1. Introduction

The ubiquity of the Internet and the increasing availability of World Wide Web (WWW or Web) technologies have provided tremendous opportunities for conducting research, and have created a burgeoning interest in Web-based surveys (Dillman, 1998). However, concomitant with this new medium is greater scrutiny of the relative advantages and disadvantages in the use of Web-based, rather than traditional pencil-and-paper, surveys.

Researchers have noted the following benefits associated with Web surveys: lower overall cost (Pitkow and Recker, 1995; Witt, 1998); increased speed and efficiency of data collection (Batagelj and Vehovar, 1998; McCullough, 1998); collapsed geography and increased communication between the researcher and respondent (Smith, 1997); higher-quality graphics, multimedia, and presentation (Sheehan and Hoy, 1999); increased candour (Smith, 1997); fewer transcription errors; and potentially increased response rates (Swoboda, Muehlberger, Weitkunat, and Schneeweiss, 1997). Shortcomings or costs, on the other hand, have been noted to include the following: high start-up costs (Batagelj et al., 1998; White et al., 2001); technological complexity of the medium (White et al., 2001); technological or human difficulties in respondent completion (Dillman et al., 1999); inability to observe or communicate with the respondent (Farmer, 1998); lower response rates (Yun and Trumbo, 2000); sample bias (Sheehan and Hoy, 1999); coverage error; and difficulty maintaining privacy, anonymity or confidentiality (Stanton and Rogelberg, 2001).

However, even though differences in the two approaches are frequently acknowledged (Bowker and Dillman, 2000), the application of the Web-based survey has followed a similar
path to many other new technologies. That is, before the power of a new technology is realized, it is used in substantially the same way as older technologies. With few exceptions, Web surveys incrementally extend our mental model of the pencil-and-paper survey without taking advantage of the unique benefits inherent in the medium. As a consequence, we believe that the Web survey is an under-exploited resource.

In this paper, we review the existing Web survey literature, identify several productive technological capabilities, and describe a recently conducted Web survey using some of these capabilities. Practical suggestions on the design and administration of Web surveys are then offered, along with a set of “lessons learned”.

2. Web survey overview

Because the use of the Web to conduct research has been driven more by computer programmers than survey methodologists (Dillman and Bowker, 2001), it is somewhat surprising that so little recognition has been given to new or innovative ways in which the technology can be used. Indeed, in the same way that the first movies were static reproductions of stage plays, many Web surveys today are simply pencil-and-paper surveys on a screen. Much of the existing research has approached the Web from the perspective of the online migration of pencil-and-paper surveys rather than from the consideration of ways in which methodological rigour can be improved or new opportunities created. In this section of the paper, we summarize existing research on Web surveys into three areas: advantages and disadvantages of using the Web, Web survey design and construction, and the emergence of new capabilities.

2.1 Advantages and disadvantages

Advocates of Web research have focused mainly on cost reduction in the logistics and mechanics of sending surveys and reminders (Witt, 1998). These studies have noted that the marginal cost of electronic surveys is close to zero or free (Sheehan and Hoy, 1999), with one illustrative example suggesting that postal surveys were more than seven times as expensive as Web-based methods (Comley, 1998).

Coverage has also been identified as a factor driving the adoption of Web research, largely because of the increase in the ability of researchers to reach remote or otherwise difficult-to-target groups (Comley, 1998). This increased coverage and reach in turn accelerates data collection and the speed with which analysis can begin - cases have been documented in which hundreds of survey responses have been received within a few days (McCullough, 1998; Smith, 1997).

Additional advantages not solely related to cost include process streamlining and the elimination of data recoding by connecting the Web site directly to a database that can be accessed by a statistical package (Batagelj and Vehovar, 1998; Dillman et al., 1999).

Research on response rate is somewhat equivocal. Some research has suggested increased response rates from improved design, better targeting of desired respondents, and identification of interested or affected parties (Swoboda et al., 1997; Yun and Trumbo, 2000), while others have suggested that higher response rates result from novelty and will ultimately decline (Klassen and Jacobs, 2001). A number of studies have reported response rates for Web surveys that are significantly lower than the response rates for comparable pencil-and-paper surveys (MacElroy, 2000; Sheehan and McMillan, 1999).

Other disadvantages associated with Web surveys have included high startup costs as well as the elevated level of technical sophistication required to construct a Web site, even though development costs are declining and tools are becoming easier to use (White et al., 2001). Sample bias has also been identified as a disadvantage of Web-based research, with certain groups unilaterally excluded and others either over- or under-represented (Pitkow and Recker, 1995). This unbalanced representation, commonly referred to as the “digital divide”, has been mitigated somewhat, particularly among populations such as academics, managers, and those with high technological familiarity (Schaefer and Dillman, 1998).

In summary, while some factors are equivocal, a number of advantages and disadvantages to the use of Web-based over
traditional pencil-and-paper surveys exist. These are summarized in Table I.

2.2 Web survey design and construction

Given that the presentation of Web surveys is dependant upon the recipients’ browser and computer configuration, it is perhaps not surprising that much of the research on survey design and construction has concentrated on the lack of control and consistency that designers have over how the surveys are displayed. This has led to a series of recommendations on how to keep pages simple, consistent, and relatively easy to understand (Dillman and Bowker, 2001).

The impact of page complexity and the time required to download images on survey abandonment have also been studied. In one case, fancy or complex pages were found to result in the decline of completed responses from 93.1 per cent to 82.1 per cent (Dillman et al., 2001).

Recognition that many different types and versions of browser can access the Web has also added significant complexity to the development process. A solution to this problem, the principle of Least Compliant Browser (Bowker and Dillman, 2000), essentially suggests that development should be capped at the most primitive or unsophisticated environment within the target population in order to ensure that the pages operate and are displayed as intended.

Multiple respondents and double counting of responses can also be a problem with Web-based research. To address this problem, personal identification numbers (PINs) or other login credentials have been recommended to ensure that only respondents from the target population are represented in the results, and to identify multiple responses. Alternatively (although technologically more complex and subject to false positives), capturing and filtering the responses using the Internet Protocol (IP) address of the respondent’s computer has also been suggested (Batagelj and Vehovar, 1998). In addition, cookies may be used to track respondents, but their use is controversial and can conflict with ethical guidelines.

Other recommendations for researchers developing Web surveys include updates or revisions to established survey guidelines such as selection of an initial question that is likely to be of some interest to most respondents, presentation of each question in a format similar to that used on paper questionnaires, restrained use of colour to maintain foreground consistency and readability and to preserve unimpeded navigational flow, provision of a progress indicator so that respondents know where they are in the survey, and avoidance of items that have known measurement problems (i.e. questions that ask respondents to check all that apply (Dillman and Bowker, 2001)). In addition, Web-specific suggestions include a welcome screen that emphasizes the ease of responding, provision of specific instructions (Dillman, 2000), directions that encourage completion of the instruments, and the avoidance of drop-down text boxes (Dillman and Bowker, 2001). These design principles are summarized in Table II.

Table I Commonly held advantages and disadvantages of Web surveys

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low marginal cost in logistics and mechanics of survey construction</td>
<td>High startup and fixed costs</td>
</tr>
<tr>
<td>Increased geographic reach</td>
<td>A high level of technical expertise may be required of both the researcher and the respondent</td>
</tr>
<tr>
<td>Accelerated data collection and streamlining of collection process – fewer transcription errors</td>
<td>Sample bias and “digital divide”</td>
</tr>
<tr>
<td>Increased response rate due to improved design, better targeting of respondents, and identification of interested parties</td>
<td>Inability to communicate with the respondent</td>
</tr>
<tr>
<td>Questions may be easily modified at any time prior to completion</td>
<td>Difficult to maintain and ensure anonymity and confidentiality</td>
</tr>
</tbody>
</table>

3. The emergence of new capabilities

The recommendations described above have almost certainly led to better Web surveys but, in general, they have failed to move researchers much beyond the basic logic of Web surveys as pencil-and-paper survey on the screen.

However, some methods that utilize the full capabilities of the online medium are emerging. These include adaptive questions or using responses to earlier questions to modify the order, type, or context of future questions
While early uses of this capability have been relatively primitive (with respondents instructed to “click here to skip to question 42”), there is no reason why the survey itself could not present the appropriate questions dynamically based upon responses (with respondents unaware that the survey had branched to a different section), or otherwise modify and adapt additional questions. This process would present a simpler survey, and would reduce the curiosity of the respondent that often leads to the selection of a branch that is inconsistent with the respondent’s normal behaviours.

Bowker and Dillman (2000) have noted that simply placing traditional surveys online implicitly assumes a cultural model of cognition that relies on the expectation that respondents employ “paper logic” when filling out Web surveys (top to bottom, left to right, etc.), and that this logic may need to be re-examined. Navigation of Web surveys is inherently different in that respondents do not turn the pages but interact between the screen, keyboard, and mouse. This, of course, has both advantages and disadvantages in that respondents can easily correct or reconsider prior answers but, at the same time, can skip ahead and either guess the survey objective or be biased in their response. Web-based surveys enable tremendous flexibility in their design and can, for example, individually randomize questions. This can significantly increase our ability to control for bias and error or allow determination of the impact of question sequence or order on preferences.

Basic information that can be obtained from each session without intrusion or the use of cookies includes the time of access, originating network, type of browser, and operating system version. In some cases, this information can be used to validate the sample or provide a control question to validate the veracity of the respondents’ knowledge (i.e. by asking a question to which the answer is unambiguous and known to the researcher). If cookies are used, then more extensive and personal information can be obtained.

Web-based technology not only allows more control and flexibility about where objects or information are presented, but can be used to reduce potential bias by randomly assigning choices to the left and right or top and bottom of the screen, and/or by generating more complex, fully randomized display patterns than have traditionally been feasible with paper surveys. Skipping ahead in order to determine the “objective of interest”, which has long been an area of concern for researchers, is also preventable in Web surveys either passively by displaying the question later in the survey, or actively by preventing respondents from scrolling ahead and “deep linking” or jumping to a particular page in the survey. In addition, beyond radio-type buttons or Likert scales, respondents can be presented with “fuel gauge” type indicators that allow them to specify their preferences with greater precision. This capability can also ameliorate the process where respondents make trade-offs or allocate resources among multiple criteria by re-calculating the remaining resources.

Cursor movements and the amount of time spent on each page can also be tracked either to measure cognitive load or to determine if respondents change their minds or alter their responses. This technique can also be extended through the use of “hover-overs”, hyper-links, and pop-up windows, and can be used to determine the factors that lead to survey abandonment or hesitation in responding to

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**Table II Summary of Web design principles**

<table>
<thead>
<tr>
<th>Objective or problem</th>
<th>Design suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of control and consistency in display of pages, and large amount of time required for download</td>
<td>Simplify pages and maintain consistency</td>
</tr>
<tr>
<td>Multiple browsers adding to design complexity</td>
<td>Use principle of Least Compliant Browser – design for the simplest and most common environment</td>
</tr>
<tr>
<td>Double or multiple counting of respondents</td>
<td>Employ personal identification numbers, login credentials, cookies, or IP filtering to identify duplicates</td>
</tr>
<tr>
<td>High drop-out rates</td>
<td>Make initial questions interesting, and use formats that increasing readability and restraining extraneous use of colour. Avoid known measurement problems and the use of drop-down boxes</td>
</tr>
<tr>
<td>Incomplete responses</td>
<td>Prompt for missing questions or force completion</td>
</tr>
</tbody>
</table>
certain questions. These capabilities are summarized in Table III.

4. Application of the principles – Web-based data collection

During June and July 2001, we conducted a survey designed to explore how respondents, senior information services managers, and decision makers made technology selection decisions, along with the criteria that they used (the results are reported elsewhere (Tingling and Parent, 2002b). We decided to use a Web rather than a pencil-and-paper survey because the research could be compromised if respondents skipped ahead and guessed our disguised agenda, the sample frame consisted mainly of information technology professionals, the research design included several treatments, and the study was national in coverage.

The survey was built from the ground up for the Web with Active Server Pages for flexibility, server-side Java to reduce the load on respondent browsers, and tables driven with a Microsoft Access database that stored responses in numeric format ready for export to a statistical analysis package. The survey was hosted in a commercial ISP environment because of its high availability, redundancy and load-sharing configuration, the expected traffic volume, and overall technical environment. In addition to 12 days of effort from the primary researcher, development and construction of the site required approximately 200 hours of analysis and coding, 25 hours of database administration, ten hours of graphic art and branding, and 20 hours of project management. Direct and indirect Web site costs (e.g. hosting, postage, URL purchase, etc.) were approximately US$700.

All pages in the Web site (see Appendix, Figure A1) had a consistent look and feel, with brand graphics and colors provided by the researchers’ university. With the exception of the demographic page, none of the screens required scrolling on a full-sized window. Responses to the database were written at the end of each section. The Web site had seven logical stages or sections.

(1) **Home page.** A dedicated URL ([www.technologyselectionresearch.org](http://www.technologyselectionresearch.org)) was selected and purchased to provide a relevant and easy-to-remember location, rather than one that had multiple extensions or one that was prone to typographic errors (e.g. [www......org/survey/selection](http://www......org/survey/selection)). The dedicated URL was also intended to provide continuity for an ongoing research agenda and to allow easy publication of the results back to the respondents (“.org” was selected as the top-level domain in order to differentiate the research from commercial surveys.).

The home page described the research agenda in general terms, provided contact information, noted that the site did not use cookie technology, and invited respondents to return to obtain results of the study. Login to the Web site required unique user identifications and passwords that were stored in an Access Database (consisting of 4,000 entries). Login credentials were derived from each respondent’s name (with initials added to broker ties) and

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### Table III New capabilities

<table>
<thead>
<tr>
<th>Capability</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive questions</td>
<td>Automatic tailoring and renumbering of questions allowing easier completion by respondents and reduced guessing of research objective</td>
</tr>
<tr>
<td>Automatic or non-invasive gathering of information, such as time of completion, technical information, or originating network</td>
<td>Sample validation, use of control questions, increased validity</td>
</tr>
<tr>
<td>Increased flexibility in placement of information and objects</td>
<td>Higher levels of randomization, lower levels of bias. Increased validity by controlling for position</td>
</tr>
<tr>
<td>Cursor tracking</td>
<td>Measurement of cognitive load or areas of respondent interest. Potential tracking of level of interest or changed responses</td>
</tr>
<tr>
<td>Completion tracking</td>
<td>Identification of problem areas or sections that are associated with drop-outs</td>
</tr>
<tr>
<td>Greater granularity – no restriction to a five or seven point scale</td>
<td>More precise scale measurement – lower measurement error</td>
</tr>
<tr>
<td>Recalculation of scales in allocation measures</td>
<td>Easier for respondents to allocate choice among multiple items. More accurate measurement. Lower measurement error</td>
</tr>
</tbody>
</table>
sequentially assigned numerals prefaced with an easy-to-remember word (e.g. DoeJA, Research0601). The Web site was designed and constructed to prevent “deep linking” - respondents could not navigate or enter the site except via the home page, and progression through the site could occur only according to the coded logic. 

(2) Consent. This page, displayed after the respondent logged in, detailed the ethical policy of the researchers’ university, commitment to confidentiality and privacy, and planned usage of the data; it also noted that respondents could decline to answer any question or have their responses deleted even after completion. (Less than 1 per cent of completed responses were declined, although one request to delete the responses was received.) Acceptance of this policy was required in order to proceed. Using Java, this screen also assigned a consecutive numeric treatment identifier (between one and eight) that was used by the Web site to randomly assign a treatment (stage 5).

(3) Research description. This page provided respondents with a sense of survey length and progress by describing the main sections of the survey, the case study where respondents would be requested to place themselves in the role of decision maker (this section containing the research treatment), and the demographic questions. The research was noted to require approximately ten minutes (based upon pre-testing). Respondents were advised that almost all of the questions could be completed using the mouse rather than the keyboard.

(4) Measurement and scales. Respondents completed six pages containing 35 questions using radio buttons on Likert-type scales. A “decline to state option” was included for each question. Responses were forced in that all questions had to be answered before proceeding to the next page. The last question of this section was open-ended and contained a 250-character, free-form text box that allowed respondents to indicate other comments.

(5) Treatment. This section presented the respondents with a scenario (a case study) that was dynamically modified in several ways depending upon an identifier that was consecutively assigned during consent (stage 2). Elements of the treatment were randomly assigned to the right and left sides of the screen, and within the overall group of treatments (a one-by-four design) the options themselves were replicated and the choices reversed to obviate position, name, or selection bias. To reduce the computing load, randomization was provided by assigning a consecutive number, between one and eight, to each of the respondents based upon their arrival sequence; this had the advantage of further equalizing the number of respondents in each of the treatment cells.

(6) Demographics. This section contained approximately 20 questions such as age, gender, experience, and industry. Use of “drop-down” text boxes was minimized. The page contained an area where respondents could indicate willingness to be contacted, and indicate their preferred method and time. Approximately 29 per cent of the respondents (or 112 people) provided contact information.

(7) Acknowledgement.

In addition to dynamic page creation, positioning of responses, and generation of treatments within the Web site, two other new capability techniques were employed. The first, adaptive questioning (suggested by many researchers (Dillman, 1978; Pitkow and Recker, 1995; Sheehan and Hoy, 1999)), removed and renumbered questions based upon early responses, and resulted in a more customized instrument that was transparent to the respondent and provided no indication that the survey had branched to a different segment, as the questions were automatically renumbered. The second technique involved capturing technical information on the respondents’ browser type and version. This allowed checking for respondent bias against the total Internet population by a comparison of the sample to published browser market-share data (at the time of the collection Netscape Navigator, for example, accounted for approximately 11 per cent of our sample, a figure comparable with published estimates).
This information was also used as a measure of the respondents’ technical knowledge of their configuration as it was compared to responses that they provided about the version and type of their browser.

The sampling frame consisted of a subset of the mailing list of a national information technology magazine aimed at executives, a sample well-suited to the medium (Bauman and Airey, 2000). Following pre-testing of the Web site by part-time MBA students (whose involvement was limited to systems testing and was not included in the analysis), recipients were randomly selected from the mailing list and sent 3,426 personalized, but otherwise identical, solicitations (Dillman, 1991) of 448, two-page letters on university letterhead and 2,978 e-mails. The solicitations, containing a description of the study, privacy policy, and personalized credentials, were sent in two phases; the first 200 letters and 200 e-mails were sent in July of 2001, and the remainder (248 letters and 2,778 e-mails) 14 days later. A single e-mail reminder was sent to all non-respondents 44 days after their initial solicitation. Respondents were asked to complete the survey within a week of receiving the solicitation; data were collected for 50 days in total, a deadline imposed by our research agenda. Timing of the responses is illustrated in Figure 1. In total, 348 usable responses were received and tested for solicitation medium, timing, naming, and position biases - none were detected. Aggregate response rate was 10.15 per cent (46 letter responses (10.26 per cent) and 302 e-mail responses (10.14 per cent)). No direct or fiscal compensation was provided to the respondents, although they were promised and did receive summaries of the results (either e-mailed or downloaded from the Web site). The demographics of the sample were compared to those of the magazine and found to be similar, with no over-weighting along any dimension. The sample is described in Table IV.

5. Lessons learned

This section of the paper summarizes the lessons learned during and after construction of the Web site, and offers suggestions for improvement.

Consistent with existing research, our Web survey had a large up-front effort. In addition to development of the survey itself (scale items, solicitation letter, personalization, etc.), development required more than six weeks of construction effort. Although we did consider using one of the survey-hosting or “turnkey” Web sites advertised on the Internet, ultimately we decided (because of ambiguity as to who owns the data and the number of third parties that would be involved) that custom building a Web site was required to implement our methodology and ensure that we could maintain our commitment to data confidentiality, anonymity, and conflict avoidance. Without the ability to make this assurance, we believe that we would not have been given the degree of access to the mailing

Table IV Respondent position

<table>
<thead>
<tr>
<th>Position</th>
<th>%</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP/Director – MIS</td>
<td>48.2</td>
<td>168</td>
</tr>
<tr>
<td>VP/Director – business unit</td>
<td>18.4</td>
<td>64</td>
</tr>
<tr>
<td>CIO</td>
<td>9.2</td>
<td>32</td>
</tr>
<tr>
<td>CEO</td>
<td>8.3</td>
<td>29</td>
</tr>
<tr>
<td>CFO</td>
<td>1.1</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>14.6</td>
<td>51</td>
</tr>
</tbody>
</table>
list that we desired, or have received the volume and type of responses that we achieved. The Web site was designed in a modular form, with the questions and all other text and parameters coded in tables rather than in each of the pages. This provided flexibility and separated the researchers from the developers, allowing us to modify and refine questions ourselves and to avoid interrupting the technical development of the site. Because the Web site was built in modular form, we expect that the majority of the coding infrastructure can be re-used in future with a decreased reliance on sophisticated technical expertise.

We encountered a high level of communication with respondents and this presented both challenges and opportunities. On the one hand, we found that we were quickly alerted to problems via e-mail or telephone; for example, login credentials that contained apostrophes (a condition that had not manifested itself during testing) caused the Java login script to fail. Fortunately, one of the respondents advised us of this the first day that the site was live and we were able to correct the code before it affected any others. Similarly, we were quickly alerted to the fact that some respondents were pasting large amounts of text into the free-form box of the last question and causing the database to fail. In real time we were able to update the page with a request to keep comments to fewer than 250 spaces, and we set the database at 300 spaces. However, on the other hand, we received a large number of long, well thought out, and constructive e-mails. These were unexpected and required a high amount of individual attention in order to provide a timely response to each of the respondents.

Response rate, at 10.2 per cent, was relatively low by some standards, although it needs to be considered within the context of the sample that consisted of time-restricted senior IS decision makers, the time-frame of the solicitation (the research being conducted during the summer vacation period of 2001), and the use of a single reminder rather than multiple reminders. Letter mailing and e-mail personalization was done by a third party, which was advantageous in that we had access to professional tools but somewhat constraining in that we were limited to one reminder (although, as is illustrated by Figure 1, this single reminder had a marked effect on response rate and suggests that non-respondents failed to complete the survey for reasons other than lack of desire). In addition, a second deficiency was that we were not provided with information on the percentage of e-mail addresses that were returned by the recipient servers. This may have resulted in lowering the reported response rate for e-mail, as prior research has suggested that up to 12 per cent of e-mail addresses may be out of date even in lists believed to be current (Smith, 1997). Approximately 5 per cent (22) of the letters were returned unopened to the researchers, although communication with some respondents indicated that letters addressed to employees who were no longer with the target firms were opened by their replacements. This suggests that physical mail might be a better solicitation mechanism for Web surveys than e-mail (as e-mail is typically not forwarded), and that login credentials should be personalized at the level of the target organization rather than the level of the incumbent (since some respondents indicated discomfort using credentials that had been personalized for someone else). Drop-outs, often a problem with any type of survey, were also problematic. While 920 respondents logged into and interacted with the Web site, more than 60 per cent failed to complete the experiment. (Because of confidentiality and anonymity assurances, we were not able to identify why this was the case.)

Debugging the Web site, an area to which we originally had not given much consideration, required a great deal of effort in order to validate that each of the treatments and modifications worked as designed. Particularly troublesome and initially overlooked was the need to develop, for both Netscape Navigator and Microsoft Internet Explorer, an activity that required a substantial amount of rework. Further, one problem that took a while to discover was the need to delete the browser Internet cache after each test in order to replicate the live environment. In future, in addition to increased testing and refinement, we would recommend using separate volunteers for testing, not only to speed up the process and reduce boredom but to more closely replicate the live environment.
### Table V Lessons learned

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The up-front design effort can be significant</td>
<td>Recognize that this is a large effort and increase the planned time for this activity. Build the Web site in modular form to allow easy modification of questions and concurrent testing of modules. Modular construction and the use of templates also supports the reuse of code by making it easier to create new or different surveys</td>
</tr>
<tr>
<td>Live production cannot be simulated and it is difficult to test concurrent access and problems associated with scale</td>
<td>Increase Web traffic slowly by sending out the solicitations in phases. Monitor the first phase, carefully paying particular attention to any reported problems. Use students and others to stress and production test the survey (deleting or excluding their responses from the database)</td>
</tr>
<tr>
<td>E-mail lists can be out of date</td>
<td>If possible, validate the e-mail list or monitor “bounced” e-mails. Be aware that organizations providing lists are generally not motivated to reduce their size. Consider sending a portion of solicitations via traditional mail and testing for sample bias</td>
</tr>
<tr>
<td>E-mail credentials may not be shared, and some names may cause the login scripts to fail</td>
<td>Consider using lesser-personalized credentials. Test credentials that have non-traditional characters (hyphens or apostrophes). Validate lists to ensure no duplicates exist for common names (e.g. Smith et al.)</td>
</tr>
<tr>
<td>Drop-out rates may be high</td>
<td>Track where respondents drop out in pilot or the first phase of the survey, and consider revising</td>
</tr>
<tr>
<td>Testing/debugging testing and debugging is complex, and simulating the “real” environment is difficult</td>
<td>Have a separate pool of testers (such as students, an excellent group), and remember to clear the cache buffers when re-running tests. During design, have programming parameters displayed on the screen (e.g. random number assignments) and have testers record, print or save screen images to validate logic</td>
</tr>
<tr>
<td>Respondents use multiple browser types</td>
<td>Determine eligible browsers used by the target population and specify requirements to developers in advance</td>
</tr>
<tr>
<td>Web site availability is not 100 per cent</td>
<td>Use professional hosting services and try to even out the survey traffic by sending solicitations in phases. Check the Web site during each day of operation with “sample” or dummy credentials. Include a telephone number or “high priority” e-mail that can be used by respondents to report technical difficulties</td>
</tr>
<tr>
<td>Wording and design (e.g. order) of the questions may change over the design of the survey as a result of pre-testing or new information</td>
<td>Use tables rather than hard coding of the questions in order to increase flexibility and reduce dependence on designers. Keep in mind that reverse-coded questions might need more complex logic when writing responses to the database</td>
</tr>
<tr>
<td>Communication requirements with respondents can be high – making is easy for respondents to contact you will encourage them to do so</td>
<td>Allocate time to respond to e-mails. Prepare or retain standard responses that can be customized but ensure that responses do not look scripted or formulaic. Keep the name short. Avoid “dot com” as the high-level qualifier in academic research. Code the name and login credentials directly into e-mail solicitations and reminders</td>
</tr>
</tbody>
</table>
Hosting the Web site also provided some challenges in that our availability and technical requirements were higher than those typically provided at low cost to entry-level hosting sites, but well below the industrial requirements that charged commercial rates and required a long-term contract. Ultimately, we were able to negotiate an arrangement with a large, US-based Internet service provider (ISP), although we still encountered several periods of downtime and believe that our response rate suffered as a result. Overall, however, we found that respondents were extremely helpful in identifying problems with the Web site and, in some cases, they advised us that they had retried and re-entered the survey. Using a professional ISP with remote access and reporting tools easily allowed us to track responses in real time. These “lessons learned” are summarized in Table V.

6. Summary and conclusion

In 1998, Dillman noted that self-administered surveys that leave interviewers out of the data-collection process will become the dominant method of surveying in the twenty-first century as a result of changes in societal organization and culture, the availability of technology, cost at efficiency, and consideration of contributions to survey error. Many Web surveys have been conducted and, like traditional surveys, they can have large variance in their sophistication and complexity depending upon which capabilities and features have been included (Smith, 1997); yet a paucity of published information exists to help advance our field methodologically and to share experience. In this paper we have attempted to describe our exploratory steps in this area and to encourage experimentation and new approaches to Web surveys. Although it is likely that Web surveys of the future will have as much in common with pencil and paper surveys as filming stage plays have with present day television, we hope that, by describing the results of our own recent, large-scale Internet survey and suggesting future possibilities, we advance our field by allowing others to avoid the same mistakes, improve our method, improve efficiency and effectiveness, and build towards a cumulative tradition.

References


Appendix

Figure A1 Web-site screen images

To assist in the accuracy of this study, please complete all questions. There are less than 50 questions – all can be answered with the mouse. Estimated time required: 10 Minutes.

This study has three sections:

1. A section on evaluation criteria that may be considered when selecting between technologies [approximately 35 questions].

2. A technology section component [1 page].

3. Demographic/firm information [approximately 15 questions].

While in your current position and firm, please specify your main or primary responsibility in the acquisition of technology:

Responsibility:
- [ ] Research
- [ ] Testing/Evaluation
- [ ] Specification
- [ ] Authorization
- [ ] Other (Specify)
- [ ] None

Other:

Questions 1 - 5

When you last decided between two (or more) competing technologies or solutions please indicate how important you considered each of the following criteria when making your decision:

1. Immediate acquisition cost:
   - Very unimportant
   - Somewhat unimportant
   - Neutral
   - Somewhat important
   - Very important
   - Decline to state

2. Three-year cost of ownership:
   - Very unimportant
   - Somewhat unimportant
   - Neutral
   - Somewhat important
   - Very important
   - Decline to state

3. Long-term (4 - 7 years) cost structure:
   - Very unimportant
   - Somewhat unimportant
   - Neutral
   - Somewhat important
   - Very important
   - Decline to state

4. Location of the firm's head office or offices:
   - Very unimportant
   - Somewhat unimportant
   - Neutral
   - Somewhat important
   - Very important
   - Decline to state

5. Documentation & Education:
   - Very unimportant
   - Somewhat unimportant
   - Neutral
   - Somewhat important
   - Very important
   - Decline to state

(continued)
Extending the capabilities of Internet-based research

Peter Tingling, Michael Parent and Michael Wade

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Figure A1

Please make your decision as if you were in your current capacity at your existing firm or organization.

Your firm or organization will be implementing a strategic business-based solution that requires a plug-in to the Internet browser that your company uses. Your organization has performed an extensive and thorough evaluation of two different products described below. One has to be selected in order to maintain the project schedule. This project has the full support of your top executive team and is a key element of your firm’s competitive position and strategy.

The products were evaluated on the following criteria:

- Age of firm
- Price
- Location
- Documentation
- Support
- Contract Terms
- Marketshare
- Fiscal Strength of the Firm
- Partners
- Architecture
- Existing Clients
- Capabilities
- Ease of use

Marketshare
One firm has a slightly higher number of clients than the other although the other has slightly more licenses installed at each client. (using vendor reported figures for both)

Both of the products that they have evaluated have slightly different features with each one having most of the specific capabilities that you need. Neither meets all of your requirements, although both have separately indicated that the features that you need will be delivered in the next release.

Each of the products was evaluated against each of these criteria and the scores in each category multiplied by the weighting. These scores were then summed and the totals were within 5 points of each other.

XYZ received 156 points in the evaluation, and SPQ received 161 points (of a maximum 225 points). At a trade show you were recently informed that a competitor has selected XYZ.

Please choose the plug-in that you would recommend your organization purchase

C PRODUCT SPQ  C PRODUCT XYZ

Demographics

Our industry is: Administrative and Support Services
If other, please specify: 

I have been with the firm for:
C < 1 year  C 2 - 4 years  C 5 - 7 years
C 8 - 10 years  C More than 10 Years  C Decline to state

My position is: Vice President Business Unit
If other, please specify: 

I report to:
C CEO  C CFO  C Business Executive / Manager
C IS/IT Executive / Manager  C Other  C Decline to state

My highest level of education is:
C Some University  C Undergraduate Degree
C graduate Degree  C Decline to State

My education is primarily:
C Technical / Engineering / Computer Programming
C Business / MBA
C Both  C Decline to State

Gender:
C Female  C Male

I am:
C 34 & under  C 35 - 44  C 45 - 54  C 55+

My main or primary Internet browser is:
C Internet Explorer  C Netscape Navigator
C Other  C Decline to State

Thank you - If you would be willing to participate in a brief interview or to answer questions about how you evaluate technology, please check here: 

My preferred method of communication is:
Telephone: 
E-mail: 

continue