MIS Quarterly

RESEARCH ARTICLE

WHAT SIGNAL ARE YOU SENDING? HOW WEBSITE QUALITY INFLUENCES PERCEPTIONS OF PRODUCT QUALITY AND PURCHASE INTENTIONS

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Appendix A

Measures

Note: All items were measured with nine-point scales. Most were anchored with strongly disagree – strongly agree unless noted with an asterisk (*) and described below.

Security (Pavlou 2001)	
sec1	I am confident that the information I provide during my transaction will not reach inappropriate parties during storage in this retailer's databases.
sec2	I believe inappropriate parties cannot deliberately observe the information I provide during my transaction with this web retailer during transmission.
sec3	In my opinion, inappropriate parties will not collect and store the information I provide during my transaction with this web retailer.
Download Delay (Loiacono et al. 2007, Response time)	
dd1	When I use this website, there is very little time between my actions and the website's response.
dd2	The website loads quickly.
dd3	The website takes very little time to load.
Navigability (Salisbury et al. 2001)	
nav1	Navigating these web pages is easy for me.
nav2	I find that my interaction with this website is clear and understandable.
nav3	It is easy for me to become skillful at navigating the pages of this website.

Visual Appeal (Loiacono et al. 2007)	
vap1	The website is visually pleasing.
vap2	The website displays visually pleasing design.
vap3	The website is visually appealing.
Web Site Quality (adapted from Everard and Galletta 2005) *Items 1, 3 anchored with a semantic differential scale of very low quality, very high quality	
wsq1	Overall, how would you rate the quality of this website?
wsq2	All in all, I would rate the Totebags.com website as being of high quality.
wsq3	How would you rate the overall quality of the Totebags.com website?
Asymmetries of Information (new scale)	
pai1	I have a good idea of what the PRODUCTS (e.g., totebags, accessories, etc.) offered at Totebags.com look and feel like.
pai2	I have sufficient information about the PRODUCTS (e.g., totebags, accessories, etc.) offered at Totebags.com to evaluate them effectively and accurately.
pai3	I possess adequate knowledge about the PRODUCTS (e.g., totebags, accessories, etc.) offered at Totebags.com
Signal Credibility (new scale)	
sc1	Designing and maintaining a high quality commercial website takes significant effort and expense.
sc2	When I see a high quality commercial website, I assume that an organization must invest a lot of time and money to design and maintain it.
sc3	The design and maintenance of a high quality commercial website requires an organization to make a significant financial investment.
Product Quality (adapted from Boulding and Kirmani 1993; Rao et al. 1999)	
pq1	I perceive the PRODUCTS (e.g., totebags, accessories, etc.) offered at totebags.com to be durable.
pq2	Totebags.com PRODUCTS (e.g., totebags, accessories, etc.) appear to me to be well crafted.
pq3	I perceive the PRODUCTS (e.g., totebags, accessories, etc.) offered at totebags.com to be of high quality.
Behavioral Intention (adapted from Loiacono et al. 2007; Van der Heijden and Verhagen 2004) *All items anchored with a semantic differential scale of very unlikely – very likely	
bint1	Suppose you were in the market for a tote bag. How likely would you be to purchase a tote bag though this website?
bint2	Suppose you were in the market for a tote bag. How likely would you be to do business with Totebags.com via its website?
bint3	If you were in the market for a tote bag, what is the likelihood that you would use this website to purchase the tote bag?
Control Variables	
Computer Playfulness (Webster and Martocchio 1992) Items were anchored with strongly disagree – strongly agree. The following questions ask you how you characterize yourself when you use computers	
cp1	Playful
cp2	Flexible
cp3	Creative
Online Purchase Experience How many purchases have you made via the Internet?	

Appendix B

Experimental Materials

Interface Manipulations and Screenshots

WSQ Dimension	Manipulation Explanation		Sample Screen Shots	
	Low	High	Low	High
Security	A brief and conservative privacy/security policy is presented via the **Security & Privacy** link. For instance, the company reserves the right to sell and distribute customer information without explicit permission from the consumer. Also, NO security seals such as Truste® and Verisign® are present on the website	An extensive and assuring privacy/security policy is presented via the **Security & Privacy** link. For instance, consumers are assured that information is secure and not distributed without explicit permission. Also, security seals such as Truste® and Verisign® are present on the website.		
Download Delay	A 4-second download delay is coded into the design of the website. Users wait 4 seconds to access any page on the website.	No download delay coded into the design of the website.	N/A	N/A
Navigability	Less efficient and inconvenient design specifications are incorporated into the website. For example, users are forced to access a separate page when viewing a particular product color combination making. information gathering and navigability more cumbersome. Also, users are forced to re-enter the product information during the checkout process.	More efficient and convenient design specifications are incorporated into the website. For example, users can view various product color combinations on the same screen, making information gathering and navigability more efficient. Also, users are able to add a product to a shopping cart for later viewing/checkout.		
Visual Appeal	Unprofessional and unattractive aesthetics are used in the design of the website.	Professional and attractive aesthetics are used in the design of the website.		

Experimental Task Sheet: Website Assessment for Totebags.com

Part 1

Mary/Bob is a 21-year-old college student with a part-time job. She/He owns an older tote bag that is a little worn and isn't exactly the latest style. She/He has recently bought a new cell-phone and needs to purchase a cell-phone holster that she/he can use along with the bag. Mary/Bob plans to spend no more than $20 for the purchase of this new accessory and would like to get it ordered ASAP. After ordering her/his cell-phone holster, Mary/Bob would like to browse around the website to see if she/he can find something to replace his/her old, worn-out tote bag. Also, she/he wouldn't mind finding something that would conveniently store her/his MP3/iPod device. After work, Mary/Bob browses a tote bag retailer's website to (a) purchase her/his cell phone holster and (b) browse around and look for a new bag and an MP3/iPod case.

- Go to the following site and complete the survey: **http://.....research.com/pre/**
- Please type in the following URL and press ENTER: **http://.....research.com/v1/**

Part 2

When considering which website to buy from, Mary/Bob is mostly concerned about the security associated with it, the features that are provided to help with order processing, and the interface presentation. Please help Mary/Bob in determining whether he should make the purchase at this website. Below is a list of items that will help you in assessing the website. Please perform and check off each action as you go through the list.

		Check
1.	Make sure you are viewing the Totebags.com home page and that you've expanded the Internet Explorer window.	
2.	Click on **Accessories** on the top menu.	
3.	Click on the **Cell Phone Holster**.	
4.	Preview the cell phone holster in AT LEAST THREE different colors.	
5.	Pick a color that you like and add it to your shopping cart by clicking on **Add to Cart**. Once you're done, click **Close**.	
6.	You will now look at available bags. Click on **Messenger** on the top menu.	
7.	Click on a bag of your choice by clicking the **View** link.	
8.	Click on the **Open the bag**, **Front Pocket**, and **Features** links.	
9.	Preview AT LEAST THREE different color combinations.	
10.	Click on **Messenger** on the top menu again and click on a DIFFERENT bag of your choice by clicking the **View** link.	
11.	Preview AT LEAST THREE different color combinations.	
12.	Pick ANY bag you like and add it to your shopping cart by clicking on **Add to Cart**.	
13.	You will now select an iPod case. Click on **Accessories** on the top menu.	
14.	**Click on the iPod Case.**	
15.	Preview the iPod case in AT LEAST THREE different colors.	
16.	Pick a color that you like and add it to your shopping cart by clicking on **Add to Cart**. Once you're done, click **Close**.	
17.	Before checking out, you want to review the customer service information provided on the website. Click on **Service** at the top of the page.	
18.	Now, click on **Security & Privacy** and read the provided information.	
19.	You are now ready to checkout. Click on **Shopping Cart** on the top menu	
20.	Click **Check Out** (bottom of page).	
21.	Enter your **Billing Address**, **Email**, and **Shipping Address** and then click **Continue**.	
22.	Enter your Student ID no. (e.g. 12345678) as the **Coupon Number** and click **Continue** (bottom of pg).	
23.	At this point, you can close the window.	

Please go to **http://.....research.com/post/** to complete a survey related to this website.

Consumer Reports Articles

These articles were used only in Study 3.

Article Used in High SC Treatment

Business Brief

The eCommerce Interface: A Significant Investment

According to recent research, the costs associated with developing and maintaining a commercial website are not trivial. In fact, the investment is so significant, that eCommerce sales, on average, need to grow at a rate of 28% per year to recoup the initial development and ongoing maintenance costs. A survey of 250 eTailers was administered, which produced some interesting insights.

The human resource costs, typically web development expertise, have risen 22% each of the past 5 years. In addition, eTailers noted a serious shortage of competent web developers, which suggests that the dramatic increase in these labor costs will continue.

Further, hardware and software costs are significant. The licensing fees for web development software have increased 15% each of the past 5 years. Hardware costs such as web servers and backup facilities account for 23% of the average operating budget for an eCommerce website.

Industry analysts say that the results from this survey make an important point – Namely, a quality website represents a significant investment on the part of the organization, which must be recovered over a long period of time. Further, recovering such an investment requires that the organization attract and retain customers who will also provide positive word-of-mouth to potential customers. In short, the organization is in it for the long run….

Article Date: January, 8th 2008

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Article Used in Low SC Treatment

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Business Brief

The eCommerce Interface: Surprisingly Affordable

According to recent research, the costs associated with developing and maintaining a commercial website are surprisingly low. In fact, the investment is so small, that eCommerce sales, on average, need to grow at a rate of less than 1% per year to recoup the initial development and ongoing maintenance costs. A survey of 250 eTailers was administered, which produced some interesting insights.

The human resource costs, typically web development expertise, have seen an average decrease of 8% each of the past 5 years. In addition, eTailers noted the relative affordability and plentiful supply of talented web developers.

Further, hardware and software costs are relatively insignificant. The licensing fees for web development software have decreased 11% each of the past 5 years. Hardware costs, such as web servers', have seen a sharp decrease downward over the past 3 years.

Industry analysts say that the results from this survey make an important point – Namely, a seemingly high quality website does NOT represent a significant investment on the part of the organization and can often be recovered over a short period of time. Further, recovering such an investment does not necessarily require that the organization attract and retain long-term customers. In short, website visitors beware….

Article Date: January, 8th 2008

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Appendix C

Descriptive Statistics and Validation by Study

Study 1: Descriptive Statistics and Validation

Table C1. Study 1: Descriptive Statistics

Item	Min	Max	Mean	Std. Dev.	Item	Min	Max	Mean	Std. Dev.
sec1	1	9	4.47	2.723	pai1	1	9	3.26	2.331
sec2	1	9	4.59	2.637	pai2	1	9	3.53	2.272
sec3	1	9	4.48	2.563	pai3	1	9	3.40	2.209
dd1	1	9	4.79	2.718	sc1	1	9	7.10	1.417
dd2	1	9	4.68	2.766	sc2	2	9	6.98	1.369
dd3	1	9	4.79	2.715	sc3	1	9	6.45	1.610
nav1	1	9	7.20	1.626	ppq1	1	9	5.09	1.942
nav2	1	9	6.65	1.907	ppq2	1	9	5.08	1.997
nav3	1	9	7.22	1.581	ppq3	1	9	4.71	2.139
vap1	1	9	4.12	2.555	bi1	1	9	3.16	2.389
vap2	1	9	4.16	2.519	bi2	1	9	3.26	2.421
vap3	1	9	4.05	2.557	bi3	1	9	3.22	2.416
wsq1	1	9	4.08	2.350	cp1	1	9	6.23	1.758
wsq2	1	9	3.82	2.436	cp2	2	9	6.81	1.436
wsq3	1	9	3.98	2.274	cp3	2	9	6.58	1.680

sec = security, dd = download delay, nav = navigability, vap = visual appeal, wsq = perceived website quality, pai = product asymmetries of information, sc = signal credibility, ppq = perceived product quality, bi = behavioral intention, cp = computer playfulness

Table C2. Study 1: Treatment Descriptive Statistics

	Interface Treatments					
	A	B	C	D	E	F
Perceived (self-reported)	H-Sec H-DD H-Nav H- VAP	H-Sec L-DD L-Nav L- VAP	L-Sec H-DD L-Nav L-VAP	L-Sec L-DD H-Nav L- VAP	L-Sec L-DD L-Nav H- VAP	L-Sec L-DD L-Nav L- VAP
SEC	6.92	5.22	3.94	3.43	3.89	3.68
DD	7.93	3.52	6.80	3.69	3.52	3.08
NAV	8.20	6.20	6.64	7.12	7.31	6.66
VAP	7.33	2.81	3.15	3.02	5.48	2.88
WSQ	7.13	2.95	3.38	2.77	4.69	2.82
PAI	3.63	3.54	3.07	3.27	3.43	3.47
SC	6.79	6.96	6.93	6.64	6.83	6.93
PPQ	6.70	5.00	4.25	4.31	5.37	4.13
BI	5.97	2.70	2.47	2.23	3.14	2.78

Manipulation checks were performed by first running an ANOVA for each of the four web site quality treatments (security, download delay, navigability, visual appeal) where the treatment was the independent variable and the dependent variable (DV) was the scale measuring perceptions of that treatment. The respective scales are provided in Appendix A. As shown below, the manipulations were significant with a p-value < .001. A more rigorous form of manipulation check was also performed as recommended by Perdue and Summers (1986) by running ANOVAs in which all four treatments were included as main effects and the dependent variable was the scale measuring perceptions of each treatment. This approach was used to insure that each treatment effect remained significant in the presence of the other treatments. The results, provided below, show that each web site quality treatment had a significant effect on the related web site quality perceptions even in the presence of the other treatments.

Table C3. Study 1: Manipulation Checks

ANOVAs with One Treatment and One DV	Perceived Security		Download Delay		Perceived Navigability		Perceived Visual Appeal	
	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Security (high/low)	**56.83**	**.000**						
Download Delay (fast/slow)			**250.81**	**.000**				
Navigability (high/low)					**22.20**	**.000**		
Visual Appeal (high/low)							**172.55**	**.000**
ANOVAs with Four Treatments and One DV	**Perceived Security**		**Download Delay**		**Perceived Navigability**		**Perceived Visual Appeal**	
	F	**Sig.**	**F**	**Sig.**	**F**	**Sig.**	**F**	**Sig.**
Security (high/low)	**36.39**	**.000**	1.65	.201	.91	.341	1.78	.184
Download Delay (fast/slow)	4.43	.036	**193.62**	**.000**	1.36	.245	6.73	.010
Navigability (high/low)	.29	.590	3.83	.052	**11.86**	**.001**	4.42	.037
Visual Appeal (high/low)	3.81	.052	1.65	.201	19.03	.000	**125.06**	**.000**

Table C4. Study 1: Loadings and Cross-Loadings

	WSQ Dimensions (1st order constructs)				WSQ (2nd order)	PAI	SC	PPQ	BI	CP
	SEC	DD	NAV	VAP						
sec1	**.939**	.421	.281	.444	.573	.105	.069	.517	.569	.025
sec2	**.949**	.464	.338	.425	.579	.103	.038	.584	.579	-.033
sec3	**.962**	.466	.310	.512	.658	.050	.052	.596	.636	-.027
dd1	.467	**.938**	.360	.449	.539	-.019	.079	.408	.440	.010
dd2	.462	**.962**	.401	.441	.539	.015	.041	.407	.422	.004
dd3	.413	**.931**	.390	.383	.482	-.011	.046	.368	.422	-.018
nav1	.236	.373	**.897**	.298	.339	.047	-.080	.307	.259	.074
nav2	.372	.401	**.918**	.497	.510	.124	-.045	.511	.386	.076
nav3	.277	.331	**.904**	.324	.362	.110	-.024	.403	.284	.091
vap1	.483	.474	.410	**.977**	.843	.048	.006	.660	.691	.033
vap2	.494	.433	.404	**.979**	.834	.044	.018	.670	.681	.079
vap3	.429	.398	.383	**.946**	.785	.050	.017	.640	.615	.062
wsq1	.608	.535	.441	.816	**.978**	.034	.000	.711	.756	.009
wsq2	.624	.537	.438	.833	**.981**	.047	.042	.737	.792	.045
wsq3	.635	.548	.431	.845	**.981**	.063	.038	.739	.773	.069
pai1	.071	.008	.123	.010	.021	**.868**	.020	.046	.056	.164

Table C4. Study 1: Loadings and Cross-Loadings (Continued)										
	WSQ Dimensions (1st order constructs)				WSQ (2nd order)					
	SEC	DD	NAV	VAP		PAI	SC	PPQ	BI	CP
pai2	.096	.006	.092	.031	.030	**.910**	-.027	.056	.095	.121
pai3	.074	-.027	.064	.088	.079	**.902**	-.041	.083	.071	.100
sc1	.022	.058	-.028	-.018	-.010	-.003	**.849**	.098	-.008	.015
sc2	.032	-.010	-.062	.004	.018	-.021	**.886**	.118	.002	-.030
sc3	.091	.105	-.053	.050	.062	-.024	**.869**	.128	.032	.066
ppq1	.465	.349	.430	.531	.591	.019	.143	**.896**	.513	.114
ppq2	.559	.399	.405	.663	.724	.092	.103	**.941**	.640	.104
ppq3	.627	.411	.416	.688	.747	.080	.122	**.940**	.658	.062
bi1	.606	.417	.326	.655	.766	.085	.001	.622	**.969**	.073
bi3	.633	.474	.339	.676	.779	.091	.014	.646	**.983**	.105
bi4	.601	.441	.339	.681	.775	.068	.014	.652	**.985**	.091
cp2	.014	.002	.040	.086	.068	.116	.006	.085	.113	**.671**
cp5	-.028	.036	.081	.024	.017	.104	.021	.085	.050	**.821**
cp7	-.010	-.040	.081	.037	.020	.115	.016	.067	.059	**.824**

Table C5. Study 1: Construct Correlations, Reliabilities, and AVEs												
	CR	AVE	SEC	DD	NAV	VAP	WSQ	PAI	SC	PPQ	BI	CP
SEC	.965	.903	**.950**									
DD	.961	.890	.474	**.943**								
NAV	.933	.822	.326	.407	**.907**							
VAP	.978	.936	.485	.450	.412	**.967**						
WSQ	.986	.960	.635	.551	.446	.848	**.980**					
PAI	.923	.799	.090	-.005	.104	.049	.049	**.894**				
SC	.902	.754	.056	.059	-.055	.014	.027	-.019	**.868**			
PPQ	.947	.857	.596	.418	.450	.679	.744	.069	.132	**.926**		
BI	.986	.959	.626	.454	.342	.685	.790	.083	.010	.653	**.979**	
CP	.817	.600	-.012	-.002	.088	.060	.042	.143	.019	.101	.092	**.775**

Note: Square root of AVE shown on diagonal, CR = composite reliability, AVE = average variance extracted

Discussion of Loadings, Cross-Loadings, and Correlations

An examination of Table C4 shows that all items load strongly on the related construct and are at least an order of magnitude higher than any cross-loadings (Gefen and Straub, 2005). Table C5 shows that the AVE for each construct (rather than the less stringent square root of the AVE) is greater than the correlations with other constructs (Gefen and Straub, 2000). While these results support the discriminant validity of the model constructs, some higher cross-loadings and construct correlations exist with the WSQ construct (measured by the overall, three reflective items and shaded in Table C4), which is not unexpected given the central role of this second-order construct and the strength of some of the relationships in the structural regression model. We also assessed the level of multicollinearity among the constructs by regressing all measured variables on behavioral intention and found that the variance inflation factors (VIF) were all less than 6, substantially lower than the threshold of 10 that is generally recommended (Petter et al. 2007). A lower VIF threshold is recommended specifically for formative items and was met as further discussed below.

The analyses conducted in Studies 2 and 3 (and also the replication study described in Appendix F) do not use the self-reported, overall measure for WSQ or the measures of the WSQ dimensions (SEC, DD, NAV, VAP). Two treatments varying WSQ (high/low) are used instead and measures of WSQ are used for manipulation check purposes only. Studies 2 and 3 provide similar support for the hypothesized relationship between WSQ and PPQ. In addition, we considered alternative representations of WSQ that do not utilize the overall three-item measure, as described below, and found similar results.

Validation of WSQ as a Second-Order Formative Construct

As previously mentioned, WSQ was modeled as a second-order formative construct formed by the four, first-order reflective constructs of security, download delay, navigability, and visual appeal. Three reflective items measuring overall WSQ enabled us to use a multiple indicator multiple causes (MIMIC) model as depicted in Figure C1.

The reflective measures for the four WSQ dimensions and for overall WSQ were analyzed earlier in this appendix and found to exhibit both convergent and discriminant validity. We assessed the validity of WSQ as a second-order, formative construct based on formative measurement guidelines (Cenfetelli and Bassellier 2009; Petter et al. 2007), by (1) assessing multicollinearity among the first-order constructs, (2) examining the path weights and correlations among the first-order constructs and the second order construct, and (3) conducting a redundancy analysis.

Multicollinearity was first assessed using the variance inflation factors (VIF) generated in SPSS when regressing the means of visual appeal, security, download delay, and navigability on overall WSQ. The VIFs ranged from 1.320 to 1.551, well below the 3.33 threshold (Diamantopoulos and Siguaw 2006). While all path weights between the first-order constructs and the second-order construct were significant (shown in Figure 1), the path weight for navigability was small (.05, t-statistic 1.90). In accordance with guidelines for formative measurement, we considered the relative and absolute contributions of the first-order constructs. While the path weight (i.e., relative contribution) shown in Figure 1 was small, the bivariate correlation between navigability and overall WSQ demonstrates a stronger absolute relationship at .446 (shown in table C5). Thus, we retained navigability in our model. Finally, we conducted a redundancy analysis as shown in Figure C2 (see examples in Cenfetelli and Bassellier 2009; Mathieson et al. 2001). We created formative and reflective WSQ constructs in PLS and examined the strength of the relationship between them. The formative WSQ construct was measured using the latent variable scores for the first-order constructs as formative indicators. The reflective WSQ construct was measured using the three reflective, overall WSQ items. The path weight of .894 between the two constructs suggests that the formative items provide good coverage of WSQ.

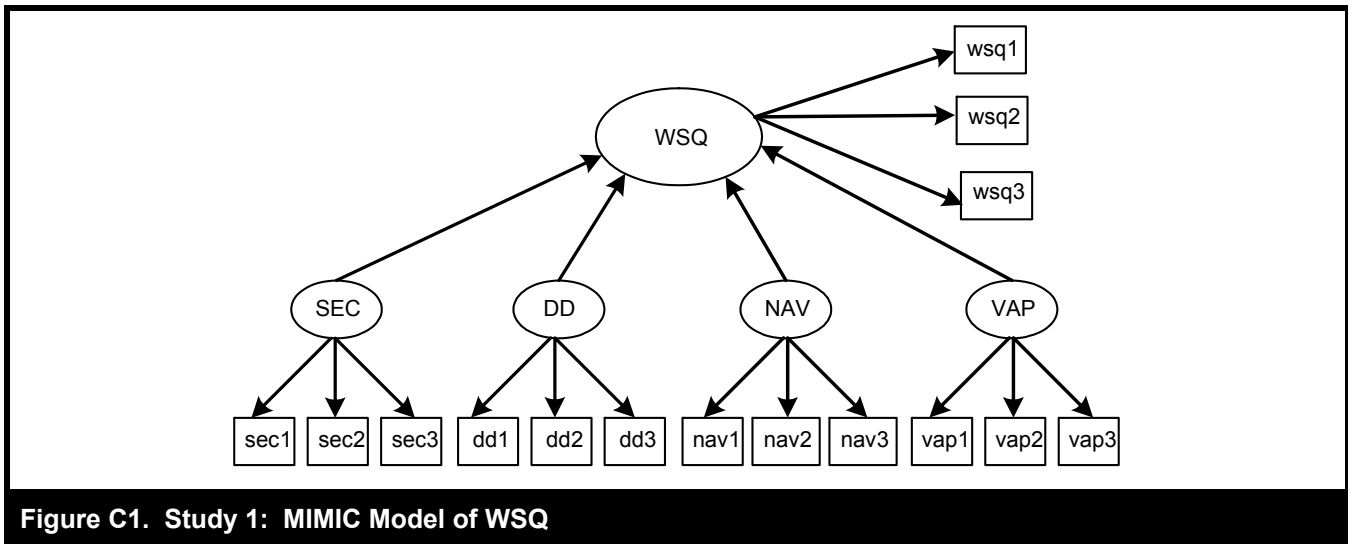
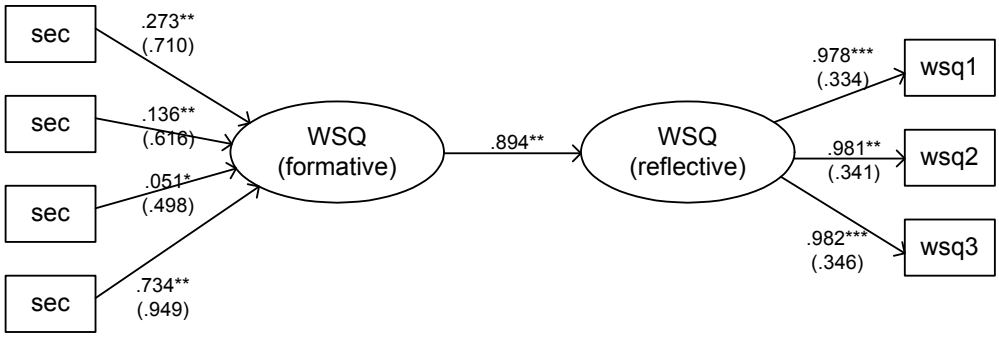


Figure C1. Study 1: MIMIC Model of WSQ



**< .001; * < .05
For formative items, the path weight is the top number, while the loading is the bottom number. For reflective items, the loading is the top number, while the path weight is provided below.

Figure C2. Study 1: Redundancy Analysis

Alternative Representations of WSQ

Study 1 provides validation for the representation of WSQ as a second-order, formative construct, formed by four, first-order reflective dimensions, as previously described. The four WSQ dimensions were treated as formative because these dimensions do not share similar content, do not necessarily covary, and do define or form overall WSQ as a second-order construct (Jarvis et al. 2003; Petter et al. 2007). Higher cross-loadings and correlations were noted with the overall WSQ construct (measured by three, overall reflective items), and thus we ran a couple of alternative formative models that did not require the use of the overall, three-item measure of WSQ to further confirm our results.

In one model, we represented WSQ as a second-order formative construct using the repeated indicator approach (Chin et al. 2003) and thus did not include the three overall WSQ items as reflective measures of the second-order construct. In a second model we represented WSQ as a first-order formative construct and used the latent variable scores generated in PLS for the four WSQ dimensions as formative indicators of WSQ (as described in Gefen and Straub 2005; Vance et al. 2008). In both of these models, similar path weights were obtained for the relationships between WSQ → PPQ (.72, .76) and PPQ → BI (.66, .66), while the higher cross-loadings and correlations among constructs were eliminated as the three-item overall measure of WSQ was not included.

WSQ Measurement and Future Research

Several of the measures used in our study were based on the WEBQUAL scale (Loiacono et al. 2007), an adaptation of SERVQUAL, and thus are subject to some of the criticisms of SERVQUAL.[1] SERVQUAL is a multidimensional scale measuring service quality which was developed in the marketing literature (Parasuraman et al. 1988; Parasuraman et al. 1991). The scale development process for SERVQUAL was somewhat atheoretical with the five dimensions of service quality (tangibles, reliability, responsiveness, assurance, and empathy) determined through reliability and factor analysis exercises. SERVQUAL was criticized for this development process and for the instability of the dimensions and items across industries (e.g., Brown et al. 1993; Carman 1990). An information systems measure of service quality was developed using the same five dimensions (Pitt et al. 1995) and faced these same criticisms due to similar inconsistencies across industries and countries with the IS SERVQUAL measure (Kettinger et al. 1995; Pitt et al. 1995) . More recent studies of service quality have tried to integrate divergent views and conceptualize the construct hierarchically with an overall service quality construct formed by dimensions and sub-dimensions, but modifications are still required based on industry-specific contexts (Brady and Cronin 2001).

The WEBQUAL scale was developed with twelve dimensions to measure user perceptions of website quality (Loiacono et al. 2007). Other measures of website quality with different dimensions have also been employed in the IS literature (e.g., Kim et al. 2002). Similar to SERVQUAL, inconsistencies with the dimensions have been found with the WEBQUAL instrument (Loiacono et al. 2007), and research

[1]WEBQUAL does not assess the gap between quality expectations and perceptions and thus is not subject to the difference score criticisms levied against SERVQUAL.

suggests that the relevant dimensions of website quality may vary based upon the nature of the task (e.g. experiential/hedonic, utilitarian) (Valacich et al. 2007). Research has shown that aesthetic features (e.g., visual appeal) are a more dominant component of website quality in experiential or hedonic contexts. Theory-based research is needed to develop an integrated conceptualization and measurement instrument for WSQ and to propose when different dimensions are more relevant. Recent research on formative measures notes that when multiple formative indicators or dimensions are measured, insignificant path weights for some dimensions are likely to result (Cenfetelli and Bassellier 2009). Instrument validation across different tasks and contexts is needed to insure that dimensions are not discarded due to insignificance in one context.

Study 2: Descriptive Statistics and Validation

Table C6. Study 1: Descriptive Statistics and Validation

	Minimum	Maximum	Mean	Std. Deviation
wsq1*	1	9	4.95	2.475
wsq2*	1	9	4.84	2.498
wsq3*	1	9	4.86	2.433
pai1*	1	9	4.41	2.424
pai2*	1	9	4.34	2.206
pai3*	1	9	4.12	2.193
ppq1	1	9	5.99	1.833
ppq2	1	9	5.99	2.003
ppq3	1	9	5.77	2.053
bi1	1	9	4.29	2.672
bi2	1	9	4.36	2.665
bi3	1	9	4.28	2.635

wsq = perceived website quality, pai = product asymmetries of information, ppq = perceived product quality, bi = behavioral intention
*These measures were used for manipulation check purposes only

Manipulation checks were performed by first running ANOVAs for both web site quality treatment and the product asymmetry of information treatment where the treatment was the independent variable and the dependent variable (DV) was the scale measuring perceptions of that treatment. The respective scales are provided in Appendix A. As shown below, the manipulations were significant with a p-value < .001. A more rigorous form of manipulation check was also performed as recommended by Perdue and Summers (1986) by running ANOVAs in which the two treatments were included as main effects and the dependent variable was the scale measuring perceptions of each treatment. This approach was used to insure that that each treatment effect remained significant in the presence of the other treatments. The results, provided below, show that both the web site quality treatment and the product asymmetry of information treatment had a significant effect on the related perceptions even in the presence of the other treatment. As an alternative manipulation check for WSQ we also conducted analysis using an index comprised of the average scores for the four WSQ dimensions (SEC, DD, NAV, VAP) and obtained similarly significant results for the manipulation of WSQ.

Table C7. Study 2: Manipulation Checks

ANOVAs with One Treatment and One DV	Perceived Web Site Quality		Perceived Asymmetries of Information	
	F	Sig.	F	Sig.
Web Site (high/low)	204.42	.000		
PAI (low/high)			27.01	.000
ANOVAs with Two Treatments and One DV	**Perceived Web Site Quality**		**Perceived Asymmetries of Information**	
	F	**Sig.**	**F**	**Sig.**
Web Site (high/low)	**207.24**	**.000**	.20	.653
PAI (low/high)	.01	.921	**26.81**	**.000**

Table C8. Study 2: Loadings and Cross-Loadings		
	PPQ	BI
ppq1	**0.89**	0.48
ppq2	**0.93**	0.65
ppq3	**0.94**	0.64
bi1	0.63	**0.97**
bi2	0.64	**0.99**
bi3	0.62	**0.98**

Table C9. Study 2: Construct Correlations, Reliabilites, and AVEs				
	CR	AVE	PPQ	BI
PPQ	.943	.847	**.920**	
BI	.987	.963	.643	**.981**

Note: Square root of the AVE is shown on diagonal in bold.
CR = composite reliability, AVE = average variance extracted

Study 3: Descriptive Statistics and Validation

Table C10. Study 3: Descriptive Statistics				
	Minimum	Maximum	Mean	Std. Deviation
wsq1*	1	9	4.71	2.511
wsq2*	1	9	4.52	2.592
wsq3*	1	9	4.63	2.524
sc1*	1	9	6.15	2.563
sc2*	1	9	6.45	2.110
sc3*	1	9	5.71	2.590
ppq1	1	9	5.34	1.780
ppq2	1	9	5.48	1.975
ppq3	1	9	5.12	2.161
bi1	1	9	3.79	2.563
bi2	1	9	3.88	2.572
bi3	1	9	3.85	2.551

*These measures were used for manipulation check purposes only.

Manipulation checks were performed by first running ANOVAs for both web site quality treatment and the signal credibility treatment where the treatment was the independent variable and the dependent variable (DV) was the scale measuring perceptions of that treatment. The respective scales are provided in Appendix A. As shown below, the manipulations treatments were significant with a p-value < .001. A more rigorous form of manipulation check was also performed as recommended by Perdue and Summers (1986) by running ANOVAs in which the two treatments were included as main effects and the dependent variable was the scale measuring perceptions of each treatment. This approach was used to insure that that each treatment effect remained significant in the presence of the other treatments. The results, provided below, show that both the web site quality treatment and the signal credibility treatment had a significant effect on the related perceptions, even in the presence of the other treatment. As an alternative manipulation check for WSQ we also conducted analysis using an index comprised of the average scores for the four WSQ dimensions (SEC, DD, NAV, VAP) and obtained similarly significant results for the manipulation of WSQ.

Table C11. Study 3: Manipulation Checks				
ANOVAs with One Treatment and One DV	**Perceived Web Site Quality**		**Perceived Signal Credibility**	
	F	**Sig.**	**F**	**Sig.**
Web Site (high/low)	**187.23**	**.000**		
SC (low/high)			**225.21**	**.000**
ANOVAs with Two Treatments and One DV	**Perceived Web Site Quality**		**Perceived Signal Credibility**	
	F	**Sig.**	**F**	**Sig.**
Web Site (high/low)	**189.54**	**.000**	.20	.655
SC (low/high)	2.95	.088	**224.07**	**.000**

Table C12. Study 3: Loadings and Cross-Loadings		
	PPQ	**BI**
ppq1	**0.91**	0.64
ppq2	**0.94**	0.64
ppq3	**0.93**	0.69
bi1	0.67	**0.97**
bi2	0.70	**0.99**
bi3	0.72	**0.98**

Table C13. Study 3: Construct Correlations, Reliabilities, and AVEs				
	CR	**AVE**	**PPQ**	**BI**
PPQ	.947	.857	**.926**	
BI	.987	.961	.711	**.980**

Note: Square root of the AVE is shown on diagonal in bold.
CR = composite reliability, AVE = average variance extracted

Appendix D

Common Method Bias Analysis

Common method bias (CMB) was assessed by including an unmeasured latent method construct (ULMC) in the structural regression model using a PLS approach documented in the IS literature (Liang et al. 2007; Vance et al. 2008). Because PLS does not allow items to load on more than one construct and does not generate random error statistics, the individual items are first converted to single indicator constructs as further described in Liang et al. (2007). An ULMC is then added to the model and paths are drawn from this method factor to the single indicator constructs. Finally, a structural regression model is run and the paths from the substantive factors and the method factor to the single indicator constructs are evaluated. The results from this analysis (below) show that all of the original factor loadings (from the measurement items to the related latent construct) remained significant as did the hypothesized paths in the structural regression model. Only 5 of the 30 paths from the ULMC to the measurement items were significant and were substantially smaller in magnitude than the corresponding loading to the related latent construct, providing further evidence that the study results were not due to CMB.

	Items	Factor Path/Loading (Orig. sample)	Factor Squared Loading (R^2)	T-statistic	Method Path/Loading (Orig. sample)	Method Squared Loading (R^2)	T-statistic
Security	sec1	0.98	0.97	**41.44**	-0.06	0.00	1.47
	sec2	0.96	0.92	**41.27**	-0.02	0.00	0.47
	sec3	0.91	0.82	**36.89**	0.07	0.01	**2.63**
Download delay	dd1	0.92	0.84	**36.00**	0.03	0.00	1.01
	dd2	0.96	0.92	**65.11**	0.01	0.00	0.36
	dd3	0.96	0.91	**40.13**	-0.04	0.00	1.50
Navigability	nav1	0.95	0.90	**41.87**	-0.10	0.01	**3.60**
	nav2	0.84	0.70	**37.85**	0.14	0.02	**5.83**
	nav3	0.93	0.87	**35.78**	-0.05	0.00	1.95
Visual appeal	vap1	0.98	0.95	**47.33**	0.01	0.00	0.48
	vap2	1.00	1.00	**40.62**	-0.02	0.00	0.59
	vap3	0.98	0.95	**26.24**	0.01	0.00	0.17
Web site quality	wsq1	1.06	1.12	**25.80**	-0.09	0.01	1.95
	wsq2	0.95	0.90	**24.64**	0.03	0.00	0.80
	wsq3	0.93	0.87	**26.29**	0.05	0.00	1.45
Product asymmetries of information	pai1	0.87	0.76	**35.95**	-0.01	0.00	0.30
	pai2	0.91	0.83	**65.27**	0.00	0.00	0.03
	pai3	0.90	0.81	**54.16**	0.01	0.00	0.37
Signal credibility	sc1	0.85	0.72	**27.61**	-0.02	0.00	0.52
	sc2	0.89	0.79	**54.60**	-0.02	0.00	0.58
	sc3	0.87	0.75	**33.90**	0.04	0.00	1.06
Product quality	ppq1	1.06	1.13	**25.85**	-0.20	0.04	**3.84**
	ppq2	0.91	0.82	**22.85**	0.04	0.00	1.07
	ppq3	0.83	0.68	**23.62**	0.14	0.02	**3.61**
Web site purchase intentions	bint1	0.99	0.98	**35.06**	-0.03	0.00	0.79
	bint2	0.95	0.91	**43.02**	0.04	0.00	1.40
	bint3	0.99	0.99	**55.00**	-0.01	0.00	0.42
Computer playfulness	cp1	0.67	0.45	**11.29**	0.04	0.00	0.82
	cp2	0.82	0.68	**30.98**	-0.01	0.00	0.28
	cp3	0.83	0.68	**36.12**	-0.02	0.00	0.53

t-statistics in bold are significant, p-value < .05.

Appendix E

Structural Regression Model Results

Table E1. Study 1: PLS Structural Equation Model Results

Dependent Variable	Independent Variable	R^2	Beta	t-statistic
BI		.43		
	PPQ		.66***	18.64
PPQ		.58		
	WSQ		.74***	25.00
	PAI		.04	.75
	SC		.11**	2.35
WSQ		.80		
	Security		.25***	5.87
	Download Delay		.11***	2.91
	Navigability		.05*	1.90
	Visual Appeal		.66***	16.40
	Computer Playfulness		.01	.20
	Gender		.03	1.14
	Number of Online Purchases		.02	1.08

***significant at .001, **significant at .01, *significant at .05
Control variables are in *italics*.

Appendix F

Replication of Study 1

This replication study used an experimental design with same six interfaces employed in Study 1to address the issues of generalizability and common method bias. Given that studies 1, 2, and 3 use the same, homogenous subject pool (i.e., undergraduate students), a more heterogeneous sample was used in this replication. Further, this study was designed to address common method bias (CMB) concerns with Study 1 in which multiple constructs were measured in the pre and post surveys. The number of constructs measured through self-reporting survey items was reduced in this study as CMB can be an issue when data are collected at the same time, using the same method (e.g., survey), with similar question formats (Podsakoff et al. 2003). CMB is particularly problematic when independent and dependent variables are measured in the instrument (e.g., WSQ and PPQ).

Subjects

A snowball sampling technique (i.e., chain-referral) (Coleman 1958) was used to access a more heterogeneous, older set of subjects. This technique has been commonly used in marketing research (Mick 1996) and in prior information systems research (Lapointe and Rivard 2005). A convenience sample of undergraduate students (seed participants) enrolled in an introductory management information systems course was asked to recruit nonstudent subjects (e.g., family and off-campus friends). A total of 240 subjects (40 for each treatment group) participated in the experiment, with 51.3 percent being female and an average age of 36.33 (ranging from 18 to 81). Limitations in the use of snowball samples have been noted in the literature (e.g., Erickson 1979; Heckathorn 1997), and thus we followed procedures to minimize the potential bias of this sample. Participation in the study was strictly voluntary, and the seed participants (undergraduate students) received course credit for each completed survey submitted on their behalf (with a limit of three submissions). The seed participants were instructed not to discuss

the study with the subjects that they recruited. Responses were filtered by IP address, and any responses that were submitted using a campus IP address were excluded to prevent the seed participants from forging responses or recruiting one another.

Experimental Procedures

This study was administered outside of a controlled laboratory setting and only included an abbreviated post-survey (no pre-survey). Subjects were first assigned to visit one of the six interface treatments (without completing a pre-survey) and were prompted to execute the series of steps specified on the experimental task sheet. Next, the subjects completed a brief post-survey that included measures of only PPQ and BI, and questions regarding age, sex, number of online purchases, and familiarity with Timbuk2 products.

Data Analysis

Descriptive statistics for PPQ and BI by treatment are provided in Table E1. Consistent with the Study 1 results, the WSQ treatments resulted in similar changes to PPQ. Manipulation checks for WSQ could not be conducted as WSQ measures were not included on the survey. An ANOVA was run in SPSS 15.0 with WSQ as a treatment variable (high, low, interfaces A, F) and PPQ as the dependent variable, resulting in a significant relationship ($p < .0001$), supporting H1. WSQ and PPQ were then regressed on BI to test H4 as shown in Table E2. PPQ significantly influenced BI (.57, p-value < .001) and partially mediated the effect of WSQ on BI (Baron and Kenny 1986), explaining .52 of the variance in BI (adjusted R^2).

Table E1. Replication of Study 1: Treatment Descriptive Statistics

	Interface Treatments					
	A	B	C	D	E	F
Perceived (Self-Reported)	H-Sec H-DD H-Nav H- VAP	H-Sec L-DD L-Nav L- VAP	L-Sec H-DD L-Nav L-VAP	L-Sec L-DD H-Nav L- VAP	L-Sec L-DD L-Nav H- VAP	L-Sec L-DD L-Nav L- VAP
PPQ	6.90	5.13	5.18	5.03	5.75	4.36
BI	5.72	3.66	2.59	2.98	3.89	2.73

Table E2. Replication of Study 1: Regression/Mediation Analysis for BI

WSQ → BI		WSQ → PPQ		WSQ + PPQ → BI				
β	p-value	β	p-value	WSQ β	p-value	PPQ β	p-value	Mediation
.595	.000	.680	.000	.207	.000	.570	.000	Partial

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