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Jon D. Morris Ph.D. [a], Chongmoo Woo Ph.D. [a] & Chang-Hoan Cho Ph.D. [a]
[a] University of Florida, USA

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Internet Measures of Advertising Effects: A Global Issue

Jon D. Morris, ChongMoo Woo, and Chang-Hoan Cho

A major concern about surveying on the Internet is the comparative reliability and mediated validity of the medium. To date, however, relatively little research has been conducted regarding this issue. The purpose of this study is to investigate the reliability and validity of an Ad effect measure to an Internet survey, when compared to a standard paper-and-pencil survey. The survey used SAM (the Self-Assessment Manikin) to measure emotional response to several well-known brands, and was placed on the AdSAM® Internet website. The various multivariate estimates show that the Internet is a valid place to measure advertising effects reliably.

Introduction

The Internet now seems to be a part of our everyday lives. In fact, for many people the Internet has become one of the major media for consumption (Stewart and Zhao 2000). The diffusion rate of this innovative medium, the Internet, is surpassing all other preceding media. It took radio 28 years to achieve an audience of 50 million; television took 13 years to become a significant player, but the Internet achieved global prominence in about 5 years (Sterne 1997). Over 581 million people have internet access worldwide as of May 2002 (NUA Internet Surveys 2002). According to the 2001 User Survey, conducted by the UCLA Center for Communication Policy, 72.3% of Americans have online access, and people spend 9.8 hours on average online. Given this exponential growth rate, the Internet can be used as a medium for gathering user information for researchers, providing an enormous potential for the interaction between Internet users and researchers. Because of its many advantages, several studies about online research have been conducted, most focusing on the advantages of the Internet survey. Although one of the major issues about the Internet as a research medium is reliability and validity, relatively little research has been conducted regarding this issue. Even if there are many merits to using the Internet to gather information, the question of reliability, validity and consistency in scoring on an Internet Survey is paramount. The purpose of this paper is to investigate the reliability and validity of an Internet survey by comparing a controlled measure to one which is conducted with paper-and-pencil.

Literature Review and Conceptualization

The Internet as an Advertising Medium

In the last ten years, the Internet has changed the landscape of communications and is predicted to have a revolutionary impact on marketing communications. Although many academics have suggested that the Internet will be the focus of media attention (Hoffman and Novak 1996; Alba, Lynch, Weitz, Janiszewski, Lutz, Sawyer, and Wood 1997; Stewart and Zhao 2000), it appears that consumers have already begun to provide evidence that they have integrated the Internet experience into their broader media usage (Pavlou and Stewart 2000).

In terms of its user penetration (i.e., 72.3 percent in the United States), the Internet can be considered a mass medium. Compared to other traditional mass advertising media, however, the Internet is unique in many aspects. First, in terms of a communication model, the Internet is considered both a many-to-many (i.e., many advertisers and many consumers) or a many-to-one medium. This is in contrast with traditional one-to-many media (e.g., television, newspapers, magazines, outdoor, etc.) (Hoffman, Novak and Chatterjee 1995; Hoffman and Novak 1996; Morris and Ogan 1996). While traditional advertising media are considered as one-way passive communications from advertisers to mass consumers, the Internet can facilitate a two-way interactive communication between advertisers and consumers. This interactivity is considered to be the key advantage of the Internet

Jon D. Morris (Ph.D., University of Florida) is a professor of Advertising Communications at the University of Florida. (jonmorris@ufl.edu)

ChongMoo Woo is an advertising doctoral student co-majoring in statistics at the University of Florida. (chongmoo@ufl.edu)

Chang-Hoan Cho (Ph.D., University of Texas-Austin) is an assistant professor of Advertising at the University of Florida. (ccho@jou.ufl.edu)

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(Rafaeli and Sudweeks 1997; Morris and Ogan 1996; Pavlik 1996). Interactivity can be defined in many different ways: e.g., "the extent to which users can participate in modifying the form and content of a mediated environment in real time" (Steuer 1992); exchanging roles between senders and receivers in their mutual discourse (Haeckel 1998); unlimited choices and controls (Hoffman and Novak 1996); mutual actions between consumers and advertisers (Leckenby and Li 2000); facilitation of each other's communication needs among communicators (Ha and James 1998); etc. Similarly, interactivity is considered as a multi-dimensional instead of uni-dimensional concept: e.g., person and machine interactivity (Hoffman and Novak 1996); person-to-person and person-to-technology (Haeckel 1998); consumer-message, consumer-advertiser, and consumer-consumer interaction (Cho and Leckenby 1999); "speed," "range," and "mapping" (Steuer 1992); "playfulness," "choice," "connectedness," "information collection," and "reciprocal communication" (Ha and James 1998); etc. Because of this interactive nature as well as the mostly unrestricted content the Internet has already become an important advertising medium for marketers. This is apparent if we look at online advertising expenditure. Despite the recent downturn in Internet advertising due to the economic slowdown, Internet advertising in 2001 accounted for $7.6 billion. In 2002, it will still see a substantial growth of 35.5 percent, amounting to $10.3 billion, and is projected to reach $23.5 billion by 2005 (eMarketer 2002).

Internet as an Advertising Research Medium

As the Internet becomes a new and popular medium, many researchers see it as a good resource for scientific research, e.g., gathering survey information quickly, easily, accurately, and with minimal cost, using email, list servers, news groups, etc. (Kelly-Milburn and Milburn 1995; Landis 1995; McGlade, Milot and Scales 1996; Rosen and Petty 1995). The Internet is also said to have an enormous potential for organizational surveys (Kuhnert and McCauley 1996). As far back as 1996, sixty-four percent of research professionals at Fortune 2000 companies expected to conduct research on-line (Harris 1997).

Moreover, given its prosperity as an advertising medium, the Internet has already generated many research studies in advertising fields, e.g., consumer surveys, advertising processing on the Internet, advertising effectiveness on the Internet, consumers' interaction with advertising messages and advertisers, and more. To date, researchers have used different research methods to study the Internet as an advertising medium. Overall, the studies can be categorized into three different research methodologies: 1) content analysis, 2) measuring consumers' perceptions or experiences, and 3) gauging consumers' actual behaviors. First, some researchers have content-analyzed web sites to examine advertiser-controlled factors such as interactivity (Ha and James 1998; Ghose and Dou 1998), information cues (Yoon and Cropp 1999), creative styles (Oh, Cho and Leckenby 1999), uses of technologies (Cho and Leckenby 1997), communication strategies (Griffith and Krampfand 1998), brand communication styles (Philport and Arbittier 1997), and more.

Second, consumers' perceptions of the Internet contents or experiences have been frequently studied. For example, researches have studied perceived interactivity (Wu 1999; Hoerner 1999), consumer motivations (Korgaonkar and Wolin 1999), web site loyalty (Lynch, Kent and Srinivasan 2001), web site usability (Foley-Wilson and Palmer 1997), perceived message credibility on the Internet (Flanagin and Metzger 2000), attitudes toward web sites, messages or products (Bezjian-Avery, Calder and Iacobucci 1996; Chen and Wells 1999; Edwards and Gangadharbatla 2002; Choi, Miracle and Biocca 2002), behavioral intentions (Cho 1999; Kang 2001), and more.

Third, measuring consumers' actual behaviors on the Internet has also been examined. Due to technological complications, however, most studies measuring audience behaviors have been conducted in the industry rather than by academics. Using server log file analyses, web publishers and advertisers have been measuring consumers' actual behaviors on the Internet, e.g., clicking banner ads, key word searching, registration, purchasing, bookmarking, time spent, number of navigated pages, etc. (Dreze and Zufreyden 1997; Leibrock 1997; Cho and Leckenby 2000).

To measure consumers' perceptions or actual behaviors on the Internet, two different methods may be employed: 1) offline and 2) online data collection. In offline methods, the data are not collected on the Internet, but collected offline using paper-and-pencil surveys or telephone interview, etc., for example, showing web pages or other web-based stimulus (e.g., banner ads, sponsorships, corporate web pages, etc.) and collecting people's responses to the stimuli offline using paper and pencil. But offline data collection is considered less desirable than online data collection because of its low external validity (artificial setting).

Online Data Collection Methods

Most research studies using online data collection have been conducted using several different techniques of data collection: 1) log file analyses, 2) online

interviews, 3) email surveys, 4) web-based surveys or experiments, etc. Through the log file analyses, as mentioned earlier, advertisers and web publishers can collect most behavioral data such as click-through, number of visits, the amount of time spent on sites or pages, most frequently asked pages, product purchasing, popular paths followed through the sites, etc. (Dreze and Zufreyden 1997; Leibrock 1997). But log file analyses have some inherent problems such as caching, proxy servers, multiple users of one machine, etc. (Zeff and Aronson 1999). Secondly, online interviews such as focus group interviews have also been used as a cost effective alternative to conventional face-to-face interviews (e.g., unlimited geographic restriction, automatic transcript, less interviewer bias, etc.) (CIT 2002). Online interviews, however, have some limitations because they use text-based real-time chatting programs: e.g., slower typing than talking, no observation of facial expressions and body language, etc. (Rezabek 2000). Thirdly, email surveys directly send the survey questions pasted into the email message, so that participants can fill out the email questionnaire and push the reply button in their e-mail programs. Email surveys are relatively easy to design and administer because no HTML programming is required. Many previous research studies compared email surveys with other data collection methods such as regular mails, paper and pencil surveys, etc. Table 1 summarizes the results of previous studies comparing online vs. offline data collection methods.

Finally, web-based surveys usually draw sample respondents to the survey web pages by posting recruiting messages through news groups, links on other web pages, list servers, banners, and news letters (Kehoe and Pitkow 1996; Greguras and Stanton 1996). Compared to email surveys, web-based surveys can take advantage of the multimedia capabilities of the Internet, combining texts, graphics, animation and sounds to make the survey web pages more interesting, attractive and interactive (Schillewaert, Langerak and Duhamel 1998). In addition, programming languages such as HTML, JavaScript, and CGI scripts enable adaptive or filtering questioning, where a subject can respond to the contingency questions depending on his or her responses to previous questions (Kehoe and Pitkow 1996). Another advantage of web-based survey is that no data entering is required with the aid of online database technologies such as Cold Fusion, File Maker Pro, Active Server Pages, etc., data are entered directly into a database file such as Microsoft Access.

However, both email and web-based online surveys have some limitations that should be recognized. The first and paramount problem of online surveys is low external validity due to inherent sampling bias, since there are no available sampling frames that list all email users, web users, and web pages (Dominick 1999; Kehoe and Pitkow 1996; Zikmund 1991; Schillewaert, Langerak and Duhamel 1998). Moreover, when using the Internet as a means to study beyond Internet users, sampling problems are exacerbated because of a relative lack of representation of those who do not have access to the Internet (Dillman 2000; Schaefer and Dillman 1998; Tse 1998). In other words, the universe of Internet users is skewed toward upscale, well-educated young males (Stanton 1998; Mehta and Sivadas 1995; Schmidt 1997). This problem of sample representativeness will be resolved as the Internet is evolving to have more female, older and lower-class Internet users (Loechner 2002). Because of these sampling difficulties, many online researchers have used convenient samples instead of representative samples drawn from general populations. Student samples have been very popular in Internet research (Cho 1999; Wu 1999; Chen and Wells 1999; Kang 2001; Edwards and Gangadharbatla 2002; Choi, Miracle and Biocca 2002; Hoerner 1999). Some researchers have used various list servers to recruit sample participants from various interest groups (Hong and Leckenby 1998, Cho, Lee and Tharp 2001; Greguras and Stanton 1996). Other researchers have used the people search functions in various email service providers such as Yahoo, Hotmail, Lycos, etc. (Sheehan and Hoy 1999; Patwardhan 2001). However, there are additional problems of using list servers or email directories in search engines: e.g., the inherent uncertainty about the real identity of the respondents (Englis and Solomon 2000), self-selection of participation in studies (Boncheck, Hurwitz, and Mallery 1996), and individuals having multiple email accounts or multiple memberships in various list servers (Fisher, Margolis, and Resnik 1996). Maybe one possible solution to these problems would be using offline sampling frames such as phone books to call and ask for email addresses for email surveys or giving respondents the URLs of the survey web pages through telephone or postal mail. However, using an offline sampling frame is labor intensive, time consuming, and yields a relatively low response rate (Leckenby 1998). In the future, there might be more accurate lists of consumers' email addresses available to marketers and researchers.

The second limitation of online surveys is that not all Internet users use the same email programs and browsers, and different programs present texts, images and animation in a different manner. In addition, different people connect to the Internet with

Table 1
Studies Comparing Online vs. Offline Data Collection Methods

Comparison	*Findings*	*Studies*
Response Rate	Email>Regular mail	Kiesler and Sproull (1986); Parker (1992)
	Regular mail>Email	Tse et al. (1995); Bachmann, Elfrink and Vazzana (1996); Schuldt and Totten (1994)
	No Significant Difference	Mehta and Sivadas (1995); Schaefer and Dillman (1998); Rosenfeld, Booth-Kewley and Edwards (1993)
Design Flexibility	Web-survey>Offline survey (more attractive, interesting and adaptive features)	Schillewaert, Langerak and Duhamel (1998); Kehoe and Pitkow (1996)
Time Efficiency	Online>Offline (online studies take less time)	Smith (1997); Schaefer and Dillman (1998); McCullough (1998); Bachmann, Elfrink and Vazzana (1996); Mehta and Sivadas (1995); Sproull (1986)
Interviewer Error/Bias	Online<Offline (online has less bias/error)	Schillewaert, Langerak and Duhamel (1998); McCullough (1998)
Cost Efficiency	Online>Offline (online is more cost efficient)	Bachmann, Elfrink and Vazzana (1996); Parker (1992); Sproull (1986)
Non-response Items	Email>Paper and Pencil (email has more non-response items)	Bachmann, Elfrink and Vazzana (1996); Sproull (1986)
	Email<Paper and Pencil	Schaefer and Dillman (1998)
	No Difference	King and Miles (1995); Tse (1998)
Reliability and Validity	Online ≈ Paper and Pencil	The current study

different connection speeds and devices (e.g., telephone modem, cable modem, ADSL, LAN, etc.), which may result in different response patterns and rates. However, if the online surveys are constructed in a way that minimizes the effects of connection speed and browser types (using mostly text and small image files without any advanced technologies such as Flash or Java), this problem of program/browser variation can be partly controlled (as we did in the current study).

The third problem is the possibility of multiple responses to the online questionnaire from the same participant (Fisher, Margolis, and Resnik 1996; Sheehan and Hoy 1999). This can be controlled using various program languages such as Cold Fusion and JavaScript by assigning a prime key or unique ID (using a certain question item such as full name, birth date, and pre-assigned ID number as a required input), so that no multiple responses from a single individual can be accepted into the database file. However, this is not an easy task, and anonymity of participants is not secured by this technique, which may reduce the response rate.

Fourth, participants' different experiences and skill levels on the Internet and on the computer are another problem associated with online data collection methods. Users' web experiences have been recognized as an important variable influencing how people process messages on the Internet, e.g., effects on flow experiences (Hoffman and Novak 1996) and perceived credibility of Internet contents (Flanagin and Metzger 2000). Similarly, Igbaria and Parasuraman (1989) have demonstrated the negative relationship between level of education and computer anxiety. In the current study, the survey web page was constructed in such a way that users could easily follow the questionnaire without using any complicated skills. This minimized the effects of web experience and skills on completion of the survey.

Despite the inherent methodological problems mentioned so far, the Internet is gaining popularity as a research medium because of its apparent advantages over traditional data-gathering methods such as telephone and mail surveys. Both email and web-based surveys afford the research community the opportunity to gain wide distribution of test instruments (Comley 1997).

The Internet as a Measurement Medium

Since the Internet has become an important research method in the new global era, the interest in surveying and conducting experiments on-line has been es-

tablished. However, there is little information about the differences in response scores between on-line and traditional methods of testing. Admittedly, much of the concern about the responses focused on sample design and selection (Biesecker and Derenzo 1995; Smith and Leigh 1997; Schillewaert, Langerak and Duhamel 1998; Hill 1998; Bradley 1999; Brenner 1999; Kent and Lee 1999; Tuten, Bosnjak and Bandilla 1999; DiNapoli 2000; De Angelis 2001; Krotki 2000), mail verses e-mail response rate, and the speed and quality of internet responses (Mehta and Sivadas 1995; Parker 1992; Simth 1997; Tse et al. 1995; Sheehan and Hoy 1999; Schuldt and Totten 1994; Rosenfeld, Booth-Dewley and Edwards 1993; Bachmann, Elfrink and Vazzana 1996; Kittleson 1995). The results show that e-mail response rates are higher than mail rates, and the quality is comparable. In addition, studies have shown that attitudes about the electronic method (Internet) have been more positive than those for the traditional methods, particularly in small groups (Sweeney, Hausknecht, Dallin and Johnson 1997). To date, however, relatively little research has been conducted regarding the fundamental issue of measures: comparative reliability and mediated validity of the Internet as a measurement medium.

Reliability and validity issues are critical concerns in every survey. The issue of reliability is essentially the same for both measurement and research design. Reliability attempts to answer our concerns about the consistency of the information collected via Internet, while validity focuses on accuracy. Both reliability and validity are needed for online survey to be useful. Since surveys exist to provide information to decision makers, they should measure the right characteristics and be as free of error as possible (Carmines and Zeller 1979). Errors in online survey responses, which are virtually inevitable in the paper-and-pencil survey and in the true score theory, are of two general types: systematic (bias error) and unsystematic (random error). Systematic errors are associated with the online survey validity and unsystematic errors are associated with the online survey reliability.

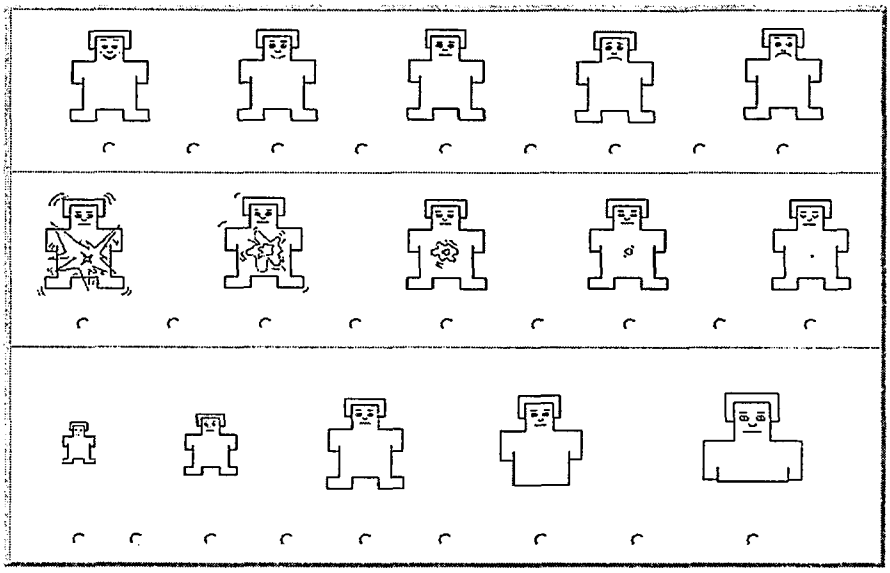
There are four general classes of reliability estimates, each of which estimates reliability in a different way. They are inter-rater reliability, test-retest reliability, alternative-forms reliability, and internal consistency reliability (Trochim 2000). Each method provides evidence that the Internet survey responses are consistent under online circumstances. Traditionally, three types of validity have been recognized: construct validity, content validity, and criterion-related validity (APA 1954; APA 1966; AERA, APA, and NCME 1985).

Though many research studies have found positive features about online research, the questions that remain unanswered are the reliability and validity of the responses online. Do online subjects respond similarly to those participants using a paper and pencil version of the same questionnaire? The issue of reliability and validity is paramount to the use of the Internet as a method for delivering the test instrument. To determine the reliability of a technique, a comparison of methods should examine the ability to deliver similar results for the same individuals on the same instrument (Beerli and Santana 1999). In addition, if the instrument is to become truly global, and cross-cultural, issues about the validity of transferring a conventional survey to the Internet needs to be addressed (Litwin 1995).

A Global Measure: AdSAM®

The best method for testing the reliability and validity of the Internet as a cross-cultural platform of data gathering for marketing communications is a method that does not require language to construct the instrument and that has been used and validated for advertising testing. The nonverbal emotional response research method, which is part of the marketing communication process called ADSAM®, fits these criteria. It is difficult to design an instrument that contains words that share the same meaning when translated from language to language; therefore, the nonverbal measurement, the Self-Assessment Manikin (SAM)(Lang 1980), has been developed and used to analyze marketing strategies and advertising executions across cultures (Morris et al. 1996). SAM is a graphic character that eliminates much of the bias associated with verbal measures (Edell and Burke 1987), and it is quick and simple to use (Morris and Waine 1993; Lang 1980). SAM uses a nine-point scale for each of the dimensions (PAD: Pleasure, Arousal, Dominance). The dimensional approach to assessing emotional response has used for many years in a verbal format using adjective checklists and semantic differential scales to measure the three (PAD) dimensions of emotion (Morris et al. 1996). Significant correlations for pleasure (.937), arousal (.938), and dominance (.660) were found between ratings generated by SAM and by the semantic differential scales used by Mehrabian and Russell (Morris, Bradley, Sutherland, and Wei 1993; Morris, Bradley, Lang and Waine 1992; Morris and Waine 1993). SAM is truly a culture free scale, and because of its strong relationship to the verbal measures of emotional response and its graphic character it is capable of measuring emotions on the Internet. Respondents are asked to

Figure 1
SAM (Self-Assessment Mannequin)



mark on the dot below the picture or between the pictures on each of the three scales (See Figure 1).

Since facial expressions have fairly consistent meanings globally, the SAM measure can be effectively interpreted in multiple cultures (Bradley, Greenwald and Hamm 1992). Two cross-cultural comparisons used SAM to test the differences (similarities) in emotional responses to standardized advertising between two distinct cultural groups, Taiwanese and Americans (Morris, Bradley, Sutherland and Wei 1992). Furthermore, research by Russell (1983) and his colleagues (Russell, Lewicka and Niit 1989) found the Pleasure and Arousal dimensions to be consistent cross-culturally in Gujarati, Croatian, Japanese, Cantonese Chinese, Greek, Chinese and English.

To date, SAM has been used effectively to measure emotional responses in a variety of studies, including reactions to advertisements (Morris, Bradley, Waine and Lang 1992), pictures (International Affective Picture System, IAPS) (Greenwald, Cook, and Lang 1989; Lang, Greenwald, Bradley, and Hamm 1993), images (Miller, Levin, Kozak, Cook, McLean, and Lang 1987), sounds (Bradley 1994) music (Morris and Boone 1997), and more.

Morris et al. conducted a series of studies on emotional response to advertising messages by using the SAM instrument and have developed a system for analyzing this data called AdSAM®. AdSAM®, a research tool that consists of a database of 232 emotional adjectives, has been used to gain insight into the relationship between advertising, brand interest and purchase intention (Morris, Woo, Geason and Kim 2002). In Morris et al.'s (2002), affect as measured by AdSAM® scores from advertising copytests were compared to the cognitive scores. Purchase intention and brand interest comprised the conative measures and served as the dependent variables. A structural equation model was used to examine the relationships between cognitive and affective attitude and conative attitude.

In this robust study of over 23,000 responses to 240 advertising messages, the authors found that affect when measured by AdSAM® dominates over cognition for predicting conative attitude and action. Contrary to previous assertions that cognition is the dominate variable for predicting intention, when compared to affect, these results show that affect accounts for almost twice the variance toward conative attitude. Emotional response is a powerful predictor of intention and brand attitude, and given the diagnostic capabilities that are missing in other measures of affect (Aad), it is a valuable tool for strategic planning, message testing and brand tracking (Morris, Woo, Geason and Kim 2002)

Research Questions

Research has shown that the administration medium can influence responses to the measuring instruments. Mead and Drasgow (1993) showed that, for speeded tests, individuals' responses to "cognitive" tests administered by computer or pencil and paper were different. King and Miles (1995), how-

ever, demonstrated that for "non-cognitive" tests such as personality and attitudinal measures, there were no significant differences in individuals' responses to measuring instruments administered by different media. In our study, the measurement device was AdSAM, which was used to measure respondent's emotional responses rather than cognitive responses. Therefore, it was expected that AdSAM would achieve measurement equivalence between a web-based and a paper and pencil survey.

In this study, the web version of AdSAM was equivalent to the paper version in its contents and structures, without facilitating unique characteristics of the Internet such as interactivity, dynamic addressability, etc. This was to minimize effects of the interactive nature of the Internet on participants' information processing, because research evidence had already demonstrated the positive or negative effects of interactivity (Cho and Leckenby 1999; Bezjian-Avery, Calder and Iacobucci 1996), telepresence (Choi, Miracle and Biocca 2002), and flow experiences (Novak, Hoffman and Yung 2000) on various communication aspects. We also made the online questionnaire very easy and user friendly, so that no extra skills were required and that anxiety would be minimized. Based on these rationales (non-cognitive tests minimizing required skill levels and interactive nature of the Internet medium), this study expected to discover measurement consistency between a web-based and a paper and pencil test.

More specifically, the following research questions were established in order to assess the reliability and validity of the test instrument:

Research Question 1: Will the advertising effect measure be consistent despite the consequences of testing online verses the paper and pencil test (Reliability)?

$H1_a$: Regardless of the order of the repeated measure, Internet preceding or following the paper and pencil version, the responses would be similar (Test-retest reliability).

$H1_b$: Regardless of the format of the presentation, of the testing instrument, Internet or paper and pencil, the responses would be similar (Alternative-form reliability).

$H1_c$: Overall, the responses gathered with the test instrument, AdSAM, would be consistent across items (Internal consistency reliability).

Research Question 2: Will the advertising effect measure be as accurate using online testing as it is with the traditional paper and pencil method (Validity)?

$H2_a$: Changes in the testing environment, online or paper and pencil, would have no effect on the theoretical implications of the test instrument (Construct and Content validity).

$H2_b$: Changes in the testing environment would have no effect on the predictability of the test instrument (Criterion-related validity).

Method

Sample and Procedure

A convenience sample of students was recruited for this study. Students are considered appropriate for experimental research because of their homogeneity (Calder, Phillips and Tybout 1981) and given for this Internet/paper cross-over design and multivariate analysis of scale reliability and validity. Subjects were lower-division, multi-disciplinary students enrolled in an introductory advertising course and participated on a volunteer basis. Subjects in two classes were asked to participate in an emotional response evaluation of three well-known consumer brands. Within the class, subjects were told that the researcher was interested in their feelings about the brands. They were not informed about the nature of the survey.

The subjects were asked to complete both a paper-and-pencil and an Internet version of the survey. The subjects were given one page self-instruction. The instruction informed respondents about the use the SAM scales to indicate their prompt emotional responses. The respondents were told that they were not to evaluate the brands themselves but their immediate emotional responses produced by the brand. Some subjects completed the paper version first while others took the Internet first. The process was reversed one week later and the order of brand name presentation was varied between the Internet and paper version. Thus, a cross-over design using within-subjects repeated measure balanced the possible residual effect by varying the sequence of independent stimuli and dependent measures in an experiment. This is quite common in experiments involving human subjects where the variation among experimental units is expected (Cochran and Cox 1957). Induced period effects by the cross-over design were also easily removed since every treatment was equally replicated in each phase (Montgomery 1997). A total of 213 responses were gathered from 71 subjects responding to three brands. The three brands were located in the high involvement/thinking quadrant of the FCB Grid (Vaughn

Table 2
Reliability and Validity of Internet Ad Effect Measures: A Research Flow

Research Question	*Research Design*	*Analysis (Estimates)*
Measure Reliability of the Internet		
1_a. Test-Retest Reliability	Testing over 7 days	Correlation (Pearson's *r*)
1_b. Alternative Form Reliability	Paper – Internet (Alternative)	Correlation (Pearson's *r*)
1_c. Internal Consistency Reliability	Test, Retest, Internet, & Paper	Covariance (Cronbach's α)
Measure Validity in the Internet		
2_a. Construct Validity	Theoretical Structure (P|A|D)	Factor (Eigenvalue %)
2_a. Content Validity	Component (Internet+Paper)	LISREL (Goodness-of-Fit)
2_b. Criterion-Related Validity	Internet ⇒ Paper (Criterion)	LISREL (Weighted R^2)

1986; Ratchford 1987; Rossiter, Percy and Donovan 1991) and were selected because they were highly advertised, well-known brandnames. SAM was chosen as the test instrument because it is non-verbal (eliminating language bias), easily transferable to the internet, and has been shown to be a good tool for analyzing advertising (Morris, Woo, Geason and Kim 2002).

Design and Analysis

In research, the term reliability means "repeatability" or "consistency." While it is not possible to directly measure the amount of error in a test, it is possible to estimate it. We *estimated* the true score component of an Internet Ad measures as the correlation between two observations of the pictorial scale and the specific research flow is summarized in the Table 2.

Each of three brands was rated in both the paper-and-pencil and the Internet version. A total of 71 matched pairs' or 213 responses were pooled across the three Internet and Paper PAD measurement variables. A research design assumption-check showed significant pre-posttest correlations (Pearson's r=.89, p<.01) and non-significant three brands differences (MANOVA Wilks' λ=.97, d.f.=12, p=.84) in the within-subject repeated measures. The Internet version of the survey was placed on the AdSAM® website and looked identical to the paper version. Respondents were able to use the mouse to place a dot in the radio button under their choice on the scale. The real-time results were electronically saved in a text file and were easily transferred to the SPSS file after the survey (AdSAM® 2000). After deleting one unanswered questionnaire, a 210 working dataset across six variables was used in the main analysis.

Results

Descriptive Statistics

The descriptive results provide a summary of variables that are important in subsequent analyses. The primary dependent variable measurement items in this study are Pleasure, Arousal, and Dominance. Across the four conditions, mean score for Pleasure, Arousal, and Dominance varied from a low of 4.98 to a high of 6.32 on a nine-unit semantic differential scale ranging from 1 to 9. Table 3 displays descriptive statistics that were used as basic trace for multivariate analyses.

Reliability and Random Error of Internet Ad Effect Measures

Table 4 shows the three reliability estimates related to the Internet Ad effect measure. All estimates are above .7.

The test-retest (time) and alternative (space) reliability between the paper-and-pencil and the Internet survey was 89 to 90% (Pearson's r=.89-.90, p<.00). Because the two conditions were applied sequentially to a crossed group of subjects, they cannot be analyzed as independent samples. The purpose of crossover design was to reduce extraneous sources of variability from the comparison between the Internet and paper measures and make it possible for more precise reliability estimate with fewer subjects within a group.

Internal consistency was used to assess the reliability of the results across items and ranged from .73 to .78, and was above the acceptable .60 threshold (Nunnally 1967; Nunnally and Bernstein 1994) as well as the .70 recommended (Nunnally 1978) reliable level of Cronbach's alpha (Cronbach 1949; Cronbach 1951; Cronbach 1955; Cronbach 1971; Cronbach 1984; Cronbach 1990).

Table 3
Descriptive Statistics of Measurement Items: Mean, Standard Deviation, and Responses

Measurement Medium	*Measurement Item*	*Test 1*			*Test 2*		
		Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
Paper	Pleasure	5.88	1.55	72	5.78	1.75	138
	Arousal	5.32	1.47	72	4.98	2.00	138
	Dominance	5.74	1.74	72	6.14	2.11	138
Paper Item Sum		16.93	3.36	72	16.90	4.28	138
Internet	Pleasure	5.49	2.09	138	6.08	1.53	72
	Arousal	5.04	2.14	138	5.28	1.87	72
	Dominance	5.40	2.31	138	6.32	1.90	72
Internet Item Sum		15.93	4.40	138	17.68	4.05	72

Table 4
Reliability of Internet Ad Effect Measures: Test-Retest, Alternative, and Internal Consistency Reliability

Alternative Form / Test-Retest	Paper	Internet (Alternative)	Test-Retest Reliability
Test	**Pleasure (Cronbach's α=.78*)**		Pearson's *r*=.89**
Retest	**Arousal (Cronbach's α=.76)**		(p<.01)
	Dominance (Cronbach's α=.73)		
Alternative Reliability	Pearson's *r*=.90**		**Internal Consistency**
	(p<.01)		**Reliability**

***Cronbach's alpha estimate of paper test, retest, Internet test, and retest.**
****Paper-Internet (alternative) reliability along with the cross-over designed test-retest reliability.**

This study estimated the degree of relevance of the Internet research method scale reliability and validity. The first three hypotheses 1_a, 1_b, and 1_c were supported showing the Internet to be a highly reliable medium when compared to the conventional paper-and-pencil research method.

Validity and Bias Error of Internet Ad Effect Measures

Unlike random error, bias error systematically affects online response averages. An Internet measure may be reliable (without random error) but not valid (with bias error) (AERA, APA and NCME 1985). That is, reliability is necessary but not a sufficient condition (Moss 1994) for the Internet measure validity. As online assessment becomes less standardized, distinctions between reliability and validity blur. The internal consistency reliability of online survey preserves an aspect of construct validity (Campbell and Fiske 1959; Cronbach 1990; Nunnally and Bernstein 1994).

Construct Validity and Factor Analysis

Prior to construct validity assessment, using an explanatory factor analysis, several *underlying statistical assumptions* were checked (Table 5). The normality check, using visual inspections, supported the Gauss shape of mean-variance distribution. The variable to sample ratio was 1:34 and satisfied the criterion suggested by

Table 5
Construct Validity of Internet Ad Effect Measures: *Factor Analysis Assumption Check*

Underlying Assumptions	*Criteria*	*Check*
Sample size	N>200	n=204*
Normality	Kolmogorov-Smirnov test	p <.05
	Histogram inspection	Approximately normal
	Stem-and-leaf plot	Approximately normal
	Normal probability plot	Approximately normal
	Detrended normal plot	Few outlier
	Box Plot	Few outlier
Linearity	Scatter Plot inspection	Almost linear
	Residual Plot	Few outlier
Multicollinearity	Correlation matrix ≠Singular	.13 Determinant
	Initial Eigen-value ≠0	.29 – 2.90 range
	.40<Communality<1.00	.65 – .76 range
Possibility of Factor Analysis	Above ±.30 correlation matrix coefficients (*r*)>50% (with some high and low *r*)	Above ±.30 was 67% (.04—.64 range)
	Anti-image covariance ≈0	Below ±.20 was 78%
	KMO** >.06	KMO=.72
	Bartlett's test of sphricity p<.05 (when factor-variable ratio is below 1:5)	p=.00 (factor-variable ratio was 1:2)
Variable Selection	MSA***> .60	.63 – .78 range
	Rotated factor loadings>.50 (considering sample size and power)	.80 – .90 range
	Relatively high communality	.65 – .76 range
Factor Selection	Variables in a factor≥3 (Two variable loading is possible when the study object is to see structure)	Variables in a factor=2
Assessing Overall Model Fit	Below 50% non-redundant residuals with absolute values>.05 in reproduced correlation matrix	Non-redundant residuals with absolute values>.05 is 33.0%

*** Two respondents were outlier from others and corresponding six responses were deleted.**
**** KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy.**
***** MSA (Measures of Sampling Adequacy).**

Nunnally (1978). On the hypothesized variance-covariance matrix, the Kaiser-Meyer-Olkin's measure of sampling adequacy was .72 and the Bartlett's test of sphericity index also showed a significant p-value at the .05 level. Thus, there was substantial evidence for the planned factoring of the measurement items used in the study (Kaiser 1974). Initial communalities were .65 to .76 across all hypothesized measurement items and interpreted, to show no extreme multicollinearity or strong linear combinations among variables. Thirty-three percent of the nonredundant residuals had absolute values over .05%. This shows a good model fit between observed and assumed correlations since nonredundant residuals with absolute values over .05 is below 50%. In conclusion, the subsequent factor analysis output based on the Internet and paper surveyed data set was statistically robust (Hair, Anderson, Tatham, and Black 1998; Woo 2001).

Table 6 provides the *results of theoretical construct* of all three emotional responses for advertising effect measures (PAD). A principal component factor analysis followed by varimax rotation revealed three correlated factors with eigenvalues greater than 1.00, with the scale items loading most highly on the "correct"

Table 6
Construct Validity of Internet Ad Effect Measures: *Factor Analysis Result*

	Factor Loadings Rotated by Theory Structure			
Item	*Factor 1*	*Factor 2*	*Factor 3*	*Communality*
Arousal: Paper	.88	.08	.22	.68
Arousal: Internet	.83	-.03	.32	.73
Dominance: Internet	.05	.90	.09	.76
Dominance: Paper	.01	.85	.23	.76
Pleasure: Paper	.27	.15	.86	.65
Pleasure: Internet	.32	.24	.80	.70
Eigen value	1.64	1.61	1.60	
% Variance Explained	27.38	26.80	26.59	
Cumulative %	27.38	54.18	80.77	
Labeling	"Arousal"	"Dominance"	"Pleasure"	

Table 7
Construct Validity of Internet Ad Effect Measures: *Validation of Factor Analysis Result*

Validation Criteria	*Random hold-out sample Group 1 (n=103/204)*	*Random hold-out sample Group 2 (n=101/204)*
Factor Structure	"Pleasure" - Pleasure: Paper - Pleasure: Internet - Arousal: Internet "Arousal" - Arousal: Paper "Dominance" - Dominance: Paper - Dominance: Internet	"Pleasure" - Pleasure: Paper - Pleasure: Internet "Arousal" - Arousal: Paper - Arousal: Internet "Dominance" - Dominance: Paper - Dominance: Internet
Total Variance Explained	79.9%	80.0%
Assessing overall model fit (below 50% non-redundant residuals with absolute values>.05 in reproduced correlation matrix)	Non-redundant residuals with absolute values>.05 is 80.0%	Non-redundant residuals with absolute values>.05 is 40.0%

factors (all pleasure items loaded most strongly on Pleasure, the arousal items loaded on Arousal, and dominance items loaded on Dominance). Thus, there is substantial evidence for the convergent and discriminant validity of the items used in the study and support for hypothesis 2_a that the Internet is a construct valid medium with when compared to the conventional paper-and-pencil method. The factor loadings and coefficients appear in the Table 6: these factors account for 80.77 percent of the original variance and clearly reflect the Pleasure (factor 3), Arousal (factor 1), and Dominance (factor 2) structure of the emotion theory.

Table 8
Content Validity of Internet Ad Effect Measures: *LISREL Analysis Assumption Check*

Underlying Assumptions	*Criteria*	*Check*
Sample size	n>200	n=204
Normality	Kolmogorov-Smirnov test	p <.05
	Histogram inspection	Approximately normal
	Stem-and-leaf plot	Approximately normal
	Normal probability plot	Approximately normal
	Detrended normal plot	Few outlier
	Box Plot	Few outlier
Linearity	Scatter Plot	Almost linear
	Residual Plot	Few outlier
Multicollinearity	Correlation matrix ≠Singular	.125 Determinant
Error Correlation	Correlations between error variance of independent measurement variable (δ) and independent exogenous variable (ξ) are not significant	A weak correlation (r=.10, p<.05)

To *externally examine the construct validity*, a cross-validation method was used with random split resampling (Rosental and Rosnow 1991; Johnson and Wichern 1992; Hair, Anderson, Tatham and Black 1998). The total 204 responses were first divided into two random subsets using a general statistical analysis package, and then the Internet and paper results were validated by comparing the sub-samples. Table 7 shows the cross-validation of the previous factor analysis results. Except for variable, "Arousal: Internet," the split sample groups showed similar patterns when compare to the total sample. Cross-validation, jackknife, and bootstrap, with multivariate analyses are often referred to as empirical-based resampling (Efron 1982; Diaconis and Efron 1983; Efron and Tibshirani 1993).

Content Validity and LISREL Analysis

Based on the sample survey questionnaire, a clear definition for content universe (offline/online out of advertising survey environments), domain specification (personified descriptive pleasure/arousal/dominance emotional response out of advertising effects), item specifications (paper-and-pencil/the Internet website out of advertising survey instruments), and a description of the content related validity (the Internet and paper items under each domain of emotional responses) was *judged first by three advertising experts* (Carmines and Zeller 1979; AERA, APA, and NCME 1985). The experts all consented that the specific Internet and paper items well represent the general online and offline content of previous advertising copy testing. Table 8 summarizes the assumption checks of the confirmatory factor analysis.

As a follow-up to the exploratory factor analysis, LISREL was used as a *confirmatory factor analysis* to check the result of the experts judgments. The framework-specific path diagram and assessed LISREL model fit for the empirical content validity is in the Figure 2 and Table 9. Overall goodness-of-fit indices of LISREL (a saturated model with two variables loaded) was assessed using (χ^2/d.f.)=1.71, GFI=.98 (AGFI=.94), NFI=.97 (NNFI=.97), and RMR=.02, and were satisfactory (Jöreskog and Sörbom 1983; Jöreskog and Sörbom 1989; Jöreskog and Sörbom 1997). Thus, there was substantial evidence to support the qualitative and quantitative content validity check of the SAM measure. The hypothesis 2_a was supported the Internet was content valid medium when compared to the conventional paper-and-pencil research method. The goodness-of-fit between theoretical and empirical content framework of the Internet and paper was over .95 in the NFI (.97) and GFI (.98) of LISREL.

To *validate the LISREL analysis results* (internal content validity of the Internet and paper ad effect measures), the cross-validation method was employed again with the split samples. Except for the AGFI of the group 1

Figure 2
Content Validity of Internet Ad Effect Measures: *LISREL Analysis Result*

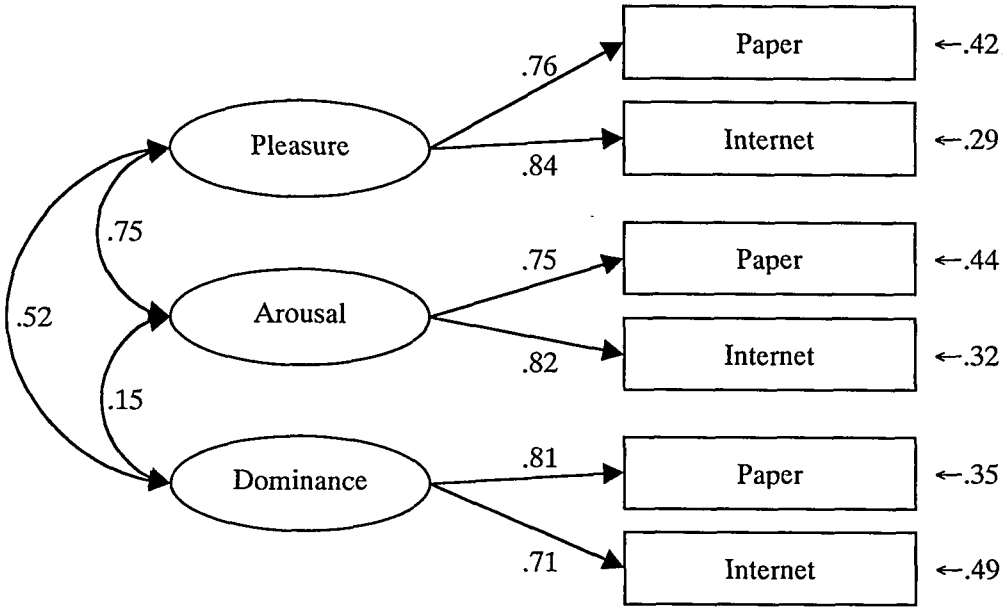


Table 9
Content Validity of Internet Ad Effect Measures: *LISREL Analysis Result*

Model Fit and Criteria	*Estimates*
χ^2 to degree of freedom ratio<2	χ^2 / d.f.=1.71
GFI (Goodness of Fit Index)>.90	GFI= .98
AGFI (Adjusted Goodness of Fit Index)>.90	AGFI=.94
RMR (Root Mean square Residual)<.05	RMR=.02
NFI (Normed Fit Index)>.90	NFI=.97
NNFI (Non-Normed Fit Index)>.90	NNFI=.97

dataset, overall goodness-of-fit indices were satisfactory and demonstrated that the Internet and paper content validity is statistically plausible and can reasonably reproduce the correlation matrix of resampling (Table 10). When the sample size is small or does not conform to the parametric assumptions, resampling is recommended as a remedy (Efron 1979; Efron 1982; Diaconis and Efron 1983; Efron 1986; Efron 1987; Efron 1988; Efron 1991; Efron and Tibshirani 1993).

Criterion-Related Validity and LISREL Analysis

Since the paper and pencil test was considered the criterion measurement tool, another LISREL analysis was conducted to asses the predictiability of the Internet toward the paper and pencil test. The results show that the Internet ad effect measure can predict 94% of test score variability of paper-and-pencil measure (Figure 3).

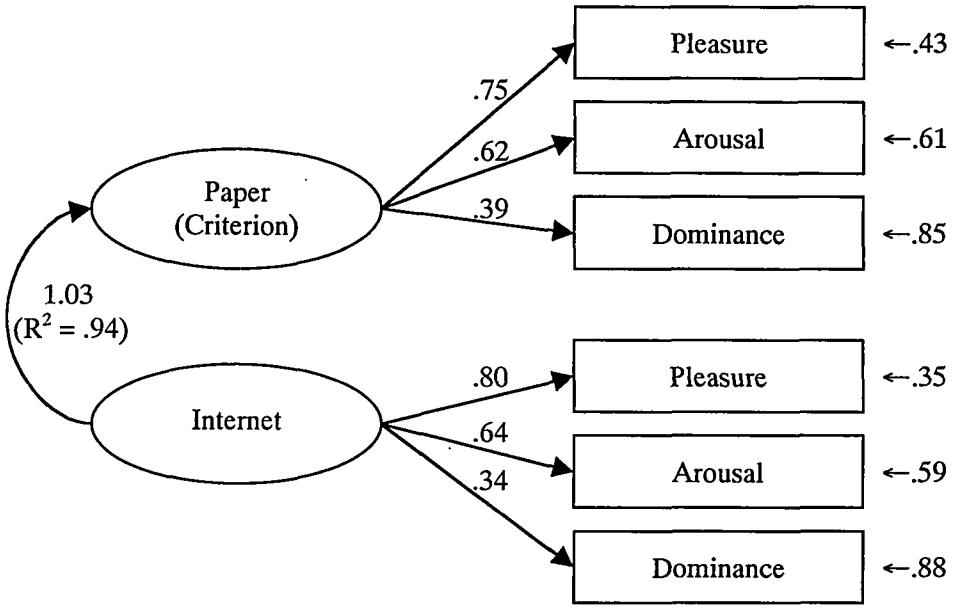
This transference of a test from one situation in which the test has been established valid to another similar situation or location is often referred to as the "transportability" of validity from one situation to another (Hunter and Schmidt 1981; Rafilson 1991). The weighted R^2 in Figure 3 is also a substantial evidence for the transportability of paper-and-pencil validity to the Internet survey, and the hypothesis 2_b is supported.

There's a lot of confusion in the methodological literature that stems from the wide variety of labels

Table 10
Content Validity of Internet Ad Effect Measures: *Validation of LISREL Analysis Result*

Validation Criteria	*Random Hold-out Sample Group 1 (n=103/204)*	*Random Hold-out Sample Group 2 (n=101/204)*
AGFI	AGFI=.85	AGFI=.91
RMR	RMR=.05	RMR=.04
NNFI	NNFI=.89	NNFI=.98

Figure 3
Criterion-related Validity of Internet Ad Effect Measures: *LISREL Analysis Result*



that have been used to describe the construct (trait validity, factorial validity, convergent validity, discriminant validity, and nomological validity), content (face validity, intrinsic validity, and circular vlaidity), and criterion-related validity (empirical validity, concurrent validity, predictive validity, and statistical validity) of the measures. In practice, three different inferences for assessing reliability and validity have been discussed: the correlation-based, the covariance-based, and the regression slope-based. The regression slope may be more robust in some situations when the metrics for the predictor and the criterion can be considered comparable across studies (Rafilson 1991). An empirical resamping study conducted with an extremely large database, however, showed that all three statistical inferences perform similarly (Raju, Pappas and Williams 1989).

Discussion

This test of responses on the Internet shows that this form interactive and globally accessible method of fielding a survey is reliable when compared to a traditional paper and pencil test. The AdSAM method of measuring affective responses to advertising has been shown to be highly predictable of brand interest and purchase intentions in a paper and pencil copytesting environment (Morris, Woo, Geason and Kim 2002). This study showed that subjects tend to respond to the scale similarly regardless of the medium. The Internet patterns of response were very similar, with an equal number of responses falling in the middle and the ends of the scale when compared to the paper and pencil test. The respondents did not seem to find any difference in the survey when it was

placed on the web. The present study supports King and Miles (1995) conclusion regarding the equivalency between computer-based and paper measures for "non-cognitive" tests. It is clear, therefore, that in this case the Internet is an equivalent research medium with paper and pencil testing, which supports the quality and usefulness of the web-based survey method.

The results of the study should be transferable to other forms of internet testing. The test involved emotional responses to brands thus eliminating a stimulus effect which may have occurred if print ads or television commercials had been employed. Moreover, the use of a visual measure eliminates some of the test instrument bias associated with reading verbal responses.

As previously mentioned, the Internet as a research medium does provide distinct advantages over paper and pencil measures: no paper or copying, time and money saving, global distribution, no separate data entry. With the knowledge that the survey will produce similar results on the Internet as it does on paper, researchers can feel confident in exploiting this new medium for distributing questionnaires. Even though the current study shows that the Internet is a viable medium and worth using, future research efforts are needed to establish the consistency over time, audiences, and instruments.

Suggestion for Future Research

Since a visual measure of emotional response was used to eliminate bias associated with verbal measures including the consistency across cultures, it is expected that verbal measures of emotional response will produce similar results, unless the Internet makes the test harder to read and follow. Therefore, as future research, it would be valuable to examine verbal measures to see whether they also yield equivalency between the web-based and the paper and pencil test. In addition, the current study used a non-cognitive emotional test to check the reliability and validity of the web-based method compared with the paper and pencil method. Therefore, it would be valuable to compare cognitive vs. non-cognitive web-based tests in terms of their equivalence with corresponding paper and pencil tests. Furthermore, it would be desirable to compare paper and pencil tests with web-based tests that facilitate interactive and dynamic characteristics of the Internet. For example, it would be interesting to combine texts, graphics, animation and sounds to make the survey web pages more interactive. In addition, HTML or scripting languages should be used for filtering so that a subject can respond to the contingency questions depending on his or her responses to previous questions.

Moreover, the current study did not examine the effects of various internal and external factors (e.g., web skills/experiences, different connection speed, and browser types) on responses to the web-based survey. Instead, the study tried to minimize the effects of these factors by building a web-based survey consisting of basic texts and graphics with no advanced technologies (e.g., Flash, Java, etc.). In conclusion, the current study is a first attempt to examine the equivalence, reliability and validity of the web-based test compared with the traditional paper and pencil test and the test show strong consistent responses. In addition, it lays a significant foundation for future research in this field.

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