WebQual™: A Measure of Web Site Quality

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WebQual™[1]: A Measure of Web Site Quality

ABSTRACT

A critical concern of both Information System (IS) and Marketing researchers has been how to measure the quality of a Web site. This research uses the general theoretical frames of the Theory of Reasoned Action and the Technology Acceptance Model as starting points to develop a measure of Web site quality that predicts consumer reuse of the site. The paper presents the development and validation process of a Web site quality measure with 12 core dimensions: informational fit-to-task; tailored communications; trust; response time; ease of understanding; intuitive operations; visual appeal; innovativeness; emotional appeal; consistent image; on-line completeness; and relative advantage. Instrument development was based on an extensive literature review, as well as interviews with Web designers and visitors. The instrument was refined using two successive samples (of 510 and 336 Web users), and the measurement validity of the final instrument was tested with a third confirmatory sample of 311 Web users. Implications and recommended courses of action are given for Web site managers as well as future research questions for IS researchers.

Keywords: Web site quality, instrument development, Theory of Reasoned Action (TRA), & Technology Acceptance Model (TAM)

ISRL Categories: HA08, HC0101, HB19, HD0108

[1] WebQual™'s trademark status is noted on the cover, abstract, and introduction page. The "™" has been omitted from the text of the paper.

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INTRODUCTION

Web sites are a critical component of the rapidly growing phenomenon of e-Commerce. Worldwide, Internet retail sales have grown from $18.23 billion in the fourth-quarter of 2000 to $25.29 billion in the fourth-quarter of 2001 (Pastore 2002). Web sites play a significant role in the overall marketing communication mix (Berthon et al. 1996)—they complement direct selling activities, present supplemental material to consumers, project a corporate image, and provide basic company information to customers. Businesses are eager to develop means for measuring and analyzing consumer responses to different kinds of Web site designs. Of particular concern to businesses is the question of whether, based on a consumer's reaction to a Web site, that person is likely to revisit or make a purchase from the site in the future.

Given the importance to both practitioners and researchers, it is critical that an instrument specifically designed to measure the consumer's perception of Web site quality is developed following a rigorous and comprehensive method. Existing efforts to date have inappropriately narrowed their scope, have used weak measurement validity tests, or too small sample sizes. Though valuable, none of these measures has been developed with the rigor required for a potentially widely used measure of a critical construct in research and practice.

This article seeks to address that gap within the realm of business-to-consumer Web sites, by reporting on the development of an instrument, WebQual, to measure Web site quality. We use a strong theoretical base, a careful instrument development methodology, and rigorous measurement validity testing.

As a general underlying theoretical model we use the Theory of Reasoned Action (TRA) (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975), and particularly TRA as applied to information technology, in the form of the Technology Acceptance Model (TAM) (Davis 1989). These theories provide a strong conceptual basis for a link between user beliefs about a Web site and the behavior of reusing the Web site at a later time.

However, TRA does not specify which beliefs might be pertinent for technology use behaviors, and TAM only identifies two very general beliefs: ease of use and usefulness. Our effort to develop a measure of Web site quality starts by looking both *beyond* ease of use and usefulness, and *within* ease of use and usefulness. We do not narrow the focus to only ease of use and usefulness for two reasons. First, there is evidence that the use of the Web is driven by some additional factors beyond these two. In particular, use of the Web may have some entertainment value that is not easily captured by ease of use or usefulness (Hoffman and Novak 1996; Singh and Nikunj 1999). For this reason it is important to consider the possibility of adding to Davis' two general constructs.

Secondly, following Goodhue and Thompson (1995), we believe that to be most useful to businesses, an instrument measuring Web site quality must identify in more detail the specific aspects that cause a Web site to be easy to use or useful to consumers. This greater clarity of detail is important conceptually since we may discover empirically that some aspects are more important than others in determining consumer behavior. It is important from a practical business sense because without having a finer grained measure than "ease of use" or "usefulness," business might not know what changes to make in a Web site that was, for example, rated low in "usefulness."

To identify the specific beliefs important to predicting consumer reuse of a Web site, we draw upon both management information systems (MIS) and marketing literature, as well as conducting exploratory research and using expert judges. An initial instrument was refined through three different versions. For each version we carefully analyzed the instrument's measurement validity using large samples (510, 336 and 311 students respectively) and further refined the conceptualization and the questions. The final version contains 36 questions on 12 dimensions of Web site quality. It demonstrates strong measurement validity, and it predicts intention to buy from or revisit a Web site.

BACKGROUND

Evaluating the quality of a Web site has been approached from three major angles: machine, expert judges, and customer's evaluation. We now consider each of these approaches.

Machine

The machine approach uses software to record automatically the key characteristics of a Web site. The process is completely automated and visitors' opinions are not sought. As one of the developers of this approach notes, it enables the analysis of thousands of systems but lacks data on the perceptions of those who visit the pages (Bauer and Scharl 2000).

Expert as judge

The expert judge approach typically starts with the researchers identifying a set of characteristics for classifying sites. This work has resulted in the creation of taxonomies of varying dimensions and emphasis (e.g., Hoffman 1997; Olsina et al. 1999). In one case, the experts identified the dimensions of Web site quality and then a team of five

experts evaluated 120 sites (Psoinos and Smithson 1999). In another case, 68 criteria to assess the information content and ease-of-use of government Web sites were identified by a group of experts (Eschenfelder et al. 1997; Wyman et al. 1997) and applied by another expert to evaluate New Zealand government Web sites (Smith 2001).

Customer as judge

Though the machine and expert approaches may identify important characteristics of Web sites, they ignore the point of view of the customer, the ultimate judge of a Web site's success. The final approach is to ask the customer, the visitor to the Web site and consumer of the information, to evaluate the Web site. Though we concur with the desirability of this approach, our assessment is that existing efforts along these lines have not yet meet the methodological requirements needed for such a critical measure. More specifically, they are weak in terms of either the sample size used for analysis (which makes many measurement validity analysis tools suspect), too rapid a convergence on a narrow subset of constructs (which leaves open the question of whether all critical constructs are included), or both.

For example, Selz and Schubert developed their WA—Web Assessment tool[2] based only on the three phases of a transaction (information, agreement, and settlement) augmented by a community phase (Selz and Schubert 1997; Schubert and Selz 1999). In subsequent research, the model is extended to create Extended Web Assessment Model (EWAM) by including elements of TAM, social influence, and reviewing four practitioner reports on Web evaluation (Schubert and Dettling 2002). The models were tested with samples of 55 and 20 respondents respectively, insufficient for a careful assessment of measurement validity.

In another customer-centric endeavor, Barnes and Vidgen refined a measure of Web site quality over four versions (Barnes and Vidgen 2000; Barnes and Vidgen 2001a; Barnes and Vidgen 2001b; Barnes and Vidgen 2001c). The instrument is based on quality function deployment (Bossert 1991), and six graduate students generated the initial items. This is, we believe, too narrow a base for establishing content validity. Furthermore, sample sizes were small for the first three versions (46, 54, and 39 respondents), which may explain why the factor structure has varied across the four versions.

TAM was used as a starting point to determine the antecedents of usefulness and ease of use in a study involving 163 subjects who self-selected a Web site they often used for work (Lederer et al. 2000). This study reports support for TAM in that it confirms that Web site use depends on ease of use and usefulness. It also reports three and five antecedents, respectively, of these two concepts. Though valuable, we would argue that narrowing the focus to ease of use and usefulness *a priori* is inappropriate for a general measure of Web site quality.

As a fourth example, Yoo et al. developed SITEQUAL (Yoo and Donthu 2001) by asking students in two marketing classes to generate appropriate questions. Fifty-four unique items were generated, which were the basis of an instrument completed by 69 students for three self-selected sites. Although sample size was very small, exploratory factor analysis (EFA) was used to reduce the instrument to 38 items and 9 factors of two broad sets: vendor-related and site quality. This first set of factors was removed because the researchers wanted to focus on site quality. An 18-item instrument measured the remaining four factors (ease of use, design, processing speed, and security). Confirmatory factor analysis (CFA), apparently using the same data, indicated a poor fit and the model

[2] http://www.businessmedia.org/businessmedia/businessmedia.nsf/pages/wa_tool.html

was respecified. After several iterations, the instrument was reduced to nine-items to measure the four factors. Next, a validation study with 47 subjects each evaluating 4 sites (n = 187) resulted in reliabilities in the range 0.69 to 0.83 and good fit indices. While a good start, SITEQUAL's original set of items is narrowly based and thus possibly excludes some key factors.

In our opinion, customer-oriented approaches have not yet completed the rigorous development that is required to produce a valid, comprehensive measure for general use. Without the careful development customarily expected of general use instruments, it would be dangerous to move too quickly to widespread use. In this article, we believe we demonstrate that level of expected rigor in creating WebQual.

RESEARCH FRAMEWORK

WebQual is founded on the contention that Web sites are a form of information system and that therefore theories related to information systems use are applicable. To use a Web site, one must employ computer hardware and software focused on information storage, display, processing or transfer. Therefore using a Web site is using an information system.

Using a Web site can also be a marketing interaction – information is passed, consumer's questions are answered, and purchases are made. One could imagine a Venn diagram in which information systems form one circle and marketing interactions form another. Use of a Web site is within the intersection of the two circles. Therefore we employed both MIS and Marketing literature in the development of our measure.

The Theory of Reasoned Action (TRA) (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975) is a theory that has been used extensively in marketing research. TRA

argues that individuals evaluate the consequences of a particular behavior and create intentions to act that are consistent with their evaluations. More specifically, TRA states that individuals' behavior can be predicted from their intentions, which can be predicted from their attitudes about the behavior and subjective norms (see top third of Figure 1). Following the chain of prediction further back, attitudes can be predicted from an individual's beliefs about the consequences of the behavior. Subjective norms can be predicted by knowing whether significant other individuals think the behavior should or should not be done. TRA has been used to predict such varied behaviors as dieting, smoking, giving blood, etc. Thus, TRA is quite appropriate for the context of predicting the behavior of visiting a Web site. However, TRA is a very general theory, and as such does not specify what specific beliefs would be pertinent in a particular situation.

Davis (1989) applied TRA to a class of behaviors that can be loosely defined as "using computer technologies," and produced a Technology Acceptance Model (TAM) (see the middle third of Figure 1), one of the most widely cited pieces of MIS research (Venkatesh 2000). Davis argues that for the behavior of "using computer technologies," two particular beliefs are predominant in predicting behavior: perceived ease of use and perceived usefulness. Through an extensive stream of research, Davis and others developed strong measures of these two beliefs, and he and others demonstrated their predictive power in a number of contexts, including use of word processors, email, drawing tools, hospital information systems, and many more (Davis et al. 1989; Methieson 1991; Sjazna 1994, 1995; Agarwal and Karanhanna 2000).

Davis found that attitudes did not completely mediate the relationship between beliefs and intentions (as Fishbein had suggested they would), and argued that it made

more sense to focus on measuring these beliefs as direct predictors of intentions than trying to measure attitudes as well. Davis also argued that in the context of using computer technologies (at least in the domains he studied), subjective norms did not seem to be a significant predictor of intentions.

Though there is some disagreement (e.g. Cheung et al. 2000) about ignoring social norms in predicting information systems use, a number of studies have successfully focused only on ease of use and usefulness as predictors of computer system use. In the use of the Web, we see no particular reasons why subjective norms should have a large impact on behavior, as opposed to other behaviors where norms might have more of an impact (e.g., smoking or dieting). For the most part, Web use is a private affair, not visible to one's peers. Though it could be argued that peer pressure might encourage an individual to use the Web in general, we see no argument for why peer pressure might affect whether an individual revisited a particular Web site. Given this argument, Davis' findings, and the need to contain the scope of this research to a reasonable size, we too have excluded social norms from this study.

We also believe that there may be multiple distinct dimensions of ease of use and of usefulness, as well as other categories of beliefs such as "entertainment" which together predict intentions to reuse a Web site (see the lower third half of Figure 1). Determining the relevant specific dimensions of WebQual, and developing an effective instrument to measure those is the subject of the rest of the paper.

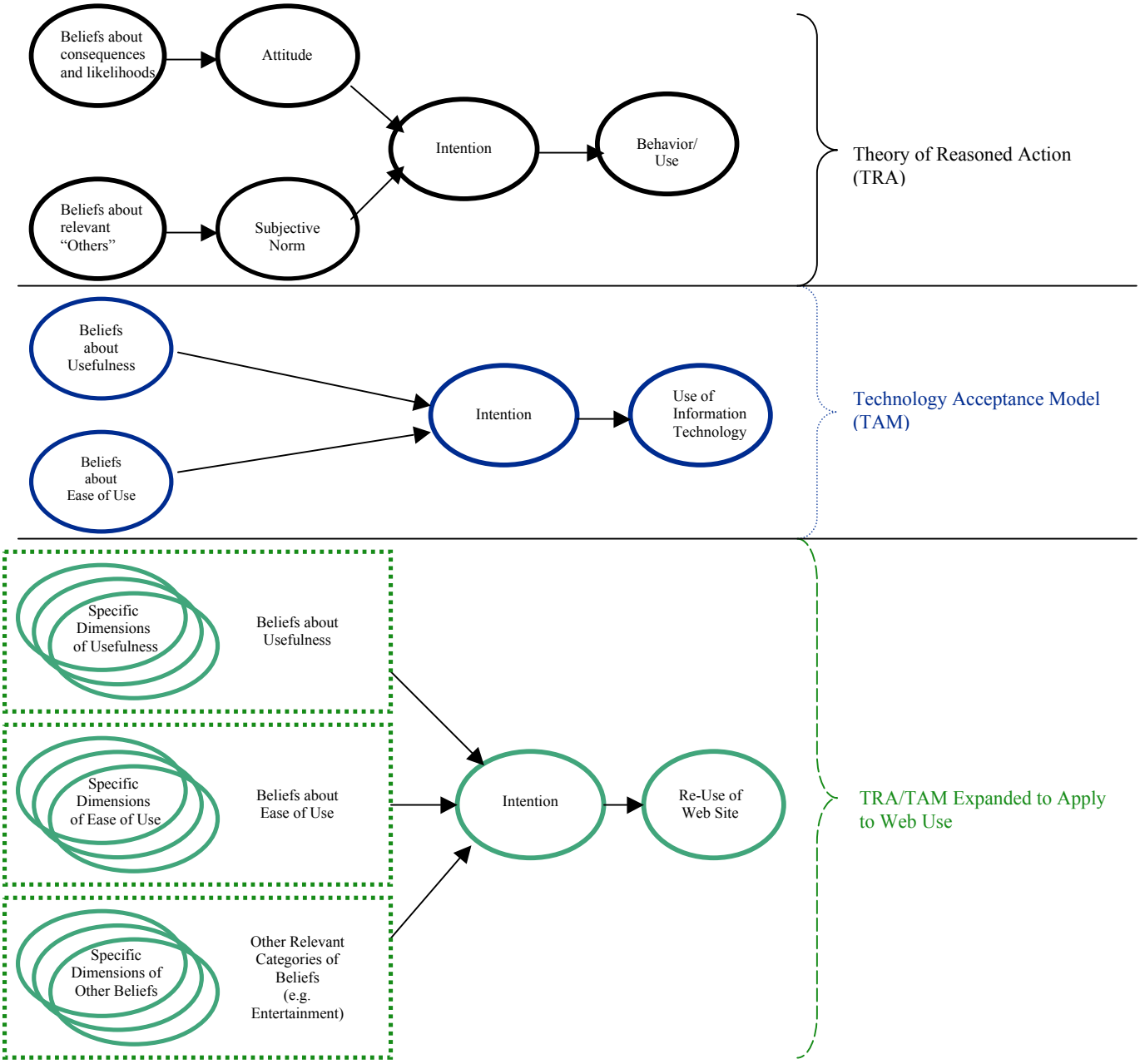

Figure 1: Research Frameworks

METHOD

There are many frameworks for thinking about measurement validity. Bagozzi (1980) and Bagozzi and Phillips (1982) are used in this paper due to their comprehensive

coverage of six key components of validity (see Table 1), which are explained along with the process used to develop WebQual.

Table 1: Validity Concerns

Validity Issue	Concern
Theoretical meaningfulness of concept	Constructs well defined Making theoretical sense
Observational meaningfulness of concept (content validity)	Measures correspond to theoretical constructs
Internal consistency	Maximally similar measures of the same construct agree (i.e. reliability)
Discriminant validity	Distinct constructs can be distinguished
Convergent validity	Maximally dissimilar measures of the same construct correlate (e.g. do a collection of questions on a questionnaire correlate with an overview question, or with some objective measure)
Nomological validity	Making sense in the larger theoretical framework

*Based on Bagozzi (1980) and Bagozzi and Phillips (1982).

INSTRUMENT DEVELOPMENT PROCESS

The goal was to develop a valid measure of Web site quality that would predict Web site reuse. The overall process included four stages, which together address each of Bagozzi's validity concerns.

1. **Defining the Dimensions.** We moved *beyond* and *within* the two constructs of ease of use and usefulness. That is, we examined whether there are other categories of beliefs that also need to be considered, and whether there are distinct dimensions of "ease of use" and "usefulness" that should be considered separately. Various techniques were used to complete these tasks: a literature review, exploratory surveys, and expert judges. Both theory and our understanding and interpretation of the phenomenon laid the foundation for WebQual.
2. **Developing the Items.** We developed questions for each of the dimensions of WebQual identified in Stage 1. The initial result was an 88-item instrument that measured 13 distinct beliefs about a Web site.
3. **Refining the Instrument.** The instrument was refined by administration to two different samples (N = 510 and N = 336). After each administration, the measurement validity of the constructs was analyzed and problem questions pruned, revised, or replaced and redundant dimensions collapsed. This resulted in an instrument with 36 questions measuring 12 dimensions.

4. **Confirmatory Assessment of Validity.** A confirmatory analysis of the overall measurement validity of the final instrument was conducted using a new sample of 311 subjects. The instrument demonstrated strong measurement validity for the four validity issues that can be empirically assessed (i.e., the final four rows of Bagozzi's Validity Concerns, Table 1).

STAGE 1: DEFINING THE DIMENSIONS

In order to determine the pertinent dimensions of Web site quality and establish content validity, a four-pronged effort was employed more or less simultaneously. First, a review of the MIS and marketing literature revealed existing constructs related to quality and customer satisfaction. Popular press publications were also examined to ensure no factor was overlooked due to the "newness" of the Web. In parallel with this effort, we conducted three exploratory research projects to ensure the comprehensiveness of the constructs relative to the domain of the Web. These included soliciting criteria from Web surfers, interviewing Web designers, and studying a large organization's standards for Web site design.

Two theoretical perspectives guided our efforts to identify all relevant distinct aspects of Web site quality that might affect a user's intent to reuse the Web site. The first was the Technology Acceptance Model (Davis 1989; Davis et al. 1989). As explained earlier, we looked both within **ease of use** and **usefulness**, and beyond ease of use and usefulness.

To explore more deeply into the usefulness realm, we utilized the insight from task-technology fit (Goodhue and Thompson 1995) that a technology is "useful" when it fits the task a user is engaged in. This suggested identifying the "possible tasks" a Web site user might be engaged in, and then identifying aspects of the technology that either supported or thwarted the user in accomplishing those tasks. We identified two generic

"tasks" that Web site users might be engaged in: **gathering information** (about a company or a product, or about some non-business issue) and **carrying out a transaction** (related to a standard purchase, or related to some more complex interaction such as a service).

Finally, we recognized that use of a web site sometimes goes beyond utilitarian aspects (i.e. usefulness) to include **entertainment value**. (Pine and Gilmore 1998; Berthon et al. 1996; Deighton, 1992; Bloch et al. 1986). Users might be interested in several of these categories at the same time (for example, entertainment and gathering information), but conceptually we can focus on each separately as we seek to understand the way a Web site affects a user engaged in that task.

Therefore our search for distinct dimensions of Web site quality begins with a framework of four categories: **ease of use**, **usefulness in gathering information**, **usefulness in carrying out transactions**, and **entertainment value**.

Dimensions Relating to Ease of Use. We looked for MIS or Marketing literature that would help us identify the aspects of ease of use in a Web site. Here the literature covers not only the traditional idea of reports or displays of information being easy to read and understand (Davis 1989; Swanson 1985; Elliot and Speck 1998; Ha and Litman 1997; Kotler 1973) but also the newly emerging importance of a Web site being easy to operate and navigate through (Benbunan-Fich 2001, Moschella 1998; Useit.com 1998; WebReview 1998; Neilsen 1997). These are arguably two distinct aspects of the original ease-of-use construct when it is applied to the Web, since each page of a Web site could be easy to read and understand, but the navigation between pages could be difficult.

Thus we consider the *ease of understanding* of the Web pages and *intuitive operations* (ease of navigation between pages) as two distinct aspects of Web site quality.

Dimensions Relating to Usefulness in Gathering Information. Customers seek information for one of two purposes, either as a prepurchase search (information sought in order to facilitate a decision regarding a specific goal—purchase) or as an ongoing search (relatively regular basis, independent of specific purchase needs) (Bloch et al. 1986). In the latter, a customer is simply "browsing" with no purchase intent necessarily in mind. Regardless of the search activity, certain characteristics of the process emerge as important. *Information quality* surfaces frequently in MIS research (DeLone and McLean 1992; Strong et al. 1997; Wang 1996; Wang and Strong 1996; Baroudi and Orlikowski 1988; Bailey and Pearson 1983; Katerattanakul and Siau 1999, Todd and Benbasat 1992) These papers highlight such characteristics as accuracy, relevancy, and completeness. To a seeker of information, presumably accuracy, relevance and/or completeness would make a Web site more useful. Further, being able to access more exactly the information that was needed as opposed to only what general information might be supplied on the Web site should also make a site more useful. Thus an important characteristic of a Web sites is its ability to provide *tailored communications* to meet the unique needs of the consumer (Ghose and Dou 1998; Steuer 1992). Interactive functions, such as search fields, assist customers in their search for relevant information on-line.

Dimensions Relating to Usefulness in Carrying Out Transactions. Perhaps following information gathering, or perhaps without such a prior step, many users desire to carry out a transaction on the Web site. There is a collection of characteristics that

reflect the extent to which the Web site supports these users. First, at a more general level, there is the extent to which the Web site meets a user's functional task needs (*functional fit-to-task*) (Franz and Robey 1984; Goodhue and Thompson 1995; Su et al. 1998). In addition, poor *response time* could frustrate a user, and encourage him/her to go elsewhere (Machlis 1999; Shand 1999; Seybold 1998). Similarly lack of *trust* in the Web site could erode an individual's desire to carry out transactions on the Web, even if all other characteristics of the Web site were very positive (Gruman 1999; Hoffman et al. 1999; Doney and Cannon 1997). The level of on-line support or *customer service* (Kaynama 2000; Xie et al. 1998; Kettinger and Lee 1997; Parasuraman et al. 1988) provided by a firm enhances or detracts from a consumer's ability to complete his/her task. Quick responses to emails or the availability of online customer support functions, such as chat, may increase the time customers spend on a particular site and their willingness to buy from that firm.

Closely related to the above, but differing in their focus on interactions specifically with a business, are an additional collection of characteristics. From the marketing literature comes the idea that a Web site is really one among many possible channels of interactions between business's and their customers (Dunan 1995; Nowak and Phelps 1994). From the customer's point of view, it is of interest whether all or most of the necessary transactions can be completed on line (*on-line completeness*), or whether some must be completed using less "convenient" means (Seybold 1998). Also in this context, it matters that there be some *relative advantage* of completing transactions over the Web, compared to alternate means (Moore and Benbasat 1991; Rogers 1982; Seybold 1998). If it is really more trouble to use the Web than to, for example, call a service

representative, we should not expect customers to use the Web site very often. Finally, in marketing there is recognition of the importance of a *consistent company image* across all points of contact with the customer (Watson et al. 2000; Seybold 1998; Machlis 1999; James and Alan 1996; Resnik and Stern 1977). The idea is that customers may become frustrated or confused if they are presented with inconsistent material, and this may deter them from using a Web site.

Dimensions Related to Entertainment Value. Finally, there are those consumers who are seeking the "full experience"—to be entertained by the process of searching. They may make a purchase or they may not. They simply enjoy "strolling down the aisles" and want to be entertained along the way. For these consumers, the Web site must create a pleasant "experience". Starting with the aesthetics, the site must be *visually appealing* (Geissler, et al. 1999; Elliot and Speck 1998; Ha and Litman 1997) and inviting with a creative or *innovative* flare separating it from just "any old" site (Eighmey, 1997; Ducoff 1995; Aakar and Stayman, 1990) Similar to a brick-and-mortar store, a pleasing atmosphere (Grove et al. 1998; Kotler 1973) and image (Zimmer and Golden 1988) attempts to entrance a consumer through an *emotionally appealing* (Richins 1997; De Pelsmacker and Van Den Bergh 1997) site that encourages continued browsing (Novak and Hoffman 1997;Csikszentmihalyi 1977; Venkatesh 1999; 2000; Venkatesh and Speier 1999; George 1991). In this sense, the customers become the "audience,' who interacts with or observes a myriad of theatrical phenomena that mingle to create an experience (Grove et al. 1998; Pine and Gilmore 1998).

It is worth noting that several individual traits such as playfulness (Webster and Martocchio 1992) or personal innovation (Agarwal and Prasad 1998), might interact with

characteristics of a web site, but are not actually characteristics of the web site itself. Though interesting for future research, addressing the impact of these individual characteristics is beyond the scope of this study.

In all 14 constructs were identified in the literature (see Table 2). Related to ease of use, we have **ease of understanding**, and **intuitive operations**. Related to gathering information, we have **information quality**, and **tailored communications**. Related to carrying out transactions, we have **functional fit-to-task**, **trust**, **response time, consistent image**, **on-line completeness**, **relative advantage**, and **customer service** Related to entertainment, we have **visual appeal**, **innovativeness**, and **emotional appeal**.

Table 2: WebQual Constructs' Sources

Constructs	Description of Concept	Major Sources*
Information quality	The concern that information provided is accurate, updated, and appropriate.	Katerattanakul and Siau, 1999 (MIS) Strong et al., 1997 (MIS) Wang and Strong, 1996 (MIS) Baroudi and Orlinkowski, 1988 (MIS) Bailey and Pearson, 1983 (MIS)
Functional Fit-to-task**	The extent to which users believe that the Web site meets their needs.	Davis, 1989 (MIS) Franz and Robey, 1984 (MIS) Goodhue and Thompson, 1995 (MIS) Ives, et al., 1983 (MIS) Doll and Torkzadeh, 1988 (MIS) Todd and Benbasat, 1992 (MIS) Su, et al., 1998 Harry, 1998
Tailored Communications	Communications can be tailored to meet the user's needs.	Ghose and Dou, 1998 (MKT) Philport and Arbittier, 1997 (MKT) Marrelli, 1996 (POP) Hoffman et al., 1995 (MIS) Emerick, 1995 (MKT) Steuer, 1992 (MIS) Blattberg and Deighton, 1991 (MKT) Xie, et al., 1998 (MIS) Parasuraman, et al., 1991 (MKT) EXPL
Trust	Secure communication and observance of information privacy.	Gruman, 1999 (POP) Doney and Cannon, 1997 (MKT) Hoffman et al., 1999 (MIS)
Response Time	Time to get a response after a request or an interaction with a Web site.	Shand, 1999 (POP) Machlis, 1999 (POP) Seybold, 1998 (POP/MKT) EXPL

Ease of Understanding	Easy to read and understand.	Davis, 1989 (MIS) Kotler, 1973 (MKT) EXPL
Intuitive Operations	Easy to operate and navigate.	Davis, 1989 (MIS) Benbunan-Fich, 2001 (MIS) Moschella, 1998 (POP) Radcliffe 1998 (POP) Nielsen, 1997 (POP) EXPL
Visual Appeal	The aesthetics Web site.	Geissler, et al. 1999 (MKT) Elliot and Speck, 1998 (MKT) Ha and Litmam, 1997 (MKT) EXPL
Innovativeness	The creativity and uniqueness of a Web site.	Eighmey, 1997 (MKT) Aaker and Stayman, 1990 (MKT) Ducoffe, 1995 (MKT)
Emotional Appeal	The emotional affect of using the Web site and intensity of involvement.	Novak and Hoffman, 1997 (MIS) Hoffman et al., 1996 (MIS) Hoffman and Novak, 1996 (MKT) Ellis, et al., 1994 (MIS) LeFevre, 1988 (MIS) Csikszentmihalyi, 1977, 1990 (MIS) Richins, 1997 (MKT) De Pelsmacker and Van Den Bergh, 1997 (MKT) EXPL
Consistent Image	The Web site does not create dissonance for the user by an image in compatible with that projected by the firm through other media.	Watson et al., 2000 (MIS) James and Alman, 1996 (MKT) Resnik and Stern, 1977 (MKT) Machlis, 1999 (POP) Seybold, 1998 (POP/MKT) EXPL
On-line Completeness	Allowing all or most necessary transactions to be completed on-line (e.g., purchasing over the Web site).	Seybold, 1998 (POP/MKT) EXPL
Relative Advantage	Equivalent or better than other means of interacting with the company.	Moore and Benbasat, 1991 (MIS) Rogers, 1982 (MIS) Seybold, 1998 (POP/MKT) EXPL
Customer Service***	The response to customer inquiries, comments, and feedback when such response requires more than one interaction.	Kaynama and Black, 2000 (MKT) Xie, et al., 1998 (MIS) Parasuraman, et al., 1991 (MKT)

*Not an exhaustive list. Items in this column should be viewed as representative. MIS = MIS (& Information Science) Literature Review, MKT = Marketing Literature Review, POP = Popular Press, & EXPL = Exploratory Research.
**Due to analysis described later in the paper Information quality & Fit-to-task were collapsed into one construct.
***As explained in text multiple interaction Customer service measures are not yet included in WebQual.

Exploratory Research

In parallel with the above literature review, three exploratory research projects were conducted to ensure that the Web site quality model generated was comprehensive.

First, we asked four groups of about 20 student web users each to divulge their ranking criteria for high versus low quality Web sites. Each group ranked 10 Web sites within one of four product/service categories: CDs, books, hotel reservations, and airline reservations (40 Web sites in all). They also recorded the factors they felt differentiated the sites in terms of quality. Two judges categorized the comments into higher-level categories.

Secondly, mirroring the development of SERVQUAL (Parasuraman et al. 1988), we also tapped into practitioner knowledge about the dimensions of Web site quality to ensure that no key factors were overlooked. Companies are concerned with what their customers want in a Web site and therefore have developed criteria based on these desires. Using telephone interviews, we asked 10 Web designers to explain the criteria they used to create a high quality Web site.

Third, along the same lines, we studied the criteria used by a Fortune 500 company to determine the quality of its Web sites. All this exploratory research lent support to nine of the WebQual dimensions uncovered in the MIS and marketing literature: Tailored communications, response time, ease of understanding, intuitive operations, visual appeal, emotional appeal, consistent image, on-line completeness, and relative advantage (see Table 2). Overlap on dimensions arising out of the literature and exploratory research was a welcomed sign that our efforts were in fact comprehensive and that critical aspects of Web site quality were not missed.

The Underlying Structure of WebQual

Our assumption is that each of the 14 dimensions is a distinct construct capable of varying independently from the others. For example, it is possible that a web page might have high "ease of understanding" on each page, but not have "intuitive operations", making navigation more difficult. Along the same lines, companies conceivably could modify any one of the 14 constructs independently of the others, and users of the web sites would reflect those modifications in their scores for the specific construct changed. Similarly, it is possible (even expected) that some constructs will be more important than others in determining "intent to reuse" a web site. This conceptual model of WebQual is what is called by Bagozzi and Edwards (1998) a total disaggregation model. Further, we conceptualize the overall structure of WebQual as "bottom up" (Bagozzi and Edwards 1999), meaning that rather than the 14 constructs being "reflections" of some single underlying overall WebQual construct, instead the overall WebQual score is seen as "produced by" the combination of the 14 underlying constructs.

This has implications for constructing items for WebQual, and for assessing their measurement validity. Of primary importance, this conceptualization of the structure of WebQual requires that we demonstrate that the measures of each construct are distinct. This is not to say that the 14 constructs will not be correlated, but only that they be statistically distinct, as an indication that they are capable of varying independently of each other. If some constructs are not statistically distinct, we will need to consolidate those until all remaining constructs are distinct.

Narrowing the Scope of the Current Research. Thirteen of the fourteen identified dimensions of Web site quality can be assessed after a single visit to a web site. Only customer service suggests the need for multiple interactions before user assessments

can be made. In fact, customer service includes both one-time and multiple interactions with the company via the Web site. For example, obtaining company information and buying a product are one-time interactions that contribute to customer service. These one-time components of customer service are captured in the aspects of Web site quality discussed above, such as tailored communications, information quality, functional fit-to-task, and relative advantage.

In order to restrict the scope of the current research to a manageable size, we decided that those customer service measures requiring multiple interactions (such as receiving an email response to an inquiry) would not be included in the initial instrument. All other dimensions of Web site quality could be determined within a single site visit. And subsequent research focusing on customer service measures would not hinder the integrity of our current endeavor. Subsequent research could then focus on refining those items with data collected from subjects who have had multiple interactions with a company and received responses via the Web site.

STAGE 2: DEVELOPING THE ITEMS

The second of Bagozzi's validity concerns, observational meaningfulness (see Table 1), refers to the extent to which the questions (i.e., the operationalizations) actually cover all relevant aspects of the concept (content validity), and whether there is a persuasive reason to believe the questions and the underlying constructs they are intended to measure are linked. Scale development can be either deductive or inductive (Hinkin 1998). We incorporated both approaches through an extensive literature review (inductive) and an exploratory research (deductive) phases, as previously described.

An initial set of 142 candidate items was developed based on 13 constructs arising out of the literature review and our exploratory studies. This list of items was then refined based on an approach used by Davis' (1989) in his pretest of measures for the TAM. Mindful of the cognitive complexity of handling all 13 constructs (Miller 1956), we opted to reduce the difficulty of this initial screening. Twenty experienced Web users from a large southeastern University (5 graduate and 15 undergraduates students) rated the items on how well they corresponded to the four high-level categories of Web site quality (ease of use, usefulness, entertainment, and complementary relationships). Participants did the following with a set of four high-level category definitions and 142 items, all on separate cards:

1. Read the definition of each of the four high-level constructs;
2. Read each potential item and categorized it by placing it in the high level category to which they thought it was most related;
3. Ranked each item based on how closely the item corresponded to the target category.

A non-statistical cluster analysis (similar to Davis, 1989) was performed by incorporating an item into one of the four high-level constructs if at least 50 percent of the subjects ranked the item as one of the top three for these particular constructs. This resulted in an initial WebQual instrument of 88 items covering a possible 13 constructs.

STAGE 3: REFINING THE INSTRUMENT

In order to prevent item order bias, two random order versions of the initial 88-item instrument were created. To prevent inflating reliabilities from artificially high correlations where subjects answered adjacent questions using anchoring and adjustment, items pertaining to a similar construct were separated from other items. Items were measured using a seven-point Likert scale. In addition, reverse scored items were

included to ensure respondents were alert while completing the survey and to eliminate response bias (Hensley 1998; Spector 1992).

The instrument was refined by examining its reliability and discriminant validity after each of two distinct administrations. With 88 questions in the initial questionnaire and a rule of thumb for factor analysis of at least five times as many observations as there are variables to be analyzed (Hair et al. 1998), at least 440 subjects were required. Data were collected from 510 undergraduates in round 1 (see Table 3). Subjects were current Web users with an average age of 20 years. Approximately half were female. These dimensions match the age and gender specifications for the largest group of Internet users—18 to 29 years old, 43 percent females and 57 percent males (Cyberatlas 1999). [3]

Table 3: Round Information and Subject Demographics

	Round 1	**Round 2**	**Round 3**
n	510	336	311
Subjects*	Undergraduates		
Number of items	88	83	36
Average age	20	21	20
Gender	Male = 50% Female = 50%	Male = 62 % Female = 38 %	Male = 52% Female = 48%
Ever made a purchase over the Web	Yes = 54% No = 46%	Yes = 67% No = 33%	Yes = 64% No = 36%
Average purchases made in past 30 days	1.47	1.71	.81
Average number of years using Web	4.02	4.66	4.75
First time on Web site	Yes = 85% No = 15%		
Heard of the company before		Yes = 18% No = 82%	Yes = 18% No = 82%

*Subjects participated in the study for partial course credit in an introductory MIS course.

3 Though the subjects were similar in many respects to a large group of Web users, it is unclear whether students are also different from typical Web users in other ways. Therefore, generalizations should be made with care.

The Task and the Web Sites

Subjects in all rounds were given a context (e.g., "Imagine it is your friend's birthday and you are searching for a good gift—a book.") and told to explore a designated Web site as if they were considering which book to buy for their friend, and then to complete the questionnaire. They were asked to look at the Web site for at least 10 minutes before beginning to respond to questions. In rounds 1 and 2, subjects completed the survey in a lab environment. The administrator of the survey reviewed the directions with each group—explaining that they should indicate their level of agreement for each statement by circling the appropriate number between 1 and 7 (strongly disagree to strongly agree). In round 3, subjects were simply provided the written instructions and allowed to complete the survey on their own time. Three of each of four different types of Web sites were used (12 in all) (see Table 4). The sites were chosen for their quality variability, based on rankings of specific Web sites generated by subjects in the earlier exploratory research phase.[4] In order to control for time of day bias, the time of day sites were visited was varied.

Table 4: Web sites for data collection

Products			
CDs	Music Point	Emusic	CDNow
Books	Amazon	ReadersNDEX	Waterstones
Services			
Airline reservations	4 Airlines	Period.com	Strangeways
Hotel reservations	First option	Hotel & Travel on Net	Places to Stay

[4] The exploratory research (described earlier as part of Stage 1) asked 80 students to visit 10 Web sites in one of four categories (books, CDs, airline or hotel reservations). Those Web sites were chosen by the researchers as embodying varying levels of quality). Subjects ranked the 10 sites they saw on quality. Using these rankings, a set of sites was selected for maximum variability.

Item Assessment and Purification –Round 1

Data analysis and purification consisted of the following three steps. First, Cronbach's alpha for each measure of the 13 target constructs was calculated. Items that were determined to decrease the reliability (alpha) of a construct's measure were deleted and the process continued until no item's removal increased a construct's overall alpha. The end result was the removal of eleven items. Before any item was deleted, it was screened to ensure that it was not the only one of its kind and could not be viewed as representing a separate additional construct.

As a second means to identify internal consistency problems, those items found to possess low correlations with similar traits (i.e., less than .40) were removed from the instrument. This follows the modified multitrait-multimethod process (Campbell and Fisk 1959) of item deletion as described by Goodhue (1998). A total of 13 items were deleted during this phase, while one was simply modified in order to clarify its meaning. Prior to deletion, all items were checked to ensure they could not be viewed as representing a distinct additional dimension.

The final step consisted of removing items that appeared to have discriminant validity problems. Items were removed if they correlated more highly with items measuring different constructs than they did with items in their intended construct (Campbell et al. 1959; Goodhue 1998). Under these criteria, eight items were deleted. Again, before any item was deleted, it was screened to ensure that it was not the only one of its kind or indicated the addition of a new possible construct. After the deletions, each construct was reviewed to ensure that at least five items per dimension remained. (This permitted us to drop up to two items for each dimension, if we discovered measurement validity problems, and still have at least three items per dimension.) For those dimensions

that were underrepresented, additional items closely related to the remaining items were added. Twenty-seven items were added—resulting in an 83-item instrument. Appendix 1 presents the results of the round 1 item purification process and Appendix 2 provides descriptive statistics for round 1 data.

Item Assessment and Purification – Round 2

A second round of data collection (see Appendix 3) allowed testing of the measurement validity of the second version of the instrument. Data were collected from 336 undergraduate students (see Table 3). A two-step process was employed to select the subset of questions to be included in the final version of WebQual.

Discriminant Validity: Round 2. Discriminant validity for the second version of the questionnaire was first assessed using exploratory factor analysis (EFA) (see Appendix 4). Five of the 13 constructs (information quality, functional fit-to-task, tailored communications, innovativeness, and relative advantage) appeared to have some possible discriminant validity problems. All other constructs loaded on separate factors.

To explicitly test for discriminant validity of the five problematic constructs, we used confirmatory factor analysis (CFA) and chi-squared difference tests. Two measurement models were run for each of four pairs of constructs that appeared to be closely related. The first model assumed the two constructs were distinct and allowed the correlation between the constructs to be determined; the second model forced the correlation between constructs to be equal to one, in effect combining the two into a single construct. Since these two models are hierarchically nested, a chi-square difference

test (Bentler and Bonnet 1980) allows us to see whether relaxing the restriction results in a statistically significant improvement in the fit (see Figure 2).

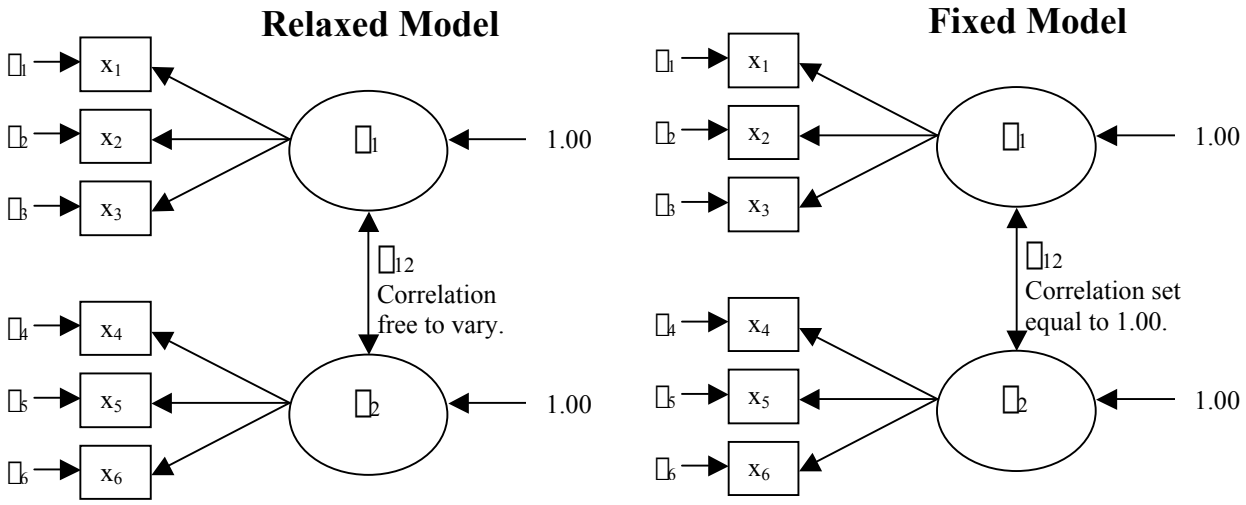

Figure 2: Fixed vs. Relaxed Model Comparisons for Assessing Discriminant Validity

The improvement in the confirmatory fit index (CFI) was also examined. The recommended cutoff of .02 or higher (Vandenberg and Lance 2000) was used as a minimum before possibly related constructs were viewed as separate.

The results (see Appendix 5) revealed that the information quality and functional fit-to-task constructs should be combined. In other words, there is no empirical support for the contention that respondents viewed these two constructs as distinct. On the other hand, tailored communications, relative advantage, and innovativeness were confirmed as independent constructs. Thus, the outcome of discriminant validity analysis was to reduce WebQual from 13 to 12 constructs. Appendix 6 presents the correlations of the 12 remaining factors.

Choice of the Items for the Final Instrument.

Since a construct should have at least three items (Cronbach and Meehl 1955) and lengthy questionnaires typically have a lower response rate (Babbie 1998), the top three items loading on each factor were chosen for the final questionnaire (see Appendix 7 for the questionnaire and Appendix 8 for items by construct). This final version of 36 items measuring 12 constructs was used to assess the empirically testable validity concerns (Bagozzi's last four concerns from Table 1).

STAGE 4. CONFIRMATORY ASSESSMENT OF VALIDITY

A third sample of 311 new students was used to confirm the measurement validity of the final instrument. First, a confirmatory factor analysis of the measurement model was conducted using LISREL to check reliability and discriminant validity. Then convergent and predictive validity were tested.

Confirmatory Factor Analysis

A final CFA was run using a new (round 3) sample of 311 undergraduate students (see Appendix 9 for descriptive statistics & Appendix 10 for Correlation of Factors). Appendix 11 reports the standard regression weights for the item loadings on their constructs. Values range from .91 (Trust4) to .54 (RA5), however, all but 4 are above .70. The results indicate strong support for the overall fit of the model.

Four recommended fit indices (Vandenberg and Lance 2000) indicate quite acceptable fit for the final version (see Table 5). These indices provide consistent and reinforcing indications of the overall adequacy of WebQual.

Table 5: Overall Fit of the Full WebQual Model

	WebQual Round 2	WebQual Round 3	Recommended Cutoff
RMSEA	0.052	0.061	< 0.06 to 0.08
SRMR	0.047	0.053	< 0.06 to 0.08
RNI	.90	.92	= or > .90
NNFI	.94	.90	= or > .90

RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual, RNI = Relative Noncentrality Index, NNFI = Non-normed Fit Index.

Internal Consistency (Reliability)

The reliability of the final questionnaire (12 constructs with 3 questions each) was calculated using Cronbach's alpha (Cronbach 1951). As Table 6 shows, alphas of the twelve constructs ranged from .72 to .93, with 10 of the 12 constructs having an alpha greater than .80. Of the two remaining constructs, one had an alpha of .79, and one had an alpha of .72. Thus, only the one construct (on-line completeness) has an alpha that is not close to or above the upper bound of acceptable alpha levels of .60 to .80 (Nunnally 1978).

Table 6: Construct Reliabilities

Construct	Alpha
Informational fit-to-task	**.86**
Tailored Communications	**.80**
Trust	**.90**
Response Time	**.88**
Ease of Understanding	**.83**
Intuitive Operations	**.79**
Visual Appeal	**.93**
Innovativeness	**.87**
Emotional Appeal	**.81**
Consistent Image	**.87**
On-Line Completeness	**.72**
Relative Advantage	**.81**

Discriminant Validity

As a final check of discriminant validity, we tested all possible pairs of the 12 remaining constructs to see if fit were improved when any pair was collapsed into a

single construct (see Appendix 12). As illustrated previously in Figure 2, the difference in the chi-squares between the fixed and relaxed models for each comparison was computed and its significance determined (Steiger et al. 1985). The chi-squared comparisons for all possible pairs of constructs (66 in all) revealed that the models with any two constructs combined resulted in a significant worsening of the fit ($p<.00001$) relative to the model with the constructs separated. Collapsing each pair of constructs to a single construct also resulted in a reduction in the Comparative Fit Index (CFI) of at least .02. The two most highly correlated constructs are information fit to task and tailored communications, correlated at .75 (see Appendix 10). Even though these two are highly correlated, the preceding discriminant analysis confirms that all 12 constructs are separate dimensions of a Web site's quality.

Convergent Validity

If a measure of a concept is valid, then correlations between that measure and a second measure of the same construct must be significantly different from zero and sufficiently large (Hinkin 1998). Following the example of the development of SERVQUAL (Parasuraman et al. 1988), subjects were asked one additional question on overall Web site quality—*Overall, how would you rate the quality of this Web site?* (1 to 7 point scale anchored on “poor” and “excellent"). The total WebQual score (36 items) was computed and then compared to the overall quality of the Web site question. The two were correlated at .78 ($p < .001$) indicating convergent validity.

Nomological Validity/Predictive Validity

In MIS, it is frequently the case that finding a network of known causal relations and well-established measures with which to test a new measure is extremely difficult if

not impossible. Researchers in these instances must resort to predictive validity, whereby confidence in the measure is secured by testing its ability to make predictions within an unproven, but theoretically defendable framework (Goodhue 1998; Sethi and King 1991; Venkatraman and Grant 1986). Confidence in the measure increases, if it behaves as expected in relation to other acceptable constructs (Bagozzi 1979; Bagozzi 1980). In the case of WebQual, predictive validity is demonstrated by testing the ability of the instrument to accurately predict a Web visitor's intention to purchase from or revisit a Web site (see questions in Table 7).

The correlations between the 12 distinct dimensions and purchase and revisit intentions are shown in Table 7. The relatively strong correlations for informational fit-to-task and tailored communications are consistent with Davis's findings that usefulness is a strong predictor of information system use. Also very strong are the correlations for innovativeness and emotional appeal, consistent with the idea that enjoyment is also important in Web use. This is a minimal but positive confirmation of overall nomological validity.

A stronger demonstration of nomological validity would be to regress the 12 constructs on intent to reuse. However, because some of the 12 constructs are highly correlated, multicolinearity would be a problem, likely distorting the strength and significance of the links. To sidetrack the multicolinearity problem will require a second-order factor analysis in advance of looking at the structural links between the second order factors and intent to reuse. This important work is beyond the scope of the current study. Future work will focus in more depth on both precursors to WebQual scores and down stream consequences of WebQual scores.

Table 7: Twelve Distinct Constructs and Correlations with Purchase & Revisit

Construct	Purchase*	Revisit**
Informational fit-to-task	.48	.50
Tailored Communications	.47	.45
Trust	.32	.21
Response Time	.31	.30
Ease of Understanding	.36	.33
Intuitive Operations	.37	.37
Visual Appeal	.31	.28
Innovativeness	.46	.44
Emotional Appeal	.47	.50
Consistent Image	.36	.37
On-Line Completeness	.41	.39
Relative Advantage	.47	.37

* How likely or unlikely would you be to make a purchase from this Web site?
** How likely or unlikely would you be to revisit this Web site?

DISCUSSION

This research extends and expands upon TAM as it applies to the Web. The exploratory phases of this research illustrated that consumer's Web behavior was affected by a larger and finer-grained set of factors than ease of use and usefulness. Based on our analysis the final WebQual instrument has very strong measurement validity. The 36 items provide a valuable and accurate measure of 12 constructs of Web site quality that affect consumers' intention to purchase and revisit, critical pragmatic indicators of a site's value.

This research makes two contributions. First, it provides practitioners and researchers with a validated reliable business-to-consumer (B2C) measure of Web site quality. The term "electronic commerce" may soon be redundant since nearly all commerce may be electronic (Porter 2001), and thus firms will increasingly need a means of assessing the quality of a Web site. Web sites in many cases will fashion the customer's view of the firm (Watson et al. 1998) and could have an important impact on

performance. Second, this study adds to our understanding of TAM, a widely used MIS instrument, by revealing the components of ease of use and usefulness in a Web context. Thus, it provides the basis for refining TAM to increase its diagnostic power.

Implications for practice

Companies now have a customer-determined means of assessing a Web site's quality. They have a measure that can be used to measure the quality of their site and those of competitors. A poor quality Web site has resulted in some companies suffering bad press, customer dissatisfaction, and even customer loss (Gruman 1999). With WebQual serving as a guide, companies can now develop more high quality Web sites that meet customer needs. They can use WebQual to "consumer test" potential sites and detect which elements need improvement prior to public release.

Both pure Web-based and click-and-mortar companies can gain from conducting a WebQual analysis. For example, a click-and-mortar firm such as Barnes and Nobles benefits from understanding how effective each aspect of its Web site is, just as Amazon, a pure Web-based competitor, does. Though both companies posses a different Web strategy, they each gain by knowing how well they are performing on basic Web site quality constructs, such as Intuitive operations and Informational fit to task. In addition, WebQual also serves as a means of benchmarking against competitors. Barnes and Nobles may determine that it is willing to score lower in a particular measure of WebQual, such as relative advantage, given its business strategy, but not in on-line completeness or consistent image.

One of the values of WebQual is that it provides a fine-grained analysis of a site's shortcomings. Thus, while TAM can diagnose a shortfall on ease of use, WebQual will

indicate whether the ease of use problem arises from problems with ease of understanding or with intuitive operations. We provide a list of recommended actions for each area of concern detected by WebQual (see Table 8). Although the recommended action in some cases might appear patently obvious, for completeness we provide a full list.

Table 8: Web site areas of conccern and recommendated actions

Area of concern	Recommended action
Ease of understanding	Design the pages that are easy to read and understand.
Intuitive operations	Develop an intuitive navigation system that is easy to learn and master.
Informational fit-to-task	Undertake market research to determine what information consumers want on the Web site.
Tailored Communications	Support consumer interaction via the Web site and the capability to receive tailored information.
Trust	Adopt and promote security and privacy policies and procedures that make customers feel secure in dealing with the company.
Response time	Have sufficient hardware and communications capacity to meet peak demand and avoid large graphics.
Visual appeal	Use colors, graphics, and text that are pleasing to the consumer's eye and avoid cluttered pages.
Innovativeness	Use a creative and differentiating approach to the Web site.
Emotional appeal	Design the Web site to provoke a positive customer experience.
On-line completeness	Allow customers to conduct important business functions over the Web.
Relative Advantage	Make the Web site just as easy, if not easier, for customers to use than other forms of interacting with the company.
Consistent image	Design the Web site to reflect the company's image.

Implications for researchers

New consumer products are evolving, such as information appliances (e.g., iMacs) that have elements of both information technology and home appliances. Other widely used consumer products (e.g., cars) are increasingly adding information systems (e.g., navigation systems). WebQual, because it is founded on a base of MIS and marketing theory and research, provides a suitable starting point for studying information appliance quality as well. In an economy where consumers more and more expect to be

entertained and consumption is a performance (Deighton 1992), strictly utilitarian MIS measures will provide an incomplete picture.

As this evolution occurs, so does the need for MIS and marketing research to meld in order to measure the effectiveness of these new devices. WebQual addresses information systems and consumer communication effectiveness, which are typical marketing and MIS goals. In doing so, WebQual stands as a significant contribution to the current marketing, as well as MIS literature.

LIMITATIONS AND FUTURE RESEARCH

WebQual's development was based on the responses of undergraduate business students to a selected group of Web sites. While these subjects are typical of a substantial body of Web users, they are not necessarily representative of all users. Furthermore, many of the subjects were not on-going customers of the sites selected for assessment. These important limitations are typical of those facing most instrument developers because such work often needs to start in an environment where many subjects are readily and repeatedly available. Further confirmatory research needs to be done with broad samples of on-going customers of a range of Web sites. Additional research will also look closer at the relationship between information fit-to-task and tailored communications. Though initial tests indicate that they should remain separate constructs, a high correlation indicates further research is warranted.

Given that WebQual has completed initial development and refinement, it is now appropriate to move to these broader settings and investigate some other important issues, such business-to-business (B2B) and non-commercial-to-consumer sites (N2C) (see Table 9). In addition, new technologies are ever expanding and broadening the

capabilities of Web sites. Subsequent WebQual research will fold in elements, such as audio and video Web applications.

Table 9: Future Research Issues and Questions

Issues	Questions
Industry norms	How and why Web sites differ on an industry level?
Frequent Web users	How and why do frequent Web site users differ in their determination of a high quality site than less frequent visitors?
Total quality	What are the dimensions of a firm's overall customer determined quality? How does WebQual contribute to this overall measure
Alternative types of Web sites	Do the same WebQual dimensions apply to business-to-business (B2B) and non-commercial (N2C), such as government and non-profit organizations, sites?
Dimensional hierarchy	Is there a hierarchy to WebQual's dimensions?
Gender issues	How does gender influence the determination of Web site quality?
Cultural issues	How does national culture influence the determination of Web site quality?

CONCLUSION

In the age of the Internet and electronic commerce, MIS and marketing need a means of assessing the effectiveness of a Web site. Our efforts have produced, we believe, a valid and reliable instrument for measuring Web site quality. WebQual should be able to support a range of important MIS and marketing studies as researchers attempt to understand what contributes to success in the electronic marketspace. The research presents the beginning of a cumulative research program by the authors, and we hope others, to understand the nature and characteristics of high quality Web sites.

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Note To Reviewers Regarding Appendices:

We have included much information asked for by the reviewers so they can check various aspects of the analysis. However, we suggest that at most only Appendices 4, 5, 6, 7, 9, 10, 11, and 12, be included in the final paper. Due to the number of modifications, and deletion of variables, providing detailed results of each step would only confuse readers.

Appendix 1: Round 1 Item Purification

	Information quality				Functional Fit-to-task				Trust	Response Time	
	VAR26	**VAR41**	**VAR43**	**VAR45**	**VAR1**	**VAR6**	**VAR12**	**VAR14**	**VAR36**	**VAR7**	**VAR17**
VAR26	**1.00**	**0.76**	**0.70**	**0.73**	0.65	0.55	0.61	0.65	0.34	0.33	0.35
VAR41	**0.76**	**1.00**	**0.77**	**0.79**	0.71	0.65	0.67	0.76	0.38	0.36	0.35
VAR43	**0.70**	**0.77**	**1.00**	**0.79**	0.66	0.60	0.65	0.71	0.37	0.39	0.44
VAR45	**0.73**	**0.79**	**0.79**	**1.00**	0.71	0.63	0.70	0.74	0.41	0.37	0.41
VAR1	0.65	0.71	0.66	0.71	**1.00**	**0.72**	**0.75**	**0.81**	0.41	0.35	0.35
VAR6	0.55	0.65	0.60	0.63	**0.72**	**1.00**	**0.77**	**0.75**	0.34	0.31	0.27
VAR12	0.61	0.67	0.65	0.70	**0.75**	**0.77**	**1.00**	**0.81**	0.38	0.36	0.34
VAR14	0.65	0.76	0.71	0.74	**0.81**	**0.75**	**0.81**	**1.00**	0.40	0.38	0.39
VAR36	0.34	0.38	0.37	0.41	0.41	0.34	0.38	0.40	**1.00**	0.31	0.27
VAR7	0.33	0.36	0.39	0.37	0.35	0.31	0.36	0.38	0.31	**1.00**	**0.72**
VAR17	0.35	0.35	0.44	0.41	0.35	0.27	0.34	0.39	0.27	**0.72**	**1.00**
VAR11	0.40	0.39	0.42	0.46	0.44	0.35	0.40	0.42	0.31	0.36	0.32
VAR13	0.48	0.51	0.56	0.57	0.51	0.44	0.48	0.57	0.40	0.45	0.47
VAR35	0.44	0.48	0.54	0.52	0.49	0.37	0.47	0.50	0.42	0.41	0.45
VAR15	0.46	0.49	0.46	0.51	0.42	0.41	0.39	0.44	0.26	0.26	0.32
VAR74	0.41	0.39	0.41	0.44	0.41	0.32	0.37	0.41	0.30	0.28	0.31
VAR39	0.39	0.41	0.47	0.47	0.41	0.30	0.36	0.41	0.42	0.34	0.41
VAR53	0.35	0.34	0.41	0.42	0.38	0.29	0.29	0.33	0.31	0.33	0.34
VAR58	0.39	0.40	0.44	0.47	0.37	0.36	0.40	0.40	0.33	0.36	0.33
VAR25	0.43	0.39	0.44	0.45	0.34	0.27	0.36	0.38	0.30	0.24	0.31
VAR33	0.44	0.41	0.45	0.46	0.35	0.30	0.35	0.37	0.29	0.23	0.29
VAR73	0.37	0.38	0.42	0.41	0.29	0.29	0.32	0.35	0.22	0.24	0.28
VAR77	0.37	0.39	0.45	0.41	0.35	0.35	0.37	0.37	0.24	0.23	0.26
VAR44	0.47	0.46	0.50	0.53	0.42	0.38	0.45	0.46	0.31	0.24	0.29
VAR85	0.44	0.45	0.47	0.48	0.37	0.31	0.38	0.39	0.26	0.18	0.26

	Information quality				Functional Fit-to-task				Trust	Response Time	
VAR59	0.29	0.29	0.28	0.30	0.29	0.30	0.33	0.32	0.29	0.24	0.16
VAR61	0.41	0.44	0.40	0.41	0.42	0.38	0.42	0.41	0.32	0.27	0.20
VAR63	0.42	0.44	0.44	0.42	0.44	0.38	0.45	0.44	0.32	0.24	0.21
VAR62	0.56	0.59	0.59	0.62	0.51	0.47	0.51	0.53	0.32	0.34	0.37
VAR64	0.46	0.46	0.49	0.51	0.43	0.36	0.41	0.44	0.31	0.31	0.31
VAR67	0.58	0.64	0.62	0.64	0.60	0.51	0.56	0.61	0.32	0.34	0.35
VAR47	0.37	0.34	0.27	0.36	0.31	0.22	0.28	0.30	0.19	0.24	0.27
VAR79	0.54	0.56	0.53	0.58	0.57	0.45	0.48	0.56	0.38	0.28	0.29
VAR86	0.36	0.36	0.35	0.35	0.38	0.32	0.34	0.36	0.29	0.23	0.23
VAR69	0.49	0.57	0.54	0.52	0.55	0.49	0.49	0.54	0.39	0.31	0.33
VAR76	0.43	0.49	0.50	0.49	0.48	0.47	0.47	0.51	0.28	0.27	0.25
VAR83	0.47	0.54	0.54	0.55	0.57	0.46	0.48	0.52	0.36	0.30	0.28

	Intuitive Operations			Tailored Communications		Ease of Understanding			Entertainment					
	VAR11	**VAR13**	**VAR35**	**VAR15**	**VAR74**	**VAR39**	**VAR53**	**VAR58**	**VAR25**	**VAR33**	**VAR73**	**VAR77**	**VAR44**	**VAR85**
VAR26	0.40	0.48	0.44	0.46	0.41	0.39	0.35	0.39	0.43	0.44	0.37	0.37	0.47	0.44
VAR41	0.39	0.51	0.48	0.49	0.39	0.41	0.34	0.40	0.39	0.41	0.38	0.39	0.46	0.45
VAR43	0.42	0.56	0.54	0.46	0.41	0.47	0.41	0.44	0.44	0.45	0.42	0.45	0.50	0.47
VAR45	0.46	0.57	0.52	0.51	0.44	0.47	0.42	0.47	0.45	0.46	0.41	0.41	0.53	0.48
VAR1	0.44	0.51	0.49	0.42	0.41	0.41	0.38	0.37	0.34	0.35	0.29	0.35	0.42	0.37
VAR6	0.35	0.44	0.37	0.41	0.32	0.30	0.29	0.36	0.27	0.30	0.29	0.35	0.38	0.31
VAR12	0.40	0.48	0.47	0.39	0.37	0.36	0.29	0.40	0.36	0.35	0.32	0.37	0.45	0.38
VAR14	0.42	0.57	0.50	0.44	0.41	0.41	0.33	0.40	0.38	0.37	0.35	0.37	0.46	0.39
VAR36	0.31	0.40	0.42	0.26	0.30	0.42	0.31	0.33	0.30	0.29	0.22	0.24	0.31	0.26
VAR7	0.36	0.45	0.41	0.26	0.28	0.34	0.33	0.36	0.24	0.23	0.24	0.23	0.24	0.18
VAR17	0.32	0.47	0.45	0.32	0.31	0.41	0.34	0.33	0.31	0.29	0.28	0.26	0.29	0.26
VAR11	**1.00**	**0.61**	**0.58**	0.27	0.29	0.47	0.43	0.45	0.30	0.28	0.25	0.23	0.25	0.19
VAR13	**0.61**	**1.00**	**0.72**	0.33	0.31	0.52	0.40	0.51	0.34	0.33	0.30	0.27	0.37	0.27
VAR35	**0.58**	**0.72**	**1.00**	0.35	0.36	0.60	0.46	0.57	0.41	0.42	0.36	0.29	0.38	0.33
VAR15	0.27	0.33	0.35	**1.00**	**0.38**	0.33	0.28	0.34	0.49	0.46	0.45	0.45	0.46	0.56
VAR74	0.29	0.31	0.36	**0.38**	**1.00**	0.35	0.32	0.29	0.46	0.45	0.45	0.43	0.48	0.52
VAR39	0.47	0.52	0.60	0.33	0.35	**1.00**	**0.61**	**0.57**	0.49	0.49	0.39	0.30	0.35	0.33
VAR53	0.43	0.40	0.46	0.28	0.32	**0.61**	**1.00**	**0.53**	0.38	0.40	0.32	0.33	0.27	0.34
VAR58	0.45	0.51	0.57	0.34	0.29	**0.57**	**0.53**	**1.00**	0.36	0.41	0.37	0.34	0.37	0.31
VAR25	0.30	0.34	0.41	0.49	0.46	0.49	0.38	0.36	**1.00**	**0.80**	**0.69**	**0.55**	**0.52**	**0.59**
VAR33	0.28	0.33	0.42	0.46	0.45	0.49	0.40	0.41	**0.80**	**1.00**	**0.65**	**0.52**	**0.53**	**0.56**
VAR73	0.25	0.30	0.36	0.45	0.45	0.39	0.32	0.37	**0.69**	**0.65**	**1.00**	**0.53**	**0.48**	**0.54**
VAR77	0.23	0.27	0.29	0.45	0.43	0.30	0.33	0.34	**0.55**	**0.52**	**0.53**	**1.00**	**0.53**	**0.64**
VAR44	0.25	0.37	0.38	0.46	0.48	0.35	0.27	0.37	**0.52**	**0.53**	**0.48**	**0.53**	**1.00**	**0.64**
VAR85	0.19	0.27	0.33	0.56	0.52	0.33	0.34	0.31	**0.59**	**0.56**	**0.54**	**0.64**	**0.64**	**1.00**
VAR59	0.24	0.25	0.23	0.34	0.22	0.17	0.12	0.24	0.28	0.29	0.22	0.27	0.35	0.31

	Intuitive Operations			Tailored Communications		Ease of Understanding			Entertainment					
VAR61	0.27	0.28	0.31	0.41	0.34	0.27	0.24	0.27	0.33	0.37	0.36	0.32	0.38	0.43
VAR63	0.29	0.30	0.31	0.46	0.37	0.30	0.30	0.32	0.38	0.39	0.40	0.34	0.42	0.48
VAR62	0.40	0.42	0.48	0.46	0.45	0.45	0.46	0.49	0.45	0.46	0.45	0.43	0.45	0.50
VAR64	0.28	0.34	0.35	0.38	0.43	0.37	0.36	0.41	0.42	0.43	0.43	0.39	0.46	0.43
VAR67	0.35	0.42	0.45	0.54	0.44	0.39	0.40	0.44	0.48	0.49	0.47	0.47	0.51	0.55
VAR47	0.37	0.39	0.44	0.19	0.30	0.34	0.27	0.32	0.28	0.30	0.24	0.20	0.25	0.26
VAR79	0.39	0.40	0.45	0.38	0.45	0.42	0.38	0.40	0.37	0.33	0.29	0.36	0.43	0.37
VAR86	0.29	0.33	0.36	0.25	0.30	0.28	0.24	0.30	0.27	0.27	0.21	0.32	0.32	0.32
VAR69	0.46	0.52	0.49	0.33	0.34	0.40	0.37	0.38	0.32	0.32	0.30	0.33	0.35	0.30
VAR76	0.37	0.41	0.39	0.32	0.36	0.41	0.38	0.38	0.31	0.33	0.29	0.32	0.32	0.32
VAR83	0.37	0.40	0.47	0.37	0.42	0.40	0.42	0.39	0.32	0.32	0.29	0.35	0.37	0.36

	Emotional Appeal			Consistent Image			Relative Advantage			On-line Completeness		
	VAR59	**VAR61**	**VAR63**	**VAR62**	**VAR64**	**VAR67**	**VAR47**	**VAR79**	**VAR86**	**VAR69**	**VAR76**	**VAR83**
VAR26	0.29	0.41	0.42	0.56	0.46	0.58	0.37	0.54	0.36	0.49	0.43	0.47
VAR41	0.29	0.44	0.44	0.59	0.46	0.64	0.34	0.56	0.36	0.57	0.49	0.54
VAR43	0.28	0.40	0.44	0.59	0.49	0.62	0.27	0.53	0.35	0.54	0.50	0.54
VAR45	0.30	0.41	0.42	0.62	0.51	0.64	0.36	0.58	0.35	0.52	0.49	0.55
VAR1	0.29	0.42	0.44	0.51	0.43	0.60	0.31	0.57	0.38	0.55	0.48	0.57
VAR6	0.30	0.38	0.38	0.47	0.36	0.51	0.22	0.45	0.32	0.49	0.47	0.46
VAR12	0.33	0.42	0.45	0.51	0.41	0.56	0.28	0.48	0.34	0.49	0.47	0.48
VAR14	0.32	0.41	0.44	0.53	0.44	0.61	0.30	0.56	0.36	0.54	0.51	0.52
VAR36	0.29	0.32	0.32	0.32	0.31	0.32	0.19	0.38	0.29	0.39	0.28	0.36
VAR7	0.24	0.27	0.24	0.34	0.31	0.34	0.24	0.28	0.23	0.31	0.27	0.30
VAR17	0.16	0.20	0.21	0.37	0.31	0.35	0.27	0.29	0.23	0.33	0.25	0.28
VAR11	0.24	0.27	0.29	0.40	0.28	0.35	0.37	0.39	0.29	0.46	0.37	0.37
VAR13	0.25	0.28	0.30	0.42	0.34	0.42	0.39	0.40	0.33	0.52	0.41	0.40
VAR35	0.23	0.31	0.31	0.48	0.35	0.45	0.44	0.45	0.36	0.49	0.39	0.47
VAR15	0.34	0.41	0.46	0.46	0.38	0.54	0.19	0.38	0.25	0.33	0.32	0.37
VAR74	0.22	0.34	0.37	0.45	0.43	0.44	0.30	0.45	0.30	0.34	0.36	0.42
VAR39	0.17	0.27	0.30	0.45	0.37	0.39	0.34	0.42	0.28	0.40	0.41	0.40
VAR53	0.12	0.24	0.30	0.46	0.36	0.40	0.27	0.38	0.24	0.37	0.38	0.42
VAR58	0.24	0.27	0.32	0.49	0.41	0.44	0.32	0.40	0.30	0.38	0.38	0.39
VAR25	0.28	0.33	0.38	0.45	0.42	0.48	0.28	0.37	0.27	0.32	0.31	0.32
VAR33	0.29	0.37	0.39	0.46	0.43	0.49	0.30	0.33	0.27	0.32	0.33	0.32
VAR73	0.22	0.36	0.40	0.45	0.43	0.47	0.24	0.29	0.21	0.30	0.29	0.29
VAR77	0.27	0.32	0.34	0.43	0.39	0.47	0.20	0.36	0.32	0.33	0.32	0.35
VAR44	0.35	0.38	0.42	0.45	0.46	0.51	0.25	0.43	0.32	0.35	0.32	0.37
VAR85	0.31	0.43	0.48	0.50	0.43	0.55	0.26	0.37	0.32	0.30	0.32	0.36
VAR59	**1.00**	**0.59**	**0.60**	0.27	0.21	0.32	0.10	0.19	0.23	0.27	0.21	0.32
VAR61	**0.59**	**1.00**	**0.81**	0.40	0.36	0.51	0.16	0.34	0.29	0.33	0.29	0.37
VAR63	**0.60**	**0.81**	**1.00**	0.45	0.38	0.55	0.16	0.37	0.30	0.36	0.32	0.40

	Emotional Appeal			Consistent Image			Relative Advantage			On-line Completeness		
VAR62	0.27	0.40	0.45	**1.00**	**0.58**	**0.66**	0.33	0.53	0.38	0.50	0.43	0.51
VAR64	0.21	0.36	0.38	**0.58**	**1.00**	**0.59**	0.25	0.48	0.24	0.33	0.32	0.41
VAR67	0.32	0.51	0.55	**0.66**	**0.59**	**1.00**	0.34	0.54	0.36	0.48	0.42	0.52
VAR47	0.10	0.16	0.16	0.33	0.25	0.34	**1.00**	**0.46**	**0.40**	0.31	0.31	0.32
VAR79	0.19	0.34	0.37	0.53	0.48	0.54	**0.46**	**1.00**	**0.51**	0.49	0.49	0.59
VAR86	0.23	0.29	0.30	0.38	0.24	0.36	**0.40**	**0.51**	**1.00**	0.34	0.37	0.43
VAR69	0.27	0.33	0.36	0.50	0.33	0.48	0.31	0.49	0.34	**1.00**	**0.55**	**0.54**
VAR76	0.21	0.29	0.32	0.43	0.32	0.42	0.31	0.49	0.37	**0.55**	**1.00**	**0.54**
VAR83	0.32	0.37	0.40	0.51	0.41	0.52	0.32	0.59	0.43	**0.54**	**0.54**	**1.00**

Appendix 2: Round 1 Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
VAR3	1	7	6.07	1.18
VER4	1	7	5.43	1.67
VAR4ORIG	1	7	2.57	1.67
VAR5	1	7	5.51	1.36
VAR5ORIG	1	7	2.49	1.36
VAR6	1	7	5.14	1.60
VAR7	1	7	5.47	1.42
VAR8	1	7	5.26	1.45
VAR9	1	7	4.92	1.48
VAR10	1	7	5.18	1.50
VAR11	1	7	6.05	1.14
VAR12	1	7	5.02	1.46
VAR13	1	7	5.87	1.20
VAR14	1	7	5.26	1.56
VAR15	1	7	4.44	1.45
VAR16	1	7	5.48	1.44
VAR17	1	7	5.59	1.44
VAR18	1	7	5.56	1.45
VAR19	1	7	5.57	1.40
VAR20	1	7	5.62	1.47
VAR21	1	7	5.33	1.36
VAR22	1	7	5.05	1.56
VAR23	1	7	5.04	1.46
VAR24	1	7	4.77	1.76
VAR24ORG	1	7	3.23	1.76
VAR25	1	7	4.85	1.41
VAR26	1	7	5.05	1.42
VAR27	1	7	5.39	1.19
VAR28	1	7	5.21	1.38
VAR29	1	7	5.59	1.43
VAR30	1	7	4.79	1.58
VAR31	1	7	4.61	1.54
VAR32	1	7	5.27	1.20
VAR33	1	7	4.93	1.42
VAR34	1	7	5.36	1.19
VAR35	1	7	5.78	1.20
VAR36	1	7	4.81	1.53
VAR37	1	7	5.02	1.50
VAR38	1	7	5.59	1.45
VAR39	1	7	5.74	1.19
VAR40	1	7	4.02	1.57
VAR40ORG	1	7	3.98	1.57
VAR41	1	7	5.06	1.60
VAR42	1	7	5.64	1.25
VAR43	1	7	5.29	1.39
VAR44	1	7	4.65	1.37
VAR45	1	7	5.25	1.32

VAR46	1	7	3.73	1.53
VAR46ORG	1	7	4.27	1.53
VAR47	1	7	5.97	1.51
VAR48	1	7	5.15	1.59
VAR48ORG	1	7	2.85	1.59
VAR49	1	7	4.91	1.50
VAR49ORG	1	7	3.09	1.50
VAR50	1	7	4.81	1.62
VAR51	1	7	5.49	1.27
VAR52	1	7	4.07	1.48
VAR53	1	7	5.77	1.25
VAR54	1	7	5.23	1.53
VAR55	1	7	3.46	1.49
VAR56	1	7	5.33	1.24
VAR57	1	7	2.89	1.56
VAR58	1	7	5.69	1.25
VAR59	1	7	3.80	1.47
VAR60	1	7	5.70	1.33
VAR61	1	7	4.21	1.39
VAR62	1	7	5.40	1.21
VAR63	1	7	4.14	1.37
VAR64	1	7	5.06	1.26
VAR65	1	7	3.57	1.41
VAR66	1	7	5.12	1.32
VAR67	1	7	5.03	1.42
VAR68	1	7	5.27	1.31
VAR69	1	7	5.61	1.61
VAR70	1	7	5.41	1.35
VAR71	1	7	5.31	1.52
VAR72	1	7	5.32	1.37
VAR73	1	7	4.94	1.60
VAR74	1	7	4.93	1.36
VAR75	1	7	5.43	1.32
VAR76	1	7	5.64	1.57
VAR77	1	7	4.54	1.40
VAR78	1	7	5.11	1.46
VAR79	1	7	5.27	1.51
VAR80	1	7	5.18	1.31
VAR81	1	7	4.13	1.46
VAR82	1	7	4.84	1.48
VAR83	1	7	5.32	1.50
VAR84	1	7	5.05	1.46
VAR85	1	7	4.62	1.42
VAR86	1	7	5.20	1.53
VAR87	1	7	3.83	1.53
VAR88	1	7	5.21	1.65

Appendix 3: Round 2 Descriptive Statistics*

	Minimum	Maximum	Mean	Std. Deviation
CI1	1	7	4.46	1.64
FTT1	1	7	5.03	1.64
CI2	1	7	4.50	1.58
INTUIT1	1	7	5.85	1.47
FTT2	1	7	5.11	1.90
RESP1	1	7	4.91	1.65
FTT3	1	7	5.10	1.64
TC1	1	7	5.04	1.50
FTT4	1	7	4.80	1.45
CI3	1	7	4.37	1.59
INTUIT2	1	7	6.05	1.21
FTT5	1	7	4.86	1.49
INTUIT3	1	7	5.57	1.45
FTT6	1	7	5.10	1.69
TC2	1	7	4.53	1.64
FTT7	1	7	5.17	1.63
RESP2	1	7	5.13	1.59
INFO1	1	7	5.29	1.57
TC3	1	7	4.97	1.51
INFO2	1	7	5.37	1.50
TC4	1	7	4.40	1.53
INFO3	1	7	4.99	1.62
CI4	1	7	4.87	1.27
TRUST1	1	7	4.94	1.55
VISUAL1	1	7	4.65	1.54
INFO4	1	7	4.88	1.55
CI5	1	7	4.63	1.56
INFO5	1	7	4.88	1.49
TC5	1	7	4.92	1.55
FTT8	1	7	4.71	1.51
RESP3	1	7	5.06	1.68
TRUST2	1	7	4.08	1.63
VISUAL2	1	7	4.60	1.50
INFO6	1	7	5.25	1.22
INTUIT4	1	7	5.46	1.48
TRUST3	1	7	4.33	1.53
INNOV1	1	7	4.12	1.55
INFO7	1	7	5.13	1.70
DESIGN1	1	7	5.52	1.23
RA1	1	7	4.80	1.70
INFO8	1	7	4.72	1.65
RESP4	1	7	5.08	1.65
INFO9	1	7	4.89	1.48
INNOV2	1	7	4.32	1.42
INFO10	1	7	4.98	1.49
INNOV3	1	7	3.10	1.43

RA2	1	7	5.70	1.70
FTT9	1	7	4.99	1.63
CI6	1	7	4.85	1.27
TRUST4	1	7	4.30	1.54
OC1	1	7	4.97	1.69
DESIGN2	1	7	5.84	1.16
FTT10	1	7	5.10	1.68
OC2	1	7	4.80	1.61
INFO11	1	7	5.11	1.16
EA1	1	7	2.60	1.45
DESIGN3	1	7	5.37	1.45
EA2	1	7	3.32	1.47
DESIGN4	1	7	5.44	1.59
EA3	1	7	3.88	1.48
CI7	1	7	4.93	1.26
EA4	1	7	3.85	1.51
CI8	1	7	4.74	1.25
EA5	1	7	3.33	1.47
CI9	1	7	4.46	1.54
VISUAL3	1	7	5.11	1.49
OC3	1	7	5.24	1.64
RESP5	1	7	4.99	1.64
RA3	1	7	5.08	1.71
VISUAL4	1	7	4.65	1.55
TC6	1	7	5.00	1.49
INFO12	1	7	5.15	1.51
OC4	1	7	5.66	1.60
INNOV4	1	7	4.18	1.51
RA4	1	7	5.08	1.61
TRUST5	1	7	4.45	1.55
CI10	1	7	4.73	1.22
INNOV5	1	7	4.22	1.52
RA5	1	7	5.03	1.53
VISUAL5	1	7	4.63	1.40
DESIGN5	1	7	4.96	1.44
OC5	1	7	5.16	1.53
INTUIT5	1	7	4.49	1.39

*Key:

DESIGN = Ease of Understanding	INNOV = Innovativeness
INTUIT = Intuitive Operations	EA = Emotional Appeal
INFO = Information Quality	OC = On-line Completeness
FTT = Functional Fit-to-task	CI = Consistent Image
TC = Tailored Communications	RA = Relative Advantage
TRUST = Trust	
RESP = Response Time	
VISUAL = Visual Appeal	

Appendix 4: Round 2 Exploratory Factor Analysis

Note: Eigenvalue cutoff = 1.00 (Additional cutoffs were explored, such as factor = 10, 11, and 12. However, factor loadings remained consistent. Items continued to load on between 8-9 factors with no loading on the remaining factors 10-12, above .5).

	1	2	3	4	5	6	7	8	9
INFO8	**0.795**	0.159	0.220	0.181	0.136	0.118	0.138	0.104	0.060
INFO3	**0.785**	0.188	0.237	0.088	0.130	0.106	0.124	0.077	0.132
TC5	**0.746**	0.226	0.173	0.090	0.027	0.105	0.131	0.189	0.070
INFO10	**0.740**	0.171	0.210	0.222	0.130	0.166	0.181	0.203	0.147
INFO1	**0.734**	0.127	0.167	0.155	0.138	0.126	0.130	-0.058	0.280
INFO2	**0.712**	0.079	0.176	0.125	0.129	0.105	0.170	-0.076	0.271
RA1	**0.702**	0.206	0.361	0.137	0.078	0.097	0.063	0.124	0.095
INFO4	**0.690**	0.158	0.135	0.178	0.176	0.147	0.117	0.082	0.193
INFO9	**0.688**	0.233	0.108	0.221	0.206	0.242	0.143	0.123	0.057
FTT8	**0.686**	0.279	0.253	0.138	0.203	0.094	0.238	0.160	0.077
INFO5	**0.678**	0.248	0.135	0.214	0.078	0.185	0.077	0.136	0.220
INFO7	**0.674**	0.267	0.185	0.166	0.070	0.179	0.094	0.063	0.087
FTT7	**0.667**	0.277	0.250	0.134	0.138	0.103	0.152	0.277	0.033
FTT4	**0.666**	0.252	0.301	0.167	0.205	0.146	0.125	0.154	0.046
FTT6	**0.662**	0.161	0.247	0.063	0.201	0.148	0.157	0.275	0.170
FTT10	**0.660**	0.040	0.127	0.159	0.120	0.057	0.198	0.213	0.127
FTT9	**0.656**	0.211	0.093	0.081	0.119	0.088	0.083	0.050	0.102
FTT5	**0.647**	0.224	0.335	0.070	0.193	0.189	0.157	0.189	0.043
TC1	**0.639**	0.206	0.176	0.210	0.067	0.089	0.071	0.217	0.118
INFO12	**0.621**	0.244	0.227	0.172	0.123	0.148	0.229	0.306	0.148
TC3	**0.621**	0.305	0.296	0.186	0.076	0.106	0.118	0.152	0.094
FTT2	**0.614**	0.168	0.254	0.002	0.121	0.089	0.186	0.153	0.105
CI1	**0.609**	0.326	0.168	0.289	0.121	0.156	0.162	0.226	0.028
TC2	**0.595**	0.239	0.176	0.217	0.042	0.097	0.047	0.168	-0.041
CI2	**0.592**	0.376	0.239	0.265	0.113	0.115	0.197	0.184	0.030
FTT1	**0.568**	0.212	0.421	0.036	0.236	0.177	0.136	0.213	0.097
CI5	**0.566**	0.415	0.155	0.333	0.127	0.162	0.133	0.181	0.062
FTT3	**0.541**	0.161	0.399	0.040	0.224	0.098	0.136	0.193	0.068
CI3	**0.526**	0.349	0.243	0.316	0.111	0.150	0.215	0.185	-0.015
RA4	**0.526**	0.179	0.474	0.203	0.079	0.234	0.089	0.094	0.179
INFO6	**0.523**	-0.037	0.205	0.443	0.161	0.263	0.138	0.004	0.197
TC4	**0.502**	0.371	0.237	0.184	0.128	0.052	0.199	0.220	-0.054
CI9	0.492	0.418	0.122	0.343	0.062	0.150	0.146	0.147	0.025
INFO11	0.485	0.042	0.125	0.347	0.171	0.391	0.171	0.086	0.263
TC6	0.478	0.409	0.267	0.177	0.133	0.132	0.155	0.156	-0.003
INTUIT5	0.465	0.337	0.106	0.206	0.095	0.234	0.254	0.225	0.173
VISUAL2	0.203	**0.756**	0.062	0.152	0.139	0.197	0.149	0.137	0.177
VISUAL5	0.275	**0.747**	0.111	0.192	0.012	0.167	0.193	0.104	0.139
VISUAL1	0.220	**0.703**	0.008	0.112	0.106	0.214	0.147	0.213	0.208
VISUAL4	0.106	**0.684**	0.089	0.114	0.105	0.058	0.263	-0.020	0.123
INNOV5	0.345	**0.678**	0.132	0.194	0.091	0.079	0.232	0.030	0.099
INNOV4	0.353	**0.671**	0.112	0.287	0.096	0.135	0.184	0.063	0.088
INNOV1	0.426	**0.608**	0.127	0.274	0.097	0.156	0.262	0.071	0.019
DESIGN5	0.373	**0.529**	0.211	0.279	0.084	0.212	0.117	0.152	0.257

	1	2	3	4	5	6	7	8	9
INNOV2	0.486	**0.503**	0.169	0.191	0.080	0.230	0.084	0.064	0.093
VISUAL3	0.335	0.483	0.172	0.185	0.081	0.190	0.099	0.122	0.248
OC1	0.396	0.028	**0.680**	0.159	0.164	0.165	0.109	0.142	0.119
RA3	0.446	0.182	**0.646**	0.112	0.107	0.153	0.083	0.101	0.050
OC4	0.383	0.094	**0.594**	0.218	0.029	0.049	0.033	0.093	0.132
RA2	0.323	0.157	**0.591**	0.085	-0.034	0.205	0.087	-0.002	0.219
OC3	0.444	0.050	**0.587**	0.080	0.167	0.156	0.176	0.232	0.122
RA5	0.406	0.229	**0.583**	0.189	0.144	0.131	-0.017	0.088	0.094
OC2	0.411	0.033	**0.563**	0.127	0.161	0.189	0.200	0.157	-0.005
OC5	0.387	0.133	0.473	0.194	0.121	0.189	0.105	0.160	0.073
CI10	0.198	0.231	0.177	**0.800**	0.109	0.084	0.086	0.139	0.114
CI8	0.173	0.218	0.152	**0.751**	0.067	0.044	0.176	0.136	0.111
CI4	0.268	0.247	0.112	**0.729**	0.117	0.134	0.059	0.083	0.072
CI6	0.249	0.209	0.057	**0.680**	0.105	0.116	0.122	0.068	-0.014
CI7	0.348	0.281	0.180	**0.672**	0.140	0.101	0.085	0.073	0.134
RESP3	0.127	0.055	0.044	0.035	**0.864**	0.053	0.079	0.081	-0.009
RESP2	0.213	0.105	0.050	0.120	**0.852**	0.070	0.066	0.166	0.107
RESP1	0.191	0.151	0.132	0.157	**0.823**	0.084	0.108	0.112	0.062
RESP4	0.099	0.051	0.074	0.025	**0.814**	0.085	0.063	0.049	0.131
RESP5	0.275	0.114	0.152	0.165	**0.779**	0.132	0.082	0.081	0.040
TRUST5	0.185	0.196	0.105	0.065	0.071	**0.842**	0.083	-0.040	0.031
TRUST4	0.156	0.204	0.116	0.121	0.064	**0.834**	0.115	0.063	0.070
TRUST3	0.229	0.160	0.168	0.113	0.135	**0.801**	0.129	0.130	0.069
TRUST2	0.203	0.141	0.235	0.081	0.109	**0.772**	0.160	0.158	0.049
TRUST1	0.346	0.247	0.168	0.162	0.130	**0.505**	0.105	0.222	0.137
EA5	0.199	0.203	0.063	0.087	0.146	0.179	**0.750**	0.096	-0.019
EA4	0.349	0.241	0.121	0.108	0.020	0.141	**0.739**	0.100	0.114
EA3	0.314	0.277	0.162	0.100	0.126	0.168	**0.715**	0.099	0.132
EA2	0.224	0.328	0.153	0.156	0.079	0.108	**0.697**	0.051	0.022
EA1	0.214	0.244	0.022	0.165	0.128	0.066	**0.515**	-0.089	-0.007
INTUIT1	0.325	0.145	0.136	0.107	0.159	0.091	-0.002	**0.766**	0.112
INTUIT2	0.237	0.080	0.216	0.131	0.108	0.129	0.057	**0.734**	0.231
INTUIT3	0.377	0.181	0.113	0.155	0.286	0.100	0.055	**0.658**	0.264
INTUIT4	0.322	0.185	0.146	0.198	0.198	0.138	0.176	**0.588**	0.298
DESIGN2	0.200	0.243	0.125	0.021	0.102	0.023	0.002	0.162	**0.701**
DESIGN1	0.272	0.280	0.164	0.117	0.184	0.158	0.042	0.223	**0.619**
DESIGN3	0.326	0.217	0.147	0.259	0.072	0.126	0.107	0.307	**0.586**
DESIGN4	0.301	0.207	0.201	0.211	0.098	0.109	0.072	0.327	**0.561**
INNOV3	-.179	-0.065	-0.080	-0.043	-0.085	-0.087	0.141	-0.061	0.024

Appendix 5: Round 2 Descriminant Validity Results

This appendix shows the results of the explicit tests of discriminant validity for five constructs which exhibited questionable discriminant validity in an EFA. The three columns present the fixed, relaxed, and fixed minus relaxed measurement chi-square value for each pair wise comparison model for the set of five possibly convergent WebQual constructs. The Comparative Fit Index (CFI) for each model is also given.

Based on these results Information quality and Fit-to-task should be combined into a single construct. All other constructs should remain distinct.

Measurement Model Comparisons (for possibly convergent construct)

Information Quality and Fit-to-Task			
	Fixed	**Relaxed**	□
□²	55.50	34.63	20.87
(p- value)	(0.000)	(0.000)	(<.005)
df	9	8	1
CFI	.99	.98	.01
Information Quality and Tailored Communications			
	Fixed	**Relaxed**	□
□²	42.58	12.15	30.43
(p- value)	(0.000)	(0.145)	(<.005)
df	9	8	1
CFI	1.00	.98	.02
On-line Completeness and Relative Advantage			
	Fixed	**Relaxed**	□
□²	147.15	14.35	132.80
(p- value)	(0.000)	(0.073)	(<.005)
df	9	8	1
CFI	1.00	.91	.09
Visual Appeal and Innovativeness			
	Fixed	**Relaxed**	□
□²	286.45	31.91	254.54
(p- value)	(0.000)	(0.145)	(<.005)
df	9	8	1
CFI	.99	.88	.11

□² = Chi-square, df = degrees of freedom, CFI = Comparative Fit Index

Appendix 6: Round 2 Correlations of 12 Factors

	INFO	TC	TRUST	RESP	DESIGN	INTUIT	VISUAL	INNOV	EA	CI	RA	OC
INFO	1											
TC	.83	1										
TRUST	.43	.40	1									
RESP	.39	.32	.25	1								
DESIGN	.57	.58	.37	.34	1							
INTUIT	.56	.56	.32	.43	.61	1						
VISUAL	.52	.54	.46	.30	.55	.45	1					
INNOV	.63	.61	.44	.33	.51	.43	.75	1				
EA	.57	.52	.44	.32	.40	.35	.53	.62	1			
CI	.53	.53	.36	.32	.48	.45	.51	.60	.42	1		
RA	.68	.65	.43	.29	.49	.46	.44	.51	.42	.44	1	
OC	.69	.65	.40	.34	.50	.53	.38	.47	.44	.45	.73	1

Appendix 7: Sample of WebQual Instrument

Instructions:

Task: Go to **www.ozelink.com/ceedees**. Imagine it is your friend's birthday and you are searching for a good gift—a CD. Review the Web site as if you were considering what CD to buy your friend. You may scroll up and down the pages, click on links, and use any feature on the site. After reviewing the site, answer the questions below. You may refer back to the Web site while answering the questions.

Based on your review of the Web site, please **circle** the number that best describes how well each of the following attributes describes the Web site.

I. **Please circle the appropriate number for each question and respond to** ALL **statements**.

	Strongly disagree						Strongly agree
1. Most all business processes can be completed via the Web site.	1	2	3	4	5	6	7
2. The Web site design is innovative.	1	2	3	4	5	6	7
3. The Web site is easier to use then calling an organizational representative agent on the phone.	1	2	3	4	5	6	7
Etc.							

Appendix 8: WebQual Items by Construct

USEFULNESS:
Informational Fit-to-Task
The information on the Web site is pretty much what I need to carry out my tasks.
The Web site adequately meets my information needs.
The information on the Web site is effective.
Tailored Communications
The Web site allows me to interact with it to receive tailored information.
The Web site has interactive features, which help me accomplish my task.
I can interact with the Web site in order to get information tailored to my specific needs.
Trust
I feel safe in my transactions with the Web site.
I trust the Web site to keep my personal information safe.
I trust the Web site administrators will not misuse my personal information.
Response Time
When I use the Web site there is very little waiting time between my actions and the Web site's response.
The Web site loads quickly.
The Web site takes long to load.
EASE OF USE:
Ease of Understanding
The display pages within the Web site are easy to read.
The text on the Web site is easy to read.
The Web site labels are easy to understand.
Intuitive Operations
Learning to operate the Web site is easy for me.
It would be easy for me to become skillful at using the Web site.
I find the Web site easy to use.

ENTERTAINMENT:
Visual Appeal
The Web site is visually pleasing.
The Web site displays visually pleasing design.
The Web site is visually appealing.
Innovativeness
The Web site is innovative.
The Web site design is innovative.
The Web site is creative.
Emotional Appeal
I feel happy when I use the Web site.
I feel cheerful when I use the Web site.
I feel sociable when I use the Web site.
COMPLIMENTARY RELATIONSHIP:
Consistent Image
The Web site projects an image consistent with the company's image.
The Web site fits with my image of the company.
The Web site's image matches that of the company.
On-Line Completeness
The Web site allows transactions on-line.
All my business with the company can be completed via the Web site.
Most all business processes can be completed via the Web site.
Relative Advantage
It is easier to use the Web site to complete my business with the company than it is to telephone, fax, or mail a representative.
The Web site is easier to use then calling an organizational representative agent on the phone.
The Web site is an alternative to calling customer service or sales.

Appendix 9: Round 3 Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
INFO3	1	7	5.26	1.32
INFO8	1	7	5.23	1.31
INFO10	2	7	5.39	1.03
TC1	1	7	5.35	1.20
TC3	2	7	5.36	1.11
TC5	1	7	5.28	1.25
TRUST3	1	7	4.81	1.30
TRUST4	1	7	4.83	1.37
TRUST5	1	7	4.85	1.41
RESP1	1	7	5.19	1.33
RESP2	1	7	5.32	1.47
RESP3	1	7	4.96	1.64
RESP3OLD	1	7	3.04	1.64
DESIGN1	1	7	5.58	1.14
DESIGN2	1	7	5.69	1.20
DESIGN3	2	7	5.80	1.15
INTUIT1	3	7	5.87	1.05
INTUIT2	2	7	5.80	1.05
INTUIT3	2	7	5.58	1.19
VISUAL1	1	7	4.84	1.29
VISUAL2	1	7	4.86	1.34
VISUAL5	1	7	4.85	1.43
INNOV1	1	7	4.95	1.25
INNOV4	1	7	4.79	1.22
INNOV5	2	7	4.77	1.29
EA3	1	7	4.38	1.29
EA4	1	7	4.41	1.33
EA5	1	7	3.78	1.32
CI4	2	7	5.08	1.07
CI8	1	7	4.96	1.15
CI10	2	7	5.00	1.09
RA2	1	7	5.93	1.34
RA3	1	7	5.40	1.36
RA5	1	7	5.43	1.23
OC1	1	7	5.27	1.46
OC3	1	7	5.27	1.40
OC4	2	7	5.87	1.17

Appendix 10: Round 3 Correlation of 12 Factors

	INFO	TC	TRUST	RESP	DESIGN	INTUIT	VISUAL	INNOV	EA	CI	RA	OC
INFO	1.00	0.75	0.37	0.34	0.56	0.61	0.36	0.50	0.46	0.42	0.59	0.53
TC	0.75	1.00	0.40	0.31	0.56	0.62	0.42	0.55	0.47	0.48	0.55	0.52
TRUST	0.37	0.40	1.00	0.33	0.29	0.24	0.32	0.38	0.35	0.34	0.30	0.30
RESP	0.34	0.31	0.33	1.00	0.33	0.28	0.39	0.35	0.36	0.40	0.22	0.30
DESIGN	0.56	0.56	0.29	0.33	1.00	0.67	0.47	0.46	0.40	0.47	0.37	0.40
INTUIT	0.61	0.62	0.24	0.28	0.67	1.00	0.31	0.36	0.38	0.39	0.42	0.56
VISUAL	0.36	0.42	0.32	0.39	0.47	0.31	1.00	0.70	0.52	0.64	0.30	0.29
INNOV	0.50	0.55	0.38	0.35	0.46	0.36	0.70	1.00	0.60	0.60	0.37	0.39
EA	0.46	0.47	0.35	0.36	0.40	0.38	0.52	0.60	1.00	0.54	0.37	0.40
CI	0.42	0.48	0.34	0.40	0.47	0.39	0.64	0.60	0.54	1.00	0.41	0.39
RA	0.59	0.55	0.30	0.22	0.37	0.42	0.30	0.37	0.37	0.41	1.00	0.56
OC	0.53	0.52	0.30	0.30	0.40	0.56	0.29	0.39	0.40	0.39	0.56	1.00

Appendix 11: Round 3 Standardized Regression Weights

Standardized Regression Weights

			Estimate
INFO10	<--	INFOFTT	0.843
INFO8	<--	INFOFTT	0.805
INFO3	<--	INFOFTT	0.752
TC5	<--	INTR	0.755
TC3	<--	INTR	0.722
TC1	<--	INTR	0.800
TRUST5	<--	TRST	0.866
TRUST4	<--	TRST	0.968
TRUST3	<--	TRST	0.815
RESP3	<--	RSP	0.750
RESP2	<--	RSP	0.907
RESP1	<--	RSP	0.864
DESIGN3	<--	DSGN	0.771
DESIGN2	<--	DSGN	0.781
DESIGN1	<--	DSGN	0.814
INTUIT3	<--	INTT	0.700
INTUIT2	<--	INTT	0.782
INTUIT1	<--	INTT	0.718
VISUAL1	<--	VSL	0.943
VISUAL2	<--	VSL	0.915
VISUAL5	<--	VSL	0.828
INNOV1	<--	INNV	0.855
INNOV4	<--	INNV	0.821
INNOV5	<--	INNV	0.819
EA3	<--	EMTN	0.907
EA4	<--	EMTN	0.853
EA5	<--	EMTN	0.572
CI4	<--	CIOM	0.826
CI8	<--	CIOM	0.792
CI10	<--	CIOM	0.864
RA2	<--	READV	0.649
RA3	<--	READV	0.838
RA5	<--	READV	0.544
OC1	<--	OCST	0.876
OC3	<--	OCST	0.803
OC4	<--	OCST	0.645

Appendix 12: Measurement Model (Round 2)

Part 1: Allowing the construct pair to be distinct

Relaxed Chi-Squares (p-values)

	INFO	TC	TRUST	RESP	DESIGN	INTUIT	VISUAL	INNOV	EA
INFO									
TC	12.15 (0.145)								
TRUST	20.92 (0.007)	18.05 (0.021)							
RESP	14.90 (0.061)	23.83 (0.002)	31.33 (0.000)						
DESIGN	40.65 (0.000)	27.75 (0.001)	29.40 (0.000)	25.78 (0.001)					
INTUIT	28.99 (0.000)	24.62 (0.002)	42.36 (0.000)	65.74 (0.000)	84.24 (0.000)				
VISUAL	11.92 (0.155)	17.07 (0.029)	16.69 (0.034)	19.93 (0.011)	22.48 (0.004)	20.49 (0.009)			
INNOV	14.10 (0.079)	24.93 (0.002)	11.36 (0.182)	15.03 (0.059)	23.17 (0.003)	17.30 (0.027)	31.91 (0.000)		
EA	9.05 (0.338)	9.60 (0.294)	15.97 (0.042)	26.29 (0.001)	17.16 (0.028)	18.27 (0.019)	19.30 (0.013)	22.29 (0.004)	
CI	20.65 (0.008)	21.37 (0.006)	33.57 (0.000)	22.29 (0.004)	24.50 (0.002)	14.21 (0.076)	29.54 (0.000)	13.42 (0.098)	16.14 (0.040)
RA	11.28 (0.186)	25.22 (0.001)	21.29 (0.006)	23.26 (0.003)	32.32 (0.000)	18.99 (0.015)	16.33 (0.038)	8.23 (0.412)	9.26 (0.321)
OC	21.95 (0.005)	35.69 (0.000)	35.89 (0.000)	16.51 (0.036)	29.88 (0.000)	27.21 (0.001)	20.45 (0.009)	22.37 (0.002)	19.61 (0.012)
NOTE: df = 8									

	CI	RA	OC
RA	20.33 (0.009)		
OC	19.61 (0.012)	24.74 (0.002)	
NOTE: df = 8			

Part 2: Constraining the constructs to be identical

Fixed Chi-Squares (p-values)

	INFO	TC	TRUST	RESP	DESIGN	INTUIT	VISUAL	INNOV	EA
INFO									
TC	42.58 (0.000)								
TRUST	647.00 (0.000)	426.30 (0.000)							
RESP	625.75 (0.000)	453.18 (0.000)	599.10 (0.000)						
DESIGN	225.47 (0.000)	195.53 (0.000)	339.84 (0.000)	327.93 (0.000)					
INTUIT	417.74 (0.000)	343.81 (0.000)	572.21 (0.000)	501.08 (0.000)	466.45 (0.000)				
VISUAL	576.40 (0.000)	354.58 (0.000)	545.77 (0.000)	645.80 (0.000)	224.24 (0.000)	466.45 (0.000)			
INNOV	518.61 (0.000)	280.16 (0.000)	552.70 (0.000)	628.75 (0.000)	248.76 (0.000)	476.07 (0.000)	286.45 (0.000)		
EA	447.60 (0.000)	352.66 (0.000)	507.85 (0.000)	526.87 (0.000)	288.59 (0.000)	490.30 (0.000)	476.62 (0.000)	424.08 (0.000)	
CI	437.76 (0.000)	370.49 (0.000)	521.54 (0.000)	522.00 (0.000)	265.53 (0.000)	484.77 (0.000)	466.50 (0.000)	378.61 (0.000)	472.37 (0.000)
RA	161.12 (0.000)	161.18 (0.000)	362.03 (0.000)	390.90 (0.000)	251.93 (0.000)	337.97 (0.000)	353.43 (0.000)	297.64 (0.000)	342.69 (0.000)
OC	197.02 (0.000)	214.48 (0.000)	420.75 (0.000)	417.35 (0.000)	264.32 (0.000)	342.40 (0.000)	390.94 (0.000)	349.94 (0.000)	361.17 (0.000)
NOTE: df = 9									

	CI	RA	OC
RA	344.10 (0.000)		
OC	361.96 (0.000)	104.52 (0.000)	
NOTE: df = 9			

Part 3: Difference in Chi-Squares for Hierarchical Models, DF = 1

Fixed vs. Relaxed Chi-Squares (All relaxed models are statistically better than fixed models at the .005 level.)

	INFO	TC	TRUST	RESP	DESIGN	INTUIT	VISUAL	INNOV	EA
INFO									
TC	30.43								
TRUST	626.08	408.25							
RESP	610.85	429.35	567.77						
DESIGN	184.82	167.78	310.44	302.15					
INTUIT	388.75	319.19	529.85	435.34	382.21				
VISUAL	564.48	337.51	529.08	625.87	201.76	445.96			
INNOV	504.50	255.23	541.34	613.72	225.59	458.77	254.54		
EA	438.55	343.06	491.86	500.58	271.43	472.03	457.32	401.79	
CI	417.11	349.12	487.97	499.71	241.03	470.56	436.96	365.19	456.23
RA	149.84	135.96	340.74	367.64	219.61	318.98	337.10	289.41	333.43
OC	175.07	178.75	384.86	400.84	234.44	315.19	370.49	327.57	337.39

	CI	RA	OC
RA	323.77		
OC	342.35	79.78	