providers should pay closer attention to the emotional aspects of the service, in addition to the rational aspects of their service offering.

The final service characteristic investigated by the model is the specificity of the service output. The research model posited that the specificity of the service output would influence the evaluation components in two ways – it would positively influence the rational evaluations of the IS service and would also positively influence its emotional evaluation. The analysis of the data partly confirms these expectations. The specificity of the service output has a positive influence on the rational components of service evaluations and also partially shows a positive influence on the positive emotions associated with the service. On the other hand, specificity has no impact on the negative emotions associated with the service. Even though previous research shows that ambiguous or uncertain information does lead to negative emotions (Chitturi et al., 2007; Drolet & Luce, 2004; Hedgecook & Rao, 2008) this research finds that, in the case of software testing services, this is not the case. Only positive emotions seem to be affected by the specificity of the testing service output. This may have to do with the expectations developers have regarding the testing service. Research on outsourcing may again shed some light on this result. Research on the quality of outsourced software development and testing services shows that the quality of such services does not always meet requirements (Lacity & Rudramuniyaiah, 2009; Lee, 2006). Software developers may have low expectation of the quality (and specificity) of testing defect reports and therefore they are no longer exhibiting negative emotions related to low levels of quality

and specificity. On the other hand, when the quality or specificity of the reports is high, software developers may be pleasantly surprised, and are more likely to exhibit positive emotions associated with the testing service.

Interplay between the emotional and rational components of IS service evaluations. The two components of evaluation are composed of four distinct constructs. On the rational side, the evaluation component is made up of information quality and usefulness of the service. The emotional component is represented by positive and negative emotions. Following Lazarus (1991) and Lowenstein et al. (2001) this research hypothesizes that rational evaluations will influence emotional evaluations. Therefore, both information quality and usefulness of the service will positively influence the emotional evaluation of the service (will have a positive influence on positive emotions, and a negative influence on negative emotions).

The results of the data analysis only partly support this hypothesis. Information quality does not have any impact on the emotional components of evaluation. Usefulness of the service has a negative impact on negative emotions (as hypothesized) but no impact on positive emotions. This is an interesting results, since it seems that perceptions of usefulness act as a mitigating factor for any negative emotions associated with the IS service. Again, since software development and testing is a very structured filed, information quality may not play such an important role in the development of the evaluations of this particular IS service. Usefulness, on the other hand is an indicator of a quality service, that can help a developer accomplish his or her job.

Impact of the emotional and rational components of IS service evaluations on behavioral intentions. The research model concludes by examining the impact of the

emotional and rational components of IS service evaluations on two distinct behavioral intentions – intentions to continue using the IS service; and intentions to engage in word-of-mouth about the service received.

The research model posits that both emotional and rational evaluations of the IS service will positively impact the two behavioral intentions. Specifically, the model stipulates that information quality and usefulness of the IS service will positively influence intentions to continue using the IS service and also increase the likelihood that individuals will engage in positive word-of-mouth about the service received. In concordance with prior literature (e.g., Bhattacherjee, 2001; Gefen, 2002; Reichheld, 2003) the results of the data analysis show this to be true. A service that provides a high information quality and is useful to the service recipient will make it more likely that the service recipient will reuse the service and praise the tester to his or her coworkers.

The model also stipulates that positive emotions associated with the IS service are likely to influence the service recipient to reuse the service and praise the tester, whereas negative emotions associated with the IS service are likely to influence the service recipient to stop using the service (switch to a different service provider) and complain about the service provider.

The results of the data analysis show that positive emotions have no significant impact on continuance behaviors, but have a significant positive impact in advocacy or word-of-mouth behavior. These results confirm the findings of prior studies (e.g., Onita & Dhaliwal, 2010), and show that simply engendering positive emotions in a service recipient may not be sufficient to convince them to reuse the service (rational confirmation of the service recipient's expectations such as usefulness of the service may

be required for them to reuse the service). On the other hand, if the service provider successfully engenders positive emotions in the service recipient, the latter is more likely to praise the former to his or her coworkers. This may be an aspect of social rewards that has not been previously investigated in this setting.

Negative emotions exhibit an opposite relationship to that of positive emotions, and have no significant impact on word-of-mouth behaviors, but, as seen in previous studies (e.g., Onita & Dhaliwal, 2010) have a negative impact on intentions to continue using the IS service. Complaining about a coworker (tester) may be considered inappropriate in a work setting, given the political and social dynamics that exist in organizations and feeling negative emotions may not be enough for the service recipient to start complaining about the service, unless these negative emotions are also coupled with perceptions of low information quality and low usefulness. On the other hand, if the opportunity arose, negative emotions related to the service received and the service provider may be enough to convince a service recipient to opt to switch to a different service provider.

Overall Conclusions of the Research Study

Overall, this study confirmed that, when it comes to IS services, and specifically software testing services, individuals use both rational and emotional components to evaluate how well the service has met their requirements. When the information quality or perceived usefulness of the service is low, service recipients are likely to stop using the service (if they have the choice) and are also likely to complain about the service and the service provider. While emotional components provided mixed results as to their impact on behavioral intentions, this study did show that positive emotions associated with the

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service encounter can influence the service recipient to praise the service provider, while negative emotions associated with the service encounter can influence the service recipient be inclined to switch service providers (providing they have the choice to do so).

Furthermore, this research showed that at least one type of rational evaluation of the service (usefulness) has an impact on the emotions associated with the service (negative emotions). Therefore, when the perceived usefulness of a service increases, any negative emotions felt about the service (from other sources than usefulness) may be mitigated.

Finally, this research identified two service characteristics that have an impact on both emotional and rational components of IS service evaluations. The specificity of the output was shown to have positive impacts on the emotional and rational components of evaluations. The complexity of the service task, was shown to increase the level of emotional evaluations (both negative and positive), which implies that, as complexity increases, emotions become more important in the evaluation of the IS service. One service characteristic that was predicted to have an impact on the emotional component of service evaluation but did not was proximity. This is an interesting result, given prior studies on service proximity in other settings.

Implications of the Research to Theory and Practice

The results of this research study have potentially important implications for IS service evaluation theory as well as for practice.

Implications to theory. Prior research on IS service evaluations has partly ignored the influence of emotions on how individuals evaluate IS services. Given the

shift in focus to a service oriented understanding of IS, this research sheds light on how emotions and rational components need to be combined to provide an overall evaluation of an IS service. This research also provides IS researchers with a means to measure the emotions associated with an IS service and shows that rational evaluations can drive emotional responses which, in turn, can have behavioral implications. This research suggests that, when investigating IS success models (e.g., DeLone & McLean 1992, 2002, 2003), or adoption models (e.g., Davis et al., 1989; Venkatesh et al., 2003), in addition to purely rational evaluations such as usefulness, systems quality, information quality, or service quality, research needs to examine the emotional implications of the IS artifact. This supports the findings of Beadury and Pinsoneault (2010) who used emotions as a predictor variable for intentions to use an IS artifact. The treatment of emotions and the measurement instruments used by prior research to quantify emotions were not comprehensive and theory based enough to permit a thorough investigation of the emotional component or allow for easy interpretation across studies. This research proposes a theory based emotion measurement tool and links it to specific emotion categories that can be used to investigate distinct IS phenomena. This research also proposes a categorization of emotions, based on important characteristics exhibited by the different types of emotions that can be very useful for IS researchers interested in the emotional phenomenon.

Furthermore, the second objective of this research was to propose a set of service characteristics that influence the emotional and rational components of service evaluations. This research shows that the specificity of the service output has a significant impacts on both the emotional and rational evaluations of the IS service. This research

also found that as the complexity of the service task increases, emotions will play a

greater role in the formation of IS service evaluations. This can provide IS researchers

with a starting point for developing a categorization of services that can be used to

understand how different types of IS services will be evaluated differently by their users.

Proximity between service provider and service recipient was found not to have a

significant impact on the emotions associated with the IS service, which may be mean

that collocation of testers and developers is not necessarily important, at least from an IS

service evaluation point of view.

Implications to Practice. The findings of this research can be important to

practice by providing managers with a better understanding about how their users

evaluate IS services. Since emotions have been largely ignored in prior IS services

research, this study can shed some light on explanations that are above and beyond the

traditional understanding of IS service evaluations. Depending on the characteristics of

the service that an organization provides to its employees or customers, IS managers and

service providers may want to be more cognizant of the effect that emotional cues and

responses have in their service provisioning. It is critical for them to understand and

appreciate the emotions engendered by their choices for service provision.

The results of this research can also be used in employee appraisal processes. As shown,

when a service provider engenders positive emotions in the individuals that he or she

serves, the service recipients are more likely to praise them. Such astute emotional skills

should be rewarded accordingly by organizations since they engender an improved

environment and work atmosphere. Similarly, when service recipient wish to discontinue

the use of a certain service provider, the cause may not necessarily be related to poor task

performance, but poor responses and design. Therefore managers of service providers may want to implement training programs that sensitize their service providers to the emotional aspects of service encounter.

This research may also be especially important to service recovery management practices since it suggests that managers of IS services organizations should focus both on mitigating negative emotions associated with service failures, and on engendering positive emotions related to the service recovery encounter.

Finally, designers of IS services should be cognizant of any potential emotional implications of their service offerings, and should build services in such a way as to blend both rational and emotional elements to increase the satisfaction with their service.

Summary of the Chapter

This chapter discussed the results of the data analysis performed in Chapter 5, and provided a host of implications to theory and practice. The chapter examines how IS service recipients use both emotional and rational components to evaluate the IS service that they receive, and shows that this evaluation will have behavioral implications related to the continued use of the service and word-of-mouth behaviors related to the service encounter. Of the three proposed service characteristics that were posited to have an impact on the emotional and rational components of IS service evaluations, only two had a significant impact – the complexity of the task and the specificity of the service output.

Chapter 7

Conclusions, Limitations and Directions for Future Research

Introduction

This research has examined how individuals evaluate IS services and has shown that IS service evaluations have two main components – a rational evaluative component and an emotional evaluative component. These two components are influenced in different proportions by the specificity of the IS service output and by the complexity of the service task and, in turn, have an impact on continuance behaviors regarding the IS service and advocacy behaviors related to the service provider. This chapter discusses the strengths and limitations of this study and proposes a set of future research directions that build on the findings of this study. The chapter concludes with a few final thoughts regarding IS service evaluations and the use of emotions to measure them.

Limitations of the Study

As with any quasi experimental study, the experimental design was created for the purpose of controlling for as many extraneous variables as possible. Controlling for intervening variables helps better understand the phenomenon of interest and also ensures that the manipulated variables are the actual causes of changes in the model. At the same time, the controls and contrived scenario reduces the generalizability of the research findings to other settings. Some of the design decisions that were made, such as the task being a package shipping related task, and the focus on software development and testing, make the results less generalizable to other IS service categories.

Another limitation also pertains to controls that were not present in the study. One such control was the location in which the participants engaged with the experimental materials. Since the researcher had no control over the setting where the experiment was conducted (the participants could access the online materials at any time and place), extraneous influences such as disruption of attention or other distractions may have contaminated some of the responses. It is hoped that the random assignment of participants to treatment cells as well as the common administration instruction for the experiment may have mitigated this potential limitation.

One of the main foci of this research was that of understanding emotional evaluations arising from an IS service encounter. Emotions can be influenced by many factors that are not directly related to the service event. One such influence may be also of an emotional nature – the present mood of the respondent. Mood was discussed in Chapter 2, and was described as a diffuse emotional state with no particular focus, but it can have a contaminating influence on other categories of emotions. This research did not directly control for mood and future research may want to examine its influences on IS service evaluations.

One of the strengths of this research is the broad distribution of its participants. Since a micro-sourcing website was used, the participants in the experiment were not members of only one organization. Thus a good representation of the general software-developer population was captured. At the same time, the researcher had less control over the participants. Administrative materials specifically prohibited individuals with no software development experience from participating, but some respondents may have gamed the system given the monetary incentive involved. Future research may want to

investigate a similar model in a more controlled, intra-organization environment to better understand if organizational culture or other intra-organization variables have an impact on IS service evaluations.

Another limitation pertained to the contrived high-low dichotomy of the treatments. While this allowed for better control of the treatments and their impact on evaluation components, in a real setting, there may be many more levels of the treatments. This simplification of the experimental materials may make the results of this research harder to generalize to real settings, despite the careful manipulation checks that were undertaken.

Finally, the one-time, cross-section nature of this study may have influenced some of the results. In a real setting, a software developer has repeated interactions with the software tester. This is especially important in regard to the relationship that may exist between them, as well as with trust-building and other social considerations. These influences cannot be easily captured in a one-time, cross-sectional study. Future research may want to examine longitudinally how these time sensitive interactions are built and evolve over time and how they influence the evaluation of IS services.

Directions for Future Research

This research finds that IS service evaluations comprise two major components – a rational component and an emotional component. Furthermore, this study proposes three theory driven antecedents to the two evaluational components. This is a first step in an effort to better understand the evaluation of IS issues from a service perspective. Future research should examine other potential influencing factors of IS evaluations.

Similarly, this research examined one category of emotions – modal emotions – as being well suited to investigating service encounters. Future research should also look into other emotional categories, such as mood or affect and their impact on IS evaluations. Indeed, in related research, such as technology adoption or use, emotions need to be examined in a more systematic way that takes into account theory based approaches to emotional measures and categories. Such a structured approach would allow for better interpretation of results between studies and would build a better understanding of the place of emotions in IS issues.

Another fruitful area of future research is related to a categorization of IS services. Such a taxonomy is not currently available in the IS literature. A characteristic driven taxonomy that clearly describes different categories of services and what differentiates them would be very helpful for both literature and practice. Understanding what differentiates IS services and how those differences impact the way individuals evaluate them would be very important in customizing a service offering to the needs of internal or external clients.

The influence of organizational culture on IS service evaluations is another potentially important influencing factor (Homburg et al., 2007) that should be investigated by future researchers. Different cultural environments may foster very distinct ways of evaluating an IS service offering.

This research found that the proximity between service provider and service recipient does not have any significant influence on the emotional evaluative component. This result should be further investigated by future research to understand if it holds for other service categories too. Prior research (Hornick, 1992; Price et al., 1995) finds that

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proximity is important in service evaluations. Research should investigate the differences between diverse services that change the level of importance of proximity in their evaluation.

When looking at the mediating influence of emotions between rational evaluations and behavioral intentions (Lazarus, 1991; Lowenstein, 2001), this research finds only partial support. Future research should investigate additional rational evaluation components that may have a stronger influence on the emotional evaluation component. Indeed, future research can provide a customized rational evaluation component similar to the emotional component that should capture the salient aspects of rational evaluations of IS services.

Future research may also want to investigate competing emotional theories that posit emotions to be antecedents of rational evaluations and behavioral intentions (see for example the Cannon-Bard theory of emotions, Cannon, 1927).

Another interesting avenue for future research is the investigation of personality types, especially in the treatment of emotional evaluations. This research has controlled for age and gender differences and found no statistical significant difference between males and females or age groups on the constructs of interest, but it has not implemented a distinct control for personality type, which can potentially be an influencing factor in service evaluations.

Finally, this study is a cross-sectional, one time study. A longitudinal study which would investigate the evolution of evaluations over time would provide additional information about the formation of evaluations and, given enough time, the formation of attitudes and beliefs about a service and/or a service provider. Emotions play a crucial

role in the building and evolution of attitudes and beliefs, and thus make a very good starting point for investigating these long term phenomena.

Conclusions

This research represents a starting point for researchers of IS service evaluations who want to have a more complete understanding of the evaluation process by combining rational evaluation with emotional evaluation. Emotions are important predictors of behaviors (Lazarus, 1991; Lowenstein, 2001) but have been largely ignored in IS research. This may be due to a lack of a comprehensive, standard treatment of the different types of emotions that can influence IS phenomena. This research describes such a categorization of emotions and provides researchers with a measurement tool that can address one type of emotions which is most applicable to IS service encounters.

Furthermore, this research discusses a set of theory driven service characteristics that are posited to influence the IS service evaluation process. Two of these characteristics are shown to have a significant impact on IS service evaluations, and can be used as starting points for the creation of a IS service taxonomy.

It is the hope of this researcher that emotions will soon receive the attention they deserve in IS research, given the important impact they have on all aspects of individual behaviors.

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APPENDIXES

Appendix A - Emotions in IS Research

Authors/Journal/Date	Research Context	Focus on Affect	Measurement of Affect	Type of Affect	Dependent and Independent variables
1. Ortiz de Guinea and Markus (2009) MISQ	IT Continuance – based on habit (automatic behavior)	Affect as direct influence on continuance	Conceptual	Direct (emotions), distinct from cognition, no indirect	Habit, emotion, on continuance
2. Liang and Xue (2009) MISQ	Technology threat avoidance (malicious IT)	Affect as emotion focused coping (when problem coping does not work)	Conceptual (simulation)	Emotional direct, distinct from cognitive, no indirect	Perceived susceptibility, severity, on threat Perceived effectiveness, costs, SE on avoidability Threat and avoidability on coping (avoidance and emotional)
3. Rutner and Hardgrave (2008), MISQ	Interaction between IT professional and other professionals within organizations	Emotional display norms and emotional dissonance for IT professionals	Schaubroeck and Jones scale (2000) to measure positive and negative emotional dissonance (available)	Direct, emotion	Emotional dissonance on job satisfaction, work exhaustion and turnover
4. Paul, McDaniel and Reuben (2004)	Interpersonal trust and virtual collaborative performance in	Affect as empathy in interactions	Empathy scale	Empathy	Self interest, ability, empathy, integration on virtual collaborative relationship performance

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MISQ	telemedicine				
5. Venkatesh 2000, ISR	TAM and PEU	The model proposes control (internal and external-conceptualized as computer sell-efficacy and facilitating conditions, respectively), intrinsic motivation. (conceptualized as computer playfulness), and emotion (conceptualized as computer anxiety) as anchors that determine early perceptions about the ease of use of a new system.	Survey	Emotion as computer anxiety	TAM constructs, CSE, facilitating conditions, computer playfulness, and anxiety on BI
6. Sarker, Valacic and Sarker 2005	Group TAM	Positive or negative orientation of a group as a whole toward a technology being considered by the group for adoption.	Conceptual, but scales available	Group mood and emotion together	individual members' a priori attitudes toward the technology, the majority subgroup's opinion, high-status members' opinions, substantive conflict, and relevant characteristics of the technology on adoption decision
7. Coppola, Hiltz and Rotter 2002 JMIS	Role changes for virtual professors	Affect as frustration or fulfillment	interviews	Mood and emotion	N/A

8. Kelly and Bostrom 1998 JMIS	Socioemotional dimension in group support systems (GSS) meeting environments from the perspective of the facilitator	Affect as socioemotional result	on critical incident technique and semi structured interviews	Emotion	Use of GSS on socioemotional issues
9. Reining et al 1996, JMIS	Adoption of GSS	Affect as reward	Survey	Emotion	Affective reward on GSS adoption
11. Kern and Wilcocks 2002, EJIS	Relationships in IT outsourcing	Affect as feelings that exists between two parties to a relationship	Qualitative, interview	feelings	Descriptive. Affective relationship to outsourcing relationship
12. Pullman and Gross 2004 DS	Loyalty behaviors elicited by service elements. No IT artifact. VIP hospitality tent	Affect as emotional connections	Initial qualitative, then survey and field experiment. Survey tool of basic emotions (happy, satisfied, amused, etc)and VIP emotions (curious, privileged, cool)	Basic emotion and VIP emotion (direct and mood mixed)	Basic emotion and VIP emotion on loyalty
13. Spreng and Page 2003, DS	Disconfirmation calculation methodologies. Methodological article comparing methods	Affect as desires and satisfaction	Field experiment, survey of students	Affect as desires and satisfaction. No direct or indirect	Expectation and desires on perceived performance on disconfirmation on satisfaction

14. Snead et al. 1994, DS	DSS use explained by expectancy theory.	Valence as attractiveness (equation based) part of the force model which leads to behavior	Experiment with 32 cases of DSSs	Affect as attractiveness	Second level affect outcome (instrumentality) on first level valance outcomes (expectancy) on effort (behavior)
15. Feng-ypung et al.2009, DSS	Framing effect in decision support systems (presentation)	Emotion from stimuli (framing of problem)	Lab-experiment – tracking eye movement to measure cognitive effort. Conditions of both negative and positive framing	Direct affect – emotion from stimuli	Framing effect on affect on cognitive effort
16. Norman et al. 2009a, DSS	Hostile communication (flaming) in negotiations	Affect as negative emotions elicited by the content of a communication	Lab experiment	Direct affect – negative emotion	Anger, problem with communication channel, unfairness of partner on flaming
17. Djamsabi 2007, DSS	Effective usage of a DSS	Affect as positive mood	Lab experiment	Indirect affect – positive mood	Positive mood on informational cues and decision accuracy
19. Norman et al 2009b, DSS	The use of IM and phones during negotiations	Affect as communicated stimuli	Lab experiment	Direct affect – as information	Media type on amount of affect communicated (decreased by use of computers) on likelihood of agreement (decreased)
20. Hwang and Kim, 2007, DSS	Value of DSS exemplified by reducing decision cost and errors.	Negative affect avoidance (regret)	Lab experiment	Direct affect Regret is a post-decision feeling regarding not having chosen a	Use of DSS on regret reduction

		better alternative			
21. Djamsabi and Loiacono 2008, DSS	Gender effects on use of computer-based feedback	Affect as mood elicited by negative framing	Lab experiment using a DSS and negatively framed feedback	Indirect affect – negative mood	Outcome feedback on decision accuracy of females vs males
23. Kiesler et al, 1985, HCI	Computer mediate communications	Affect as information mediated by communication medium	Lab experiment	Direct affect – as information	computer-mediated communication on the evaluation of anxiety

Appendix B: Pilot Study 1 factor structure and measurement scale

Emotion Item	Type of Emotion	Loading	Measurement Scale
1: Enjoyment		.752	
2: Amusement		.671	
3: Pride		.841	
4: Joy	Positive Modal Emotions	.865	
5: Interest		.889	
6: Hope		.850	
7: Satisfaction		.825	
8: Relief		.726	Not Felt Strongly Felt
9: Sadness		.951	1 2 3 4 5 6 7
10: Worry		.870	
11: Embarrassment		.962	
12: Disappointment		.905	
13: Envy	Negative Modal Emotions	.875	
14: Repulsion		.975	
15: Contempt		.975	
16: Irritation		.921	

Appendix C: Survey Instrument

Please provide ratings about the defect report you just read. We will be using a 1 to 7 scale, with 1 signifying strong agreement with the statement, and 7 signifying strong disagreement. Please indicate your response by checking the appropriate number. Please answer all of the questions.

Complexity		
The coding task required for the decision matrix presented above is complicated	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
The coding task related to the decision matrix would require a lot of effort to complete	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
In your opinion, how complex is this task (coding required for decision matrix)?	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
Specificity		
The defect report provides me with enough information about the defect discovered	Very Simple 1 2 3 4 5 6 7	Very Complex
The defect report makes it easy for me to find the error	Very difficult 1 2 3 4 5 6 7	Not at all Difficult
The defect report makes it easy for me to fix the error	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
The defect report specifically identifies the error	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
The defect report has a high level of specificity in the information it provides	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
Proximity		
The tone used by the tester to communicate the results of the defect report is friendly	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
The defect report indicates that the relationship between the tester and myself is good	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
I felt a personal connection with the tester who created this defect report	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree

In the following section we would like to ask you what is your evaluation of the information provided by the defect report. You will be asked first to evaluate your EXPECTATION of quality for such a defect report, and second to evaluate the ACTUAL quality of the defect report you have just read. Please indicate your level of disagreement or agreement with the statements below by checking the appropriate button. Please answer all of the questions.

Information Quality		
The accuracy of information that I normally EXPECT for this type of defect report is very high	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A
The ACTUAL accuracy of information of this defect report is very high	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A
The availability of information that I normally EXPECT for this type of defect report is very high	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A

The ACTUAL availability of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The reliability of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL reliability of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The updatedness of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL updatedness of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The relevance of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL relevance of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The timeliness of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL timeliness of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The completeness of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL completeness of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The quality of the presentation of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL quality of the presentation of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The accessibility of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The breadth of information (the task related range/variety of information) that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The accessibility of information that I normally EXPECT for this type of defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A
The ACTUAL breadth of information (the task related range/variety of information) of information of this defect report is very high	Strongly Agree	Strongly 1 2 3 4 5 6 7 Disagree	N/A

Next, we need you to provide ratings about the following statements that relate to your satisfaction with the defect report provided. Please indicate your level of disagreement or

agreement with the statements below by checking the appropriate button. Please answer all of the questions.

Usefulness		
I am very content with the defect report provided by the tester	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A
The defect report meets my needs for this task	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A
This defect report is a useful service to me as the developer	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A
This defect report helps me do my job as a software developer	Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree	N/A

For each of the following 20 items please indicate how you felt when reviewing the defect report. For each expression, we need you to rate the intensities of what you felt. We will be using a 1 to 7 scale, with 1 signifying no feeling experienced and 7 signifying a strong feeling experienced. Please indicate your response by checking the appropriate number. Please answer all of the questions.

1: Enjoyment	Not Felt 1 2 3 4 5 6 7 Strongly Felt
2: Amusement	Not Felt 1 2 3 4 5 6 7 Strongly Felt
3: Pride	Not Felt 1 2 3 4 5 6 7 Strongly Felt
4: Joy	Not Felt 1 2 3 4 5 6 7 Strongly Felt
5: Interest	Not Felt 1 2 3 4 5 6 7 Strongly Felt
6: Hope	Not Felt 1 2 3 4 5 6 7 Strongly Felt
7: Satisfaction	Not Felt 1 2 3 4 5 6 7 Strongly Felt
8: Relief	Not Felt 1 2 3 4 5 6 7 Strongly Felt
9: Surprise	Not Felt 1 2 3 4 5 6 7 Strongly Felt
10: Preoccupied	Not Felt 1 2 3 4 5 6 7 Strongly Felt
11: Sympathy	Not Felt 1 2 3 4 5 6 7 Strongly Felt
12: Sadness	Not Felt 1 2 3 4 5 6 7 Strongly Felt
13: Worry	Not Felt 1 2 3 4 5 6 7 Strongly Felt
14: Embarrassment	Not Felt 1 2 3 4 5 6 7 Strongly Felt

15: Remorse	Not Felt	Strongly Felt
		1 2 3 4 5 6 7
16: Disappointment	Not Felt	Strongly Felt
		1 2 3 4 5 6 7
17: Resentment	Not Felt	Strongly Felt
		1 2 3 4 5 6 7
18: Repulsion	Not Felt	Strongly Felt
		1 2 3 4 5 6 7
19: Disapproval	Not Felt	Strongly Felt
		1 2 3 4 5 6 7
20: Irritation	Not Felt	Strongly Felt
		1 2 3 4 5 6 7

Please tell us next about some potential follow-up actions you may take given the scenario and the defect report presented above. Please indicate your level of disagreement or agreement with the statements below by checking the appropriate button. Please answer all of the questions.

Continuance		
If the need arises and I had a choice, I intend to use the testing services (defect detection and reporting) provided by this tester again.	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
If the need arises and I had a choice, I anticipate that I will use the testing services of this tester again	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
If the need arises and I had a choice, I plan to use the testing services provided by this tester again	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree

Word of Mouth		
Given the above defect report, I will probably praise the tester who wrote it to my colleagues	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
I am likely to say good things about the tester who wrote this defect report	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
After reviewing this defect report, I will likely engage in positive word of mouth about the tester who wrote it	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree

We now need you to tell us a little bit about your background. Please note that the answers will be kept completely confidential. There is no way for us or other parties to trace the responses back to you or your organization.

In my day to day job, I frequently deal with defect reports provided by testers	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
I am very familiar with defect reports similar to the one presented by this scenario	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree
In my organization, most of the testers are located in close vicinity to where I work	Strongly Agree 1 2 3 4 5 6 7	Strongly Disagree

Please indicate the length of your tenure with the company
Less than 1 year
1 to 4 years
4 to 8 years
Over 8 years

Please indicate the level of your software development experience *This question is required

   Entry—Limited Experience with the Topic
   Intermediate—Some Experience with the Topic
   Senior—Significant Experience with the Topic
   Executive—Strategic Approach to the Topic

Please indicate the level of your testing experience *This question is required

   Entry—Limited Experience with the Topic
   Intermediate—Some Experience with the Topic
   Senior—Significant Experience with the Topic
   Executive—Strategic Approach to the Topic

Please indicate the highest level of education you have achieved *This question is required

   Graduated high school or equivalent
   Some college, no degree
   Associate degree
   Bachelor's degree
   Post-graduate degree

Please indicate your gender:
Male
Female

Please indicate your age:
Below 20 years of age
20-25
26-31
31-40
41-50
Over 50 years of age

Please indicate the size of your organization in number of employees *This question is required

1-99
100-499
500-999
1000-4999
4999-10,000
10,000-49,999
49,999-100,000
100,000+

Thank you very much for your help with this research. Your responses are very important to us.

Appendix D – Experimental Materials

Administrative instructions for participants – common across all treatment cells:

Dear Participant,

The University of Memphis and the Systems Testing Excellence Program at the FedEx Institute of Technology are researching ways to improve the quality of testing services. The focus of this research is to identify important characteristics of testing services that can be used to improve the quality of the service you receive from the testing department. To accomplish this, we need you to review a typical defect report, and respond to a set of questions pertaining to your satisfaction and perceptions about the testing service depicted by the defect report.

Your participation is entirely voluntary. Your identity and answers will be kept strictly anonymous and confidential. Your responses will only be used for research purposes to improve the quality of testing services.

 Your participation will involve:

1.   Reading a scenario regarding code you wrote that has been tested by a tester,
2.   Reading a defect report prepared for you by the abovementioned tester,
3.   Evaluating the defect report in terms of its value to you.
The completion of this task will not take more than 15-20 minutes of your time. Please make sure that you have sufficient uninterrupted time to finish this task in one sitting.

We ask that you turn off your cell phones or other devices whose operation may interrupt the task to be completed.

If you have any questions or concerns, please email us at cgonita@memphis.edu.

To start the task, please click the link below:

<Please click here to go forward>

Thank you for agreeing to participate in this survey.

Sincerely,

Colin Onita
University of Memphis

Scenario and decision matrix for low complexity treatment cells:

Imagine that you are a member of a development team working for a large organization which develops its own application software. Your team has been tasked with developing and maintaining the shipping system used by your organization to accept, track and deliver packages. Your team is tasked to code a component of this system which establishes the required shipping fee based on a set of rules presented in the decision table below. For the purpose of this exercise, the process of software development which you are part of entails only three steps. First, you code the software described by the decision rules depicted in the decision matrix below. Second, the code is sent to a tester who tests it for correctness and reports any errors back to you through a defect report similar to the one provided below. Third, you use the defect report provided to fix any error found in the code. Upon competition of this final step, the defect is closed and the code/module is incorporated in the finished product.

Your role, in this scenario, pertains only to the module depicted in the decision matrix below. All other associated modules have already been coded and tested separately. In addition to this, the development, testing and live environments, where the code is to be run, are all identical. The requirements and decision table below have already been tested and approved by the users/clients from business functions.

The decision matrix below is composed of a set of conditions with associated actions. For each condition, a certain action should take place. The link between condition and action is represented by a set of rules shown on the right side of the decision matrix. A "Y" in the Rules section of a condition row symbolizes that the respective condition is true for that Rule column. A "N" in the Rules section of a condition row symbolizes that the condition is false for that Rule column. When a condition is true, a certain action should take place. This is symbolized by an "X" in the "Action Stub" row which is associated with a particular true ("Y") condition. For example, if a package is sent to zip code 10001 then it will be included in the condition that has a Y in the first column. That condition has an associated action (an X in the action rows) which stipulates that the shipping for that type of package is $5/pound. Therefore the associated software code will calculate the shipping for that letter by multiplying the weight of the package with $5/pound. Please take a moment to review and understand the decision matrix presented below.

	Conditions/Courses of Action	Rules	
Condition Stubs	US territories for zip codes 00501 to 49999	Y	N
	US territories for zip codes 50000 to 99950	N	Y
Action Stubs	Shipping $5/pound	X	
	Shipping $5.5/pound		X

Imagine that you have already written the code for this part of the application and you have sent it for testing some days ago. Now you receive a defect report from the testing group. This defect report is depicted below and was prepared by the tester for your

follow-up. Please read the defect report and evaluate it for its quality and usefulness. Once you have carefully read the defect report, please answer a few questions regarding the defect report.

Scenario and decision matrix for high complexity treatment cells:

Imagine that you are a member of a development team working for a large organization which develops its own application software. Your team has been tasked with developing and maintaining the shipping system used by your organization to accept, track and deliver packages. Your team is tasked to code a component of this system which establishes the required shipping fee based on a set of rules presented in the decision table below. For the purpose of this exercise, the process of software development which you are part of entails only three steps. First, you code the software described by the decision rules depicted in the decision matrix below. Second, the code is sent to a tester who tests it for correctness and reports any errors back to you through a defect report similar to the one provided below. Third, you use the defect report provided to fix any error found in the code. Upon competition of this final step, the defect is closed and the code/module is incorporated in the finished product.

Your role, in this scenario, pertains only to the module depicted in the decision matrix below. All other associated modules have already been coded and tested separately. In addition to this, the development, testing and live environments, where the code is to be run, are all identical. The requirements and decision table below have already been tested and approved by the users/clients from business functions.

The decision matrix below is composed of a set of conditions with associated actions. For each condition, a certain action should take place. The link between condition and action is represented by a set of rules shown on the right side of the decision matrix. A "Y" in the Rules section of a condition row symbolizes that the respective condition is true for that Rule column. A "N" in the Rules section of a condition row symbolizes that the condition is false for that Rule column. When a condition is true, a certain action should take place. This is symbolized by an "X" in the "Action Stub" row which is associated with a particular true ("Y") condition. For example, if a package is a letter below 0.1 pounds, then it will be included in the condition that has a Y in the first column. That condition has an associated action (an X in the action rows) which stipulates that the shipping for that type of package is $.2.5/pound. Therefore the associated software code will calculate the shipping for that letter by multiplying the weight of the letter with $2.5/pound. Please take a moment to review and understand the decision matrix presented below.

Conditions/Courses of Action		Rules															
	Package is letter below 0.1 pounds	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Package bundling discount	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
	Package between 0.1 pounds and 1 pound	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
	Package between 1 pound and 10 pounds	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
	Package over 10 pounds	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
	Package has special contents	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N
Condition	Package is a rush order	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
	Package has discount rate	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
stubs	Additional handling surcharge	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
	Delivery area surcharge	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
	Extended service area delivery	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
	Extended service area pickup	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N
	Oversize charge	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N
	Residential delivery charge	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
	Residential pickup charge	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
	Shipping $2.5/pound	X														
	Discount 5% for each additional package		X		X											
Action	Shipping $7.5/pound					X										
	Shipping discount 30%								X							
Stubs	Straight shipping fee $5			X												
	Shipping fee $10/pound						X	X								
	Original shipping fee + $5									X	X				X	X
	Original shipping fee + $7											X	X	X		

Imagine that you have already written the code for this part of the application and you have sent it for testing some days ago. Now you receive a defect report from the testing group. This defect report is depicted below and was prepared by the tester for your follow-up. Please read the defect report and evaluate it for its quality and usefulness. Once you have carefully read the defect report, please answer a few questions regarding the defect report.

Defect Report for treatment cell 11:

Defect Report   Ref:LCLSLP11

Heading:

Cannot calculate shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked an error is displayed informing the user that the data for shipping_charges could not be found.

Attachments:

N/A

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at <u>testing@organization.com</u> and reference defect report no.LCLSLP11. Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Defect Report   Ref:
LCHSLP12

Heading:

Missing shipping fee for zip codes within 00501 and 49999 for calculating shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a - shipping_charge

Version 1.0 from date: Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application, module 1a, ver. 1.0

Enter information about destination of package: A random sampling of 12 ZIP codes has been entered as follows: 00501, 12345, 34267, 45670, 99234, 67903,78456, 45689, 38115, 49999, 50000, 99950

Enter information about package: Weight of package was set at 5 pounds for each test.

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

If ZIP codes within 00501 and 49999 are entered, the application returns error 105 "Missing data for field – shcharge" (please see attached screen shot of error message displayed). For ZIP codes between

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50000 and 99950, the system returns the correct value of the shipping charge.

The information for the shcharge field is defined in lines 34-46 of the shipping_charge module.

Attachments:

Error105ShippingChargeCalculator.jpg

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at testing@organization.com and reference defect report no.   LCHSLP12.
Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Defect report for treatment cell 13:

Defect Report

Ref:LCLSHP13

Heading:

Cannot calculate shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked an error is displayed informing the user that the data for shipping_charges could not be found.

Attachments:

N/A

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that some of the shipping charges are missing. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Defect Report

Ref:LCHSHP14

Heading:

Missing shipping fee for zip codes within 00501 and 49999 for calculating shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application, module 1a, ver. 1.0

Enter information about destination of package: A random sampling of 12 ZIP codes has been entered as follows: 00501, 12345, 34267, 45670, 99234, 67903,78456, 45689, 38115, 49999, 50000, 99950

Enter information about package: Weight of package was set at 5 pounds for each test.

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

If ZIP codes within 00501 and 49999 are entered, the application returns error 105 "Missing data for

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field – shcharge" (please see attached screen shot of error message displayed). For ZIP codes between 50000 and 99950, the system returns the correct value of the shipping charge.

The information for the shcharge field is defined in lines 34-46 of the shipping_charge module.

Attachments:

Error105ShippingChargeCalculator.jpg

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that some of the shipping charges are missing for Module 1a. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Defect Report

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked the result does not show the discount being applied to the entire sum including oversized charges, just to the standard shipping charge.

Attachments:

N/A

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at <u>testing@organization.com</u> and reference defect report no.   HCLSLP21 . Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Defect Report   Ref: HCLSHP22

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked the result does not show the discount being applied to the entire sum including oversized charges, just to the standard shipping charge.

Attachments:

N/A

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that there is a problem with calculating discounts on the entire shipping charge when oversized package charges are applied to the package. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call any time at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Defect Report   Ref:

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application - Module 1a, version 1.0

Enter information about destination of package: Different combinations of test data have been entered. The system returns the correct results for any category of destination (residential, extended area, etc)

Enter information about package: Different combinations of test data have been entered. The system returns the correct results for any weight category and surcharge type with the exception mentioned below, when discount and oversize charges are entered

Check the Discount box in order to apply a discount rate to the shipping charges

---

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

When both conditions of oversized package and application of discount to the package shipping charge are true, the discount is applied only to the standard shipping charge without taking into account the oversized package surcharge.

According to the business rules, the discount should be applied to the entire shipping fee of standard shipping fee plus oversized package charge.

This calculation error is probably a result of a logic error in the calculation of the discount when the package is oversized.

The code for the calculation of the overall shipping charge with discount being true is probably the source of the error (lines 345 – 375 of shipping_charge module).

Attachments:

ShippingChargeCalculator.jpg

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at <u>testing@organization.com</u> and reference defect report no.HCHSLP23. Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Defect Report
Ref:
HCHSHP24

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application - Module 1a, version 1.0

Enter information about destination of package: Different combinations of test data have been entered. The system returns the correct results for any category of destination (residential, extended area, etc)

Enter information about package: Different combinations of test data have been entered. The system returns the correct results for any weight category and surcharge type with the exception mentioned below, when discount and oversize charges are entered

Check the Discount box in order to apply a discount rate to the shipping charges

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Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

When both conditions of oversized package and application of discount to the package shipping charge are true, the discount is applied only to the standard shipping charge without taking into account the oversized package surcharge.

According to the business rules, the discount should be applied to the entire shipping fee of standard shipping fee plus oversized package charge.

This calculation error is probably a result of a logic error in the calculation of the discount when the package is oversized.

The code for the calculation of the overall shipping charge with discount being true is probably the source of the error (lines 345 – 375 of shipping_charge module).

Attachments:

ShippingChargeCalculator.jpg

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that there is a problem with calculating discounts on the entire shipping charge when oversized package charges are applied to the package in Module 1a. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call any time at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Appendix E – Experimental Website Screenshots

Dear Participant,

The University of Memphis and the Systems Testing Excellence Program at the FedEx Institute of Technology are researching ways to improve the quality of testing services. The focus of this research is to identify important characteristics of testing services that can be used to improve the quality of the service you receive from the testing department. To accomplish this, we need you to review a typical defect report, and respond to a set of questions pertaining to your satisfaction and perceptions about the testing service depicted by the defect report.

Your participation is entirely voluntary. Your identity and answers will be kept strictly anonymous and confidential. Your responses will only be used for research purposes to improve the quality of testing services.

Your participation will involve:

1. Reading a scenario regarding code you wrote that has been tested by a tester,
2. Reading a defect report prepared for you by the abovementioned tester,
3. Evaluating the defect report in terms of its value to you.

The completion of this task will not take more than 15-20 minutes of your time. Please make sure that you have sufficient uninterrupted time to finish this task in one sitting.

We ask that you turn off your cell phones or other devices whose operation may interrupt the task to be completed.

If you have any questions or concerns, please email us at cgonita@memphis.edu.

To start the task, please click the link below:

<Please click here to go forward>

Thank you for agreeing to participate in this survey.

Sincerely,

Colin Onita
University of Memphis

Imagine that you are a member of a development team working for a large organization which develops its own application software. Your team has been tasked with developing and maintaining the shipping system used by your organization to accept, track and deliver packages. Your team is tasked to code a component of this system which establishes the required shipping fee based on a set of rules presented in the decision table below. For the purpose of this exercise, the process of software development which you are part of entails only three steps. First, you code the software described by the decision rules depicted in the decision matrix below. Second, the code is sent to a tester who tests it for correctness and reports any errors back to you through a defect report similar to the one provided below. Third, you use the defect report provided to fix any error found in the code. Upon competition of this final step, the defect is closed and the code/module is incorporated in the finished product.

Your role, in this scenario, pertains only to the module depicted in the decision matrix below. All other associated modules have already been coded and tested separately. In addition to this, the development, testing and live environments, where the code is to be run, are all identical. The requirements and decision table below have already been tested and approved by the users/clients from business functions.

The decision matrix below is composed of a set of conditions with associated actions. For each condition, a certain action should take place. The link between condition and action is represented by a set of rules shown on the right side of the decision matrix. A "Y" in the Rules section of a condition row symbolizes that the respective condition is true for that Rule column. A "N" in the Rules section of a condition row symbolizes that the condition is false for that Rule column. When a condition is true, a certain action should take place. This is symbolized by an "X" in the "Action Stub" row which is associated with a particular true ("Y") condition. For example, if a package is sent to zip code 10001 then it will be included in the condition that has a Y in the first column. That condition has an associated action (an X in the action rows) which stipulates that the shipping for that type of package is $5/pound. Therefore the associated software code will calculate the shipping for that letter by multiplying the weight of the package with $5/pound. Please take a moment to review and understand the decision matrix presented below.

	Conditions/Courses of Action	Rules	
Condition Stubs	US territories for zip codes 00501 to 49999	Y	N
	US territories for zip codes 50000 to 99950	N	Y
Action Stubs	Shipping $5/pound	X	
	Shipping $5.5/pound		X

Imagine that you have already written the code for this part of the application and you have sent it for testing some days ago. Now you receive a defect report from the testing group. This defect report is depicted below and was prepared by the tester for your follow-up. Please read the defect report and evaluate it for its quality and usefulness. Once you have carefully read the defect report, please answer a few questions regarding the defect report.

Imagine that you are a member of a development team working for a large organization which develops its own application software. Your team has been tasked with developing and maintaining the shipping system used by your organization to accept, track and deliver packages. Your team is tasked to code a component of this system which establishes the required shipping fee based on a set of rules presented in the decision table below. For the purpose of this exercise, the process of software development which you are part of entails only three steps. First, you code the software described by the decision rules depicted in the decision matrix below. Second, the code is sent to a tester who tests it for correctness and reports any errors back to you through a defect report similar to the one provided below. Third, you use the defect report provided to fix any error found in the code. Upon competition of this final step, the defect is closed and the code/module is incorporated in the finished product.

Your role, in this scenario, pertains only to the module depicted in the decision matrix below. All other associated modules have already been coded and tested separately. In addition to this, the development, testing and live environments, where the code is to be run, are all identical. The requirements and decision table below have already been tested and approved by the users/clients from business functions.

The decision matrix below is composed of a set of conditions with associated actions. For each condition, a certain action should take place. The link between condition and action is represented by a set of rules shown on the right side of the decision matrix. A "Y" in the Rules section of a condition row symbolizes that the respective condition is true for that Rule column. A "N" in the Rules section of a condition row symbolizes that the condition is false for that Rule column. When a condition is true, a certain action should take place. This is symbolized by an "X" in the "Action Stub" row which is associated with a particular true ("Y") condition. For example, if a package is a letter below 0.1 pounds, then it will be included in the condition that has a Y in the first column. That condition has an associated action (an X in the action rows) which stipulates that the shipping for that type of package is $.2.5/pound. Therefore the associated software code will calculate the shipping for that letter by multiplying the weight of the letter with $2.5/pound. Please take a moment to review and understand the decision matrix presented below.

	Conditions/Courses of Action	Rules														
Condition stubs	Package is letter below 0.1 pounds	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Package bundling discount	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
	Package between 0.1 pounds and 1 pound	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N
	Package between 1 pound and 10 pounds	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
	Package over 10 pounds	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N
	Package has special contents	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N
	Package is a rush order	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N
	Package has discount rate	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N
	Additional handling surcharge	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
	Delivery area surcharge	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N
	Extended service area delivery	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
	Extended service area pickup	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N
	Oversize charge	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N
	Residential delivery charge	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
	Residential pickup charge	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Action Stubs	Shipping $2.5/pound	X														
	Discount 5% for each additional package		X		X											
	Shipping $7.5/pound					X										
	Shipping discount 30%								X							
	Straight shipping fee $5			X												
	Shipping fee $10/pound						X	X								
	Original shipping fee + $5										X	X			X	X
	Original shipping fee + $7												X	X	X	

Imagine that you have already written the code for this part of the application and you have sent it for testing some days ago. Now you receive a defect report from the testing group. This defect report is depicted below and was prepared by the tester for your follow-up. Please read the defect report and evaluate it for its quality and usefulness. Once you have carefully read the defect report, please answer a few questions regarding the defect report.

Heading:

Cannot calculate shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked an error is displayed informing the user that the data for shipping_charges could not be found.

Attachments:

N/A

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at testing@organization.com and reference defect report no.LCLSLP11. Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

<Please click here to go forward>

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked the result does not show the discount being applied to the entire sum including oversized charges, just to the standard shipping charge.

Attachments:

N/A

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that there is a problem with calculating discounts on the entire shipping charge when oversized package charges are applied to the package. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call any time at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

Heading:

Missing shipping fee for zip codes within 00501 and 49999 for calculating shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a - shipping_charge

Version 1.0 from date: Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application, module 1a, ver. 1.0

Enter information about destination of package: A random sampling of 12 ZIP codes has been entered as follows: 00501, 12345, 34267, 45670, 99234, 67903,78456, 45689, 38115, 49999, 50000, 99950

Enter information about package: Weight of package was set at 5 pounds for each test.

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

If ZIP codes within 00501 and 49999 are entered, the application returns error 105 "Missing data for field – shcharge" (please see attached screen shot of error message displayed). For ZIP codes between 50000 and 99950, the system returns the correct value of the shipping charge.

The information for the shcharge field is defined in lines 34-46 of the shipping_charge module.

Attachments:

Error105ShippingChargeCalculator.jpg

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at testing@organization.com and reference defect report no.LCHSLP12. Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

<Please click here to go forward>

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application - Module 1a, version 1.0

Enter information about destination of package: Different combinations of test data have been entered. The system returns the correct results for any category of destination (residential, extended area, etc)

Enter information about package: Different combinations of test data have been entered. The system returns the correct results for any weight category and surcharge type with the exception mentioned below, when discount and oversize charges are entered

Check the Discount box in order to apply a discount rate to the shipping charges

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

When both conditions of oversized package and application of discount to the package shipping charge are true, the discount is applied only to the standard shipping charge without taking into account the oversized package surcharge.

According to the business rules, the discount should be applied to the entire shipping fee of standard shipping fee plus oversized package charge.

This calculation error is probably a result of a logic error in the calculation of the discount when the package is oversized.

The code for the calculation of the overall shipping charge with discount being true is probably the source of the error (lines 345 – 375 of shipping_charge module).

Attachments:

ShippingChargeCalculator.jpg

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that there is a problem with calculating discounts on the entire shipping charge when oversized package charges are applied to the package in Module 1a. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call any time at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

<Please click here to go forward>

Heading:

Missing shipping fee for zip codes within 00501 and 49999 for calculating shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application, module 1a, ver. 1.0

Enter information about destination of package: A random sampling of 12 ZIP codes has been entered as follows: 00501, 12345, 34267, 45670, 99234, 67903, 78456, 45689, 38115, 49999, 50000, 99950

Enter information about package: Weight of package was set at 5 pounds for each test.

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

If ZIP codes within 00501 and 49999 are entered, the application returns error 105 "Missing data for field – shcharge" (please see attached screen shot of error message displayed). For ZIP codes between 50000 and 99950, the system returns the correct value of the shipping charge.

The information for the shcharge field is defined in lines 34-46 of the shipping_charge module.

Attachments:

Error105ShippingChargeCalculator.jpg

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that some of the shipping charges are missing for Module 1a. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

Heading:

Cannot calculate shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked an error is displayed informing the user that the data for shipping_charges could not be found.

Attachments:

N/A

Comments:

Hey Mark, good to work with you and your team again. Hope all is well with you. I was tasked with testing this module of the Bill of Lading application. It seems that some of the shipping charges are missing. The systems works overall, and I think you guys did a good job coding this system. This is a minor issue, which should be very easily fixed. Do give me a call at 6742 if you need any further information, or email me at Jane.Smith@organization.com. If you think that a face-to-face meeting would expedite the resolution of this issue, please let me know. I could walk over to your building and we get this fixed. Best, Jane.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

<Please click here to go forward>

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

System: Shipping charges calculator

Module 1a

Version 1.0 from date Jan. 30 2011

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

Start bill of lading application - Module 1a, version 1.0

Enter information about destination of package: Different combinations of test data have been entered. The system returns the correct results for any category of destination (residential, extended area, etc)

Enter information about package: Different combinations of test data have been entered. The system returns the correct results for any weight category and surcharge type with the exception mentioned below, when discount and oversize charges are entered

Check the Discount box in order to apply a discount rate to the shipping charges

Proceed to calculating shipping expenses by clicking the "Calculate Shipping Charge" button

When both conditions of oversized package and application of discount to the package shipping charge are true, the discount is applied only to the standard shipping charge without taking into account the oversized package surcharge.

According to the business rules, the discount should be applied to the entire shipping fee of standard shipping fee plus oversized package charge.

This calculation error is probably a result of a logic error in the calculation of the discount when the package is oversized.

The code for the calculation of the overall shipping charge with discount being true is probably the source of the error (lines 345 – 375 of shipping_charge module).

Attachments:

ShippingChargeCalculator.jpg

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at testing@organization.com and reference defect report no.HCHSLP23. Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

Heading:

Miscalculated shipping charges

Product:

Bill of lading manifesto calculation application

Component:

Shipping charges calculator

Defect type:

Functionality

Priority:

High

Severity:

Low

Environment:

Development, testing and live environments are identical.

Steps:

When the "calculate shipping charge" button is clicked the result does not show the discount being applied to the entire sum including oversized charges, just to the standard shipping charge.

Attachments:

N/A

Comments:

To the development department. The system has a few glitches, as described above. If you have any questions, please contact the testing department at testing@organization.com and reference defect report no.HCLSLP21 . Our time zone is 4 hours behind yours, please try to contact us during our local office hours.

Now that you have carefully read the defect report prepared for you by the tester, please go to the next page to answer a few questions about the value of this report to you as the developer of the shipping and billing software application.

A new window containing the survey will open. You can toggle between the pages and review the defect report and decision matrix at any time.

<Please click here to go forward>

Appendix F – Measurement Model Factor Structure

	Comp	Info	Neg	Pos	Prox	Spec	Use	WoM	Cont
com1	**0.9155**	0.1365	0.1535	0.3161	-0.0279	0.0733	0.0396	0.0813	0.068
com2	**0.9241**	0.0781	0.2065	0.3004	-0.074	0.1516	0.0718	0.0875	0.0227
com3	**0.9331**	0.1242	0.2176	0.3222	-0.0769	0.1146	-0.0226	0.0704	0.0606
cont1	0.0015	0.6046	-0.2334	0.1748	0.3579	0.5211	0.5556	0.6055	**0.8957**
cont2	0.0339	0.6211	-0.305	0.1578	0.353	0.6278	0.6914	0.6888	**0.8928**
cont3	0.1075	0.7118	-0.1788	0.263	0.3908	0.5633	0.6047	0.795	**0.9157**
info10a	0.1636	**0.811**	-0.0135	0.3636	0.3519	0.6373	0.6559	0.6616	0.6014
info3a	0.0715	**0.7812**	-0.1434	0.1962	0.3774	0.5417	0.5481	0.4998	0.5929
info4a	0.0385	**0.6659**	-0.1536	0.0839	0.2829	0.3378	0.4019	0.1754	0.3995
info5a	0.0256	**0.8519**	-0.0552	0.1545	0.3675	0.4853	0.5551	0.5111	0.5582
info6a	0.033	**0.5457**	-0.2136	-0.1233	0.319	0.278	0.2799	0.224	0.341
info7a	0.1375	**0.812**	-0.0756	0.2766	0.2233	0.6923	0.6978	0.611	0.6325
info8a	0.0421	**0.6572**	-0.2098	0.1227	0.3187	0.3945	0.4352	0.4942	0.5562
info9a	0.1571	**0.718**	-0.0448	0.1889	0.2835	0.3679	0.4476	0.4318	0.4259
neg1	0.3057	0.0335	**0.61**	0.5305	-0.0972	0.081	-0.0995	0.0799	-0.0821
neg10	0.1	-0.1638	**0.8075**	0.0329	-0.2296	-0.1424	-0.2368	-0.1698	-0.2605
neg2	0.1755	-0.0416	**0.7896**	0.4099	-0.0736	-0.0058	-0.1382	0.0264	-0.1416
neg3	0.1456	-0.0962	**0.7878**	0.2278	-0.2053	-0.118	-0.1315	-0.0524	-0.2274
neg4	0.0811	0.0394	**0.6224**	0.3367	0.008	0.1189	0.0205	0.2088	0.0474
neg5	0.107	-0.0907	**0.7198**	0.3018	-0.0593	-0.0316	-0.0641	0.0404	-0.1059
neg6	0.033	-0.1696	**0.7224**	0.0476	-0.0377	-0.1496	-0.1549	-0.0543	-0.2067
neg7	0.2649	0.0067	**0.7421**	0.4684	-0.1487	0.0861	-0.0658	0.1078	-0.0492
neg8	0.2172	-0.0813	**0.8174**	0.1869	-0.1361	-0.0418	-0.128	-0.0864	-0.2008

neg9	0.1262	-0.2009	**0.8567**	0.0813	-0.279	-0.2313	-0.3341	-0.2321	-0.3299
pos1	0.3281	0.197	0.2588	**0.8299**	0.0794	0.2678	0.2136	0.3056	0.1487
pos10	0.2503	-0.016	0.582	**0.5864**	-0.1402	0.0648	-0.0085	0.0552	-0.1042
pos2	0.2442	0.1171	0.3586	**0.6793**	0.0035	0.1995	0.1714	0.2218	0.1266
pos3	0.3644	0.2497	0.3367	**0.7992**	0.1645	0.1872	0.1043	0.2555	0.1962
pos4	0.3094	0.1343	0.4135	**0.8406**	0.0327	0.2202	0.0494	0.2855	0.0573
pos5	0.1786	0.2838	-0.0703	**0.6963**	0.1768	0.2704	0.2082	0.3362	0.2865
pos6	0.2609	0.1911	0.1188	**0.8581**	0.1138	0.29	0.1638	0.3163	0.1859
pos7	0.2935	0.2851	0.0942	**0.8534**	0.1069	0.4387	0.2597	0.4006	0.3021
pos8	0.2102	0.1698	0.2132	**0.7775**	0.0647	0.3143	0.1955	0.303	0.1155
pos9	0.0237	0.0402	0.3446	**0.4418**	0.0844	0.0715	0.0045	0.237	0.0352
prox1	-0.1102	0.4179	-0.2337	0.0855	**0.897**	0.2428	0.2616	0.4128	0.3873
prox2	-0.0354	0.3748	-0.2174	0.0684	**0.8776**	0.1442	0.1993	0.3439	0.3545
prox3	0.04	0.1852	0.0145	0.219	**0.7392**	0.2104	0.1949	0.3468	0.2508
spec1	0.1016	0.6564	-0.1008	0.2217	0.2398	**0.8971**	0.6881	0.5548	0.5759
spec2	0.1101	0.5765	-0.1374	0.3374	0.1845	**0.8959**	0.6902	0.6195	0.5981
spec3	0.1162	0.549	-0.0565	0.3707	0.1868	**0.8775**	0.5675	0.5229	0.5176
use1	0.0231	0.6624	-0.2573	0.1982	0.2716	0.7155	**0.8871**	0.6038	0.6363
use2	-0.0256	0.6183	-0.2662	0.1505	0.2377	0.5955	**0.9009**	0.6014	0.631
use3	0.0899	0.5834	-0.062	0.2042	0.1673	0.5983	**0.8297**	0.5502	0.5241
wom1	0.1828	0.5483	-0.0273	0.401	0.3005	0.5645	0.6159	**0.886**	0.6778
wom2	0.0544	0.6411	-0.0519	0.38	0.4342	0.559	0.5553	**0.9033**	0.6942
wom3	-0.0105	0.5665	-0.1804	0.2509	0.4282	0.5825	0.6271	**0.8881**	0.7073