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SIMILARITY ANALYSIS OF THREE ATTITUDE-TOWARD-THE-WEBSITE SCALES

by

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ABSTRACT

As e-commerce continues to change business as we know it, a construct is growing in popularity for researchers to study: attitude-toward-the-website (A_{ws}). Several alternative scales for measuring the construct are available but it is not known if they are equally good at measuring the construct. The purpose of the study is to compare three such scales and to do so by reintroducing a technique called *similarity analysis* that has been little used in our field since it was first proposed. The paper explains how the approach draws from both exploratory and confirmatory methods and is especially suited for assessing scale quality in studies such as pretests and pilot tests that have small sample sizes. The analysis shows that the A_{ws} scales are not psychometrically equivalent. Further, the results of an experiment indicate that depending upon which scale is used in a study, different conclusions could be drawn.

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One of the most studied constructs in the last few decades in the field of marketing has been attitude-toward-the-ad (Bruner, James, and Hensel 2001, pp. 722-729). Although this construct will likely continue to be popular, up-and-coming constructs that deal with the ways people react to websites have the potential to become just as common to study. Among the range of reactions is one that can be referred to as *attitude-toward-the-website* (Aws). Various scales are being proposed for measuring this construct and, as of yet, there has been no critical analysis of the alternatives.

The purpose of this research is to compare three alternative Aws scales that have been proposed. To what extent are they equivalent measures? Is one "better" than another? Is it possible that their suitability depends upon the context?

In the process of comparing these scales a little used methodology will be employed called *similarity analysis*. As will be explained, this technique not only has advantages over typical approaches to assessing a scale's psychometric properties like internal consistency and unidimensionality via exploratory factor analysis but it even has some benefits over confirmatory factor analysis.

Literature Review

With the rise in the use of the Internet in the 1990s, researchers began to investigate what users thought and how they behaved with the new medium. Some constructs and scales have been carried over from existing contexts to study the new medium. For example, attitude-toward-the-brand and purchase intention are very familiar constructs that are relevant for brick-and-mortar as well as online contexts. In

contrast, some constructs are mostly new such as concerns about privacy on the web (Korgaonkar and Wolin 1999), web-based financial services adoption (Lin 1999), and the flow experience (Novak, Hoffman, and Yung 2000). Measures have been developed from scratch for these new constructs or previous ones have been adapted. Unfortunately, in many cases the lag time involved in learning about the work of others has led to multiple scales being developed for measuring the same thing.

The focus of this research is on one of these new constructs: attitude-toward-the-website. Although explicit definitions are rarely provided by researchers, it is viewed here simply as *a person's predisposition to respond to a website in a consistent manner*. This attitude is most likely to develop upon visiting a site but could arise in other ways such as hearing about a site from others or assuming a site is a certain way based on attitudes already held towards the organization associated with the site or its products.

Irrespective of how an attitude is created the construct is expected to be very useful in understanding many other attitudes and behaviors in a variety of Internet-related studies. In trying to appreciate the long-term value of A_{ws} we could draw upon some past concepts with which it might have operational similarities such as attitude-toward-the-company (e.g., Homer 1995) and attitude-toward-the-TV-program (e.g., Murry and Dacin 1996). It might also have great similarity to attitude-toward-the-ad. Based upon academic (Brown and Stayman 1992) and industry (Haley and Baldinger 1991) research it has been concluded that how well a person likes an advertisement is a good if not the best single predictor of sales effects. Likewise, it seems quite possible that A_{ws} has the potential to play a very significant role in understanding and predicting the attitudes,

intentions, and behaviors people will have with respect to websites, particularly those involved in e-commerce.

As we begin to routinely use Aws in our studies it would be nice to avoid the wasteful propagation of measures that has occurred with many other marketing-related constructs. For example, a close examination of dozens of attitude-toward-the-ad scales used over many years led to the conclusion that almost half had been used as a set of items just once (Bruner 1998; Bruner and Brownlow 1995). In other words, it has not been unusual for new measures to be created despite the existence of other scales.

The proliferation of scales for measuring the same construct suggests that some researchers assume that it does not matter much whether a study uses scale X or Y as long as they both *appear* to have items drawn from the same semantic domain. Yet, empirical support for a claim of *scale equivalency* (extent to which they are parallel) is rarely if ever provided in our published research. In fact, we may be placing too much faith in the domain sampling model. That is, we may be constructing scales with items *out of convenience* using our own idiosyncratic views of a construct rather than randomly sampling items from the same domain as has been used by others.

This problem of determining scale equivalency does not have an easy solution in practice, however. For example, if three different studies used three different sets of items to measure the same construct then there would be no direct means of assessing their degree of scale equivalency. Just because the three are called similar names and each is reported to be unidimensional and to have acceptable internal consistency in their respective studies would not be sufficient. All of the items would need to be used in the

same study since we know that psychometric properties may vary based upon the context in which they are used (e.g., Anderson, Gerbing, and Hunter 1987).

Given this, we should be cautious about assuming several Aws scales measure the same thing and explain a similar amount of variance in other constructs of interest just because they are called the same thing. In other words, short of having empirical evidence of their scale equivalency it is premature to conclude it does not matter which scale is used.

Purpose

This study compares three different Aws scales that have been used in published empirical research: one by Chen and Wells (1999), one by Burns (2000), and another by Bruner and Kumar (2000). Although their items are different they were all presented in the literature as global measures of the same construct.

As shown in Table 1, the one by Chen and Wells (1999) has six items. They generated items based upon responses they received from a sample of web users who were asked to describe good and bad websites. Since the items dealt with specific characteristics of websites, they were intended to go beyond a general evaluative measure.

In contrast, the scale by Burns (2000) is a reapplication of three items that are familiar from their use in the measurement of other popular constructs. Specifically, bi-polar adjectives are employed which have been commonly used in the measurement of such constructs as attitude-toward-the-brand as well as attitude-toward-the-ad.

The scale by Bruner and Kumar (2000) is like the Chen and Wells scale in that is composed of Likert-type statements. But, it is similar to the Burns scale in that it has

three items and is an adaptation of a scale previously used to measure attitude-toward-the-brand (Chattopadhyay and Basu 1990).[1]

[Insert Table 1 about here]

The three scales will be compared in terms of their internal consistency, external consistency, and unidimensionality. Some preliminary insights into the convergent and discriminant validities of the scales will be made as well. Finally, use of the scales will be made in an actual experiment to determine the extent to which they lead to the same conclusion.

The two main approaches used in the past for conducting this sort of comparison were exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). A problem with EFA is that it produces weighted sums of *all items* in the analysis not just the ones thought to measure a specific construct. The interaction of the other items in the analysis may affect the results and their interpretation. At the other extreme, analysis of covariance structure (e.g., Jöreskog and Sörbom 1989) is an obvious technique for testing scale equivalency but is sensitive to sample size. Ironically, it is with small samples from pretests and pilot tests that many researchers make critical decisions about measures to be used in a main study.

Another purpose of this paper, therefore, is to illustrate a procedure called *similarity analysis* that focuses on the psychometric property of *external consistency*. As will be explained below, one of the main advantages of similarity analysis is that, as with CFA, statistics are based upon a measurement model where sets of items are specified *a priori.* Unlike CFA, however, it can be used with small samples (< 100). Even when

sample size is not an issue, this approach provides an easy means for exploring the structure among variables during a pretest phase of a study by comparing alternative measurement models.

The genesis of similarity analysis is with Hunter (1973) who explained that if two items are equivalent then their correlations with other items should be proportionally similar.[2] The equivalency of two or more measures could then be assessed by comparing their correlations with other measures, (thus the term *external consistency*). To simplify this comparison he devised a *similarity coefficient* (φ). The difference between this statistic and one measuring internal consistency is that the former has to do with the degree of covariation *between* a set of measures and other measures. Internal consistency is a special case of external consistency where the focus is on the covariation *within* a set of items (scale). Although it is rarely acknowledged and tested for, unidimensionality depends upon *both* qualities being present (Anderson and Gerbing 1982; Anderson, Gerbing, and Hunter 1987).

Methodology

The context in which the scales were compared was a study investigating how consumer reactions vary between sites that either require more cognitive faculties or more affective ones. To accomplish this, two real websites were utilized. One of them was **DealTime** (*www.dealtime.com*) where the subject's task was to use certain parameters to search for and select a specified appliance. In contrast, another group of respondents was asked to browse the online version of the Louvre art museum in Paris (*www.louvre.fr/louvrea.htm*) and decide which gallery they would choose to visit in person if it was possible.

The experiment's sample was drawn from college students attending a large Midwestern U.S. university. Of the 80 people involved in the experiment, there was a near even split on gender (51% female) and the majority were in their early 20s (median of 21). Most of the subjects were single (95%) and a majority (70%) were employed either part- or full-time.

Analyses that have been typically used with small samples were complemented here with similarity analysis to make a comparison of the scales. As the name suggests, similarity analysis helps quantify the degree of equivalency among scales. The particular approach and software used here to perform similarity analysis was developed by Steenbergen (2000). His *semiparallel similarity coefficient* (ψ) was developed due to the difficulties inherent in calculating Hunter's similarity coefficient (φ).[3] Regardless of which coefficient is used, however, the interpretation is similar such that the coefficients are high (approaching 1) when scales measure the same thing and are very low (approaching 0) when they measure different things.

This study also included three additional scales for measuring other constructs to help provide a sense of the convergent and discriminant validity of the Aws scales. The three additional scales were web skill (Novak and Hoffman 1997), an abbreviated version of the verbal/visual processing style scale (Childers, Houston, Heckler 1985), and task involvement (original).[4]

Findings

To begin with, several factor analyses were conducted. When items for each Aws scale were analyzed separately for each site as well as when combined for both sites they produced only one factor a piece. This might lead some to conclude that each set of

items was unidimensional. However, as argued by Anderson, Gerbing, and Hunter (1987), dimensionality should be examined in the context of the full set of measures under study because it is determined by external as well as internal consistency and is, therefore, context specific. Table 2 shows the results of that analysis. A_{ws2} and A_{ws3} exhibited evidence of unidimensionality but A_{ws1} did not. When analyses were run separately for the two websites only the structure of A_{ws3} remained stable.

[Insert Table 2 about here]

Regarding internal consistency, each of the three A_{ws} scales had acceptable alpha levels with A_{ws3} having by far the highest level. (See Table 1.) The previously described limitations of analyzing dimensionality and other psychometric qualities with exploratory factor analysis and Cronbach's alpha led to using similarity analysis. Input for the software amounts to a correlation matrix of the scales being examined as well as specification of the measurement model (number of scales and the items composing them). Output of the similarity matrix for the scales included in this study is shown in Table 3.[5] It has been suggested that internal scalewise similarity (analogous to internal consistency) should be at least .80 (Anderson and Gerbing 1982; Steenbergen 2000). A_{ws3} performed best on this criterion and A_{ws2} performed well too but A_{ws1} did not quite achieve that level.

[Insert Table 3 about here]

Although similarity analysis does not rigorously test validity, it is possible to get a sense of a scale's convergent and discriminant validities. This can be done by comparing

a scale's internal scalewise coefficient (along the diagonal in Table 3) with the other coefficients in its column. The coefficients should be much higher for related scales (convergent validity) than for unrelated ones (discriminant validity). All three A_{ws} scales did quite well on that account. Note how the similarity coefficients for the A_{ws} columns in Table 3 are much higher in the top three rows than they are in the bottom three rows. This means that the three A_{ws} scales are much more similar to each other than they are to the other scales.

A further test of discriminant validity can be made by noting if a scale's internal scalewise similarity is higher than its similarities to other scales. Specifically, coefficients along the diagonal in Table 3 should be the highest in their respective columns. This was achieved by both A_{ws2} and A_{ws3} but not by A_{ws1} suggesting the first two had discriminant validity with respect to each other.

Although the sample size was somewhat low for supporting it, a confirmatory factor analysis was performed on the three A_{ws} scales to see if it could corroborate the findings from similarity analysis. The results showed no support for a 1-factor model (χ^2=95.06 with 54 d.f., p<0.001, GFI=0.83, RMSEA=0.10). While 2-factor models provided moderately good fits, a three factor model provided the best fit (χ^2=52.95 with 51 d.f., p=0.40, GFI=0.90, RMSEA=0.03).

In addition to the overall model fit, the discriminant validity between the three A_{ws} scales was examined by computing the average variance extracted (AVE) for each latent construct and comparing it to the square of the correlation between the pairs of constructs (γ^2). AVE for the three scales were .35 (A_{ws1}), .58 (A_{ws2}), and .77 (A_{ws3}) and the γ^2 were .53 (A_{ws1} and A_{ws2}), .72 (A_{ws1} and A_{ws3}), and .48 (A_{ws2} and A_{ws3}). Given

this, the evidence strongly supports the discriminant validity of A_{ws3} with A_{ws2} but is lacking for the other pairs. Further, because the AVE for A_{ws1} was so low it suggests that "the validity of the individual indicators and the construct is questionable" (Fornell and Larcker 1981, p. 46).

Finally, the three different operationalizations of A_{ws} were compared in how they performed in testing a simple hypothesis. Recall that in the experiment some subjects were exposed to one site and performed a more cognitive task while other subjects were exposed to another site where they performed a more affective task. An obvious question to ask subjects after their respective tasks was what their attitudes were towards the sites they visited? The ANOVA shown in Table 4 illustrates the problem. If A_{ws2} or A_{ws3} were used a researcher could conclude that there was a significant difference in subjects' attitudes toward the two different sites. However, if A_{ws1} was used then many researchers would <u>not</u> draw that conclusion because the level of significance is much weaker (beyond the typical .05 level).

[Insert Table 4 about here]

Discussion

One of the most powerful findings of this study is that several scales may be called the same thing yet still be different enough that their usage in a study leads to different conclusions. This can occur even when they have reasonable internal consistency and are apparently unidimensional when the items are factor analyzed by themselves. Multiple analytical methods were used in this study and they led to a fundamental conclusion: the three A_{ws} scales are not equivalent measures of the same

latent construct! Beyond that, the psychometric quality of the scales by Burns (2000) and Bruner and Kumar (2000) were generally positive though stronger for the latter. In contrast, the scale by Chen and Wells (1999) was fraught with psychometric weaknesses and, in fact, led to a different conclusion compared to the other two Aws scales when used in a hypothesis test.

One might still argue that the advantage of the Chen and Wells (1999) measure is that its items deal with specific aspects of a website and are helpful if one wants to know *why* a site performs a certain way. However, it appears that building a scale out of multiple specific diagnostic items when the scale is intended to be global in scope runs the risk of inadequately tapping into all facets of a construct (lack of content validity) and/or being multidimensional. If one is interested in diagnostic issues then scales specifically developed for that purpose should be used. For example, several scales have been published for measuring such specifics as how entertaining a site is, its visual appeal, and its organization (e.g., Chen and Wells 1999; Mathwick, Malhotra, and Rigdon 2001).

It has been illustrated here how similarity analysis can be useful with small samples when testing whether two or more scales are comparable measures of the same construct. This is accomplished via the assessment of *external consistency*, a scale quality introduced to our field in the past but rarely acknowledged in recent years. This quality deserves greater attention given that multiple indicator models must have this quality in order to fit data successfully (Anderson and Gerbing 1982). It will also be useful to have this information when performing full meta-analyses and replications that are likely to be more welcomed in the future than in the past (Hunter 2001; Mick 2001).

A limitation of the similarity analysis at this point is that metrics to facilitate significance tests of psychometric quality have not been developed yet. Users are dependent upon visual inspection and suggested heuristics. The judgment involved in this may be more than some are comfortable with. Given this, covariance structure analysis is still the recommended procedure when sample sizes are large enough. But, similarity analysis has a role to play when more rigorous procedures can not be used and/or when something more exploratory is desired.

Another limitation of the evaluation presented here is that only three Aws scales were included. Since gathering the data, other scales measuring the same or similar constructs have been identified (Thistlethwaite and Bauerly 2000; Wu 1999) and no doubt there are others that have been or will be proposed. Clearly, this is an ongoing effort. More studies are called for that examine the equivalency of competing measures as well as their relative strengths and weaknesses.

Summary and Conclusions

As with any new context or medium, the Internet provides marketing researchers with the opportunity to study new relationships as well as seeing whether old relationships still hold. In the process of doing this they will likely need new or modified measures. The study presented here indicates that just because several scales have been developed for measuring Aws does not mean they end up measuring the same construct. It is recommended that as much as possible researchers use previously developed scales rather than creating new scales that may not in fact measure exactly the same thing. Further, as a guide to making such selections, more studies of scale equivalency should be conducted from time to time.

ENDNOTES

1. These three scales are referred to hereafter as A_{ws1} (Chen and Wells 1999), A_{ws2} (Burns 2000), and A_{ws3} (Bruner and Kumar 2000).

2. A full explanation of similarity analysis is beyond the scope of this paper. Interested readers are referred to seminal articles by Hunter (1973) and Anderson and Gerbing (1982). A more recent article that updates the techniques and simplifies their calculation using a newly developed piece of software is by Steenbergen (2000).

3. To calculate Hunter's similarity coefficient (φ) requires information that is rarely available during the pretest phase of a study such as item reliabilities. In contrast, Steenbergen's coefficient (ψ) assumes that items are equally reliable and he has shown the robustness of the approach in leading to proper conclusions even when violations of this assumption occur.

4. It was not the purpose of this paper to make any claims, positive or negative, about the psychometric qualities of these three additional scales. They were included merely to provide a means of comparison with the A_{ws} scales.

5. Itemwise similarity coefficients can be calculated in addition to scalewise coefficients and would provide a sense of the average similarity between an item and a scale. While this is something worthy of examination when scales are being purified, it is skipped in this case due to space constraints.

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Table 1

The Aws Scales

Aws1, α = .75, (Chen and Wells 1999)

1. This website makes it easy for me to build a relationship with this company.
2. I would like to visit this website again in the future.
3. I'm satisfied with the service provided by this website.
4. I feel comfortable in surfing this website.
5. I feel surfing this website is a good way for me to spend my time.
6. Compared with other websites, I would rate this website as *one of the worst/one of the best*.

Aws2, α = .79, (Burns 2000)

1. good /bad
2. pleasant/unpleasant
3. favorable/unfavorable

Aws3, α = .91, (Bruner and Kumar 2000)

1. I liked the website.
2. I think it is a good website.
3. I think it is a nice website.

Table 2

Factor Analysis of Scale Items in Study

Item	Dimension						
	1	2	3	4	5	6	7
Aws1 #1			.598				
Aws1 #2			.730				
Aws1 #3	.401		.461				
Aws1 #4	.692						
Aws1 #5			.748				
Aws1 #6				.504			
Aws2 #1				.709			
Aws2 #2	.426			.654			
Aws2 #3				.639			
Aws3 #1	.726						
Aws3 #1	.794						
Aws3 #1	.793						
Web Skill #1		.884					
Web Skill #2		.847					
Web Skill #3							.707
Web Skill #4		.664					
Web Skill #5							.768
Verbal/Visual Processing #1						.733	
Verbal/Visual Processing #2						.719	
Verbal/Visual Processing #3				.539			-.450
Verbal/Visual Processing #4						.788	
Task Involvement #1					.671		
Task Involvement #2					.667		
Task Involvement #3					.706		
Task Involvement #4					.763		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. All loadings less than .40 suppressed.

Table 3

Scalewise Similarities

Block	1 (A_{ws1})	2 (A_{ws2})	3 (A_{ws3})	4 (WS)	5 (V/VP)	6 (TI)
1	0.7769	0.7663	0.8418	0.0762	0.1219	0.2020
2	0.7663	0.9046	0.8596	0.1988	0.1592	0.3253
3	0.8418	0.8596	0.9711	0.0738	0.1243	0.3161
4	0.0762	0.1988	0.0738	0.7182	-0.2878	0.0076
5	0.1219	0.1592	0.1243	-0.2878	0.6251	0.0149
6	0.2020	0.3253	0.3161	0.0076	0.0149	0.6123

WS = web skill; V/VP = verbal/visual processing; TI = task involvement

Table 4

Website Differences in A_{WS}

			MEANS	
Scale	**F-Ratio**	**Sig. level**	**Site 1**	**Site 2**
A_{ws1}	3.127	.081	3.692	3.504
A_{ws2}	14.321	.000	4.401	3.935
A_{ws3}	11.512	.001	4.180	3.764