Chapter III
Surveys as a Complementary Method for Web Log Analysis

Lee Rainie
Pew Internet & American Life Project, USA

Bernard J. Jansen
Pennsylvania State University, USA

ABSTRACT

Every research methodology for data collection has both strengths and limitations, and this is certainly true for transaction log analysis. Therefore, researchers often need to use other data collection methods with transaction logs. In this chapter, we discuss surveys as a viable alternate method for transaction log analysis and then present a brief review of survey research literature, with a focus on the use of surveys for Web-related research. The chapter then identifies the steps in implementing survey research and designing a survey instrument. We conclude with a case study of a large electronic survey to illustrate what surveys in conjunction with transaction logs can bring to a research study.

INTRODUCTION

Even the most ardent proponent of transaction log analysis must admit that the method has shortcomings (B. J. Jansen, 2006; Kurth, 1993), as do all methodological approaches. These shortcomings include a lack of understanding the affective, situational, an cognitive aspects of system users. Therefore, the researcher employing transaction logs must look to other methods in order to address some of these shortcomings. Fortunately, the Web and other information technologies provide a convenient means for employing survey and survey research for such a purpose

Survey research is a method for gathering information by directly asking respondents about some aspect of themselves, others, objects, or their environment. Survey instruments are a data collection procedure that one can use in a variety of research designs. Researchers can use surveys to describe current characteristics of a sample population. One can also use surveys to

try to discover the relationship among variables. Surveys gather data on respondents' recollections or opinions; therefore, surveys provide an excellent companion method for transaction logs that typically focus exclusively on actual behaviors of participants.

This chapter briefly reviews some previous studies that used surveys for Web research. We then discuss the types of surveys, the steps in survey research, and how to construct an appropriate survey instrument. We then present a case study and survey instrument to illustrate how surveys can supplement and enhance an overall research study that may also employ transaction logs.

REVIEW OF LITERATURE

Although surveys have been used for hundreds of years, the Web provides a remarkable channel for the use of surveys to conduct data collection (K. J. Jansen, Corley , & B. J. Jansen, 2006) (K. J. Jansen, Corley , & Jansen, 2006). Many of these Internet surveys have focused on demographical aspects of Web use over time (Kehoe & Pitkow, 1996) or one particular Website feature (Waite & Harrison, 2002). Treiblmaier (2007) presents an extensive review of the use of surveys for Website analysis.

Survey respondents may include general Web users or samples from specific population. For example Jeong, Oh, and Gregoire (2003) surveyed travel and hotel shoppers, Huang (2003) surveyed users of continuing education programs, and Kim and Stoel (2004) surveyed female shoppers who have purchased apparel online.

For academic researchers, a convenience sample of students is often used to facilitate survey studies, including the users of Web search engines (Spink, Bateman, & Jansen, 1999). McKinney Yoon and Zahedi (2002) used both undergraduate and graduate students as their sample examining use of a Website. The major advantages of using students that are often cited include a homogeneous sample, access (Huizingh, 2002), their familiarity with the Internet (B. J. Jansen & McNeese, 2005) (Bernard J. Jansen & McNeese, 2005), and creation of experimental settings (Rose, Meuter, & Curran, 2005). There are concerns in generalizing these results (Abdinnour-Helm, Chaparro, & Farmer, 2005), most notably for Websites and services where students have limited domain or system knowledge (Kim & Stoel, 2004; Koufaris, 2002). However, as a sample of demographic slice of the Web population, students appear to be a workable convenience sample with results from studies with student (c.f., B. J. Jansen & McNeese, 2005; Kellar, Watters, & Shepherd, 2007) (c.f., Bernard J. Jansen & McNeese, 2005; Kellar, Watters, & Shepherd, 2007) similar to those using more rigorous sampling methods (c.f., Hargittai, 2002; Kehoe & Pitkow, 1996).

An increasing important type of survey instruments are electronic or Web surveys. Jansen, Corley, and Jansen (2006) define an electronic survey as "one in which a computer plays a major role in both the delivery of a survey to potential respondents and the collection of survey data from actual respondents" (p.). Several researchers have examined electronic survey approaches, techniques, and instruments with respect to methodological issues associated with their use (Couper, 2000; Dillman, 1978; Fink, 1995; Fowler, 1995; Krosnick, 1999; Sudman, Bradburn, & Schwarz, 1996). There have been mixed research results concerning the benefits of electronic surveys (Kiesler & Sproull, 1986; Mehta & Sivadas, 1995; Sproull, 1986; Tse et al., 1995). However, researchers generally agree that electronic surveys offer faster response times and decreased costs. The electronic and Web-based surveys allow for a nearly instantaneous data collection into a backend database, which reduces potential errors caused by manual transcription.

Regardless of which delivery method used, survey research requires a detailed project planning approach.

PLANNING AND CONDUCTING A SURVEY

Although it may seem that conducting a survey is an easy task, one must employ a detailed planning process if survey research is to be successful. The goal of any survey is to shed insight into how the respondents perceive themselves, their environment, their context, their situation, their behaviors, or their perceptions of others.

To execute a survey, the researcher must identify the content area, construct the survey instrument, define the population, select a representative sample, administer the survey instrument, analyze and interpret the results, and communicate the results. These steps are somewhat linear but are also overlapping and may require several iterations. A 10-step survey research process is illustrated in Table 1, based on a process outlined in (Graziano & Raulin, 2004).

Step 1 and Step 2: *Determine the specific desired information* and *define the population that is being studied*. The information being sought and the population to be studies are the first tasks of the survey researcher. The answers to these questions are based on the goals of the survey research and drive both the construction and administration of the survey. If one uses a survey as a supplement to on-going Web log analysis, then these questions may already be partially answered.

Step 3: *Decide how to administer the survey.* There are many possibilities for administering a survey, ranging from face-to-face (i.e., an interview), to pen and paper, to the telephone (i.e., phone survey), to the Web (i.e., electronic survey). A survey can also be a mixed mode survey, combining more than one of these approaches. The exact method really depends on the answers to steps one and two (i.e., what information is needed and what population is studied). Used in conjunction with Web log analysis, surveys can be conducted prior to or after a lab study, or one can administer a survey to get insight into the demographics of the wider Web population.

Step 4: *Designing a survey instrument*. Developing a survey instrument takes several steps. The researcher must determine what questions to ask, in what form, and in what order. The researcher must construct the survey so that it adequately gathers the information being sought. A basic rule of survey research is that the instrument should have a clear focus and should be guided by the research questions or hypotheses of the overall study. This implies that survey research is not well suited to early exploratory research because it requires some orderly expectations and focus of the researcher.

Table 1. Ten step process for conducting a survey

STEP	ACTIONS
1	Determine the specific desire information
2	Define the population that is being studied
3	Decide how to administer the survey
4	Designing a survey instrument
5	Pretest the survey instrument with a sub-sample
6	Select a sampling approach and representative sample
7	Administer the survey instrument to the sample
8	Analyze the data
9	Interpret the findings
10	Communicate the results to the appropriate audience

Step 5: *Pretest the survey instrument with a sub-sample*. Once the researcher has the survey instrument ready and refined, the researcher must pilot test the survey instrument. In this respect, a survey instrument is like developing a system artifact, where a system is beta tested prior to wider deployment. Generally, one conducts the pilot test on a sample that represents the population being studied, after which the researcher may (generally, will) refine the survey instrument further. Depending on the extent of the changes, the survey instrument may require another pilot test.

Step 6: *Select a sampling approach and representative sample*. Selecting an adequate and representative sample is a critical and challenging factor when conducting survey research. The population for survey study is the larger group about or from whom the researcher desires to obtain information. From this population, one generally surveys a representative sample. If the researcher is administering a survey to the respondents of a laboratory study, the representativeness is not a problem, as the respondents are already the sample from the chosen population. However, if one is looking at the Web population, this population is so large and diverse. It is impossible to question every member. One should carefully select a representative sample.

Whenever one uses a sample as a basis for generalizing to a population, the researcher is engaging in an inductive inference from the specific sample to the general population. In order to have confidence in inductive inferences from sample to population, the researcher must carefully choose the sample to represent the overall population. This is especially true for descriptive research, where the researcher wishes to describe some aspect of a population that may depend on demographic characteristics. In other cases, such as verifying the application of universal theoretical constructs, for example, Zipf's Law (Zipf, 1949), sampling is not as important since these universal construct should apply to everyone within the population.

Sampling procedures typically fall into three classifications, convenience sampling (i.e., selecting a sample with little concern for its representativeness to some overall population), probability sampling (i.e., selecting a sample where each respondent has some known probability of being included in the sample), and stratified sampling (i.e., selecting a sample that includes representative samples of each subgroup within a population).

Step 7. *Administer the survey instrument to the sample*. For actually gathering the survey data, the researcher must determine the most appropriate manner to administer the survey instrument. Many surveys are administered via the Web or electronically, as the Web offers substantial benefits in its easy access to a wide population sample. Additionally, administering a survey electronically, even in a laboratory study, has significant advantages in terms of data preparation for analysis. The survey can be administered once to a cross sectional portion of the population or one can administer the survey repeatedly over time to the same sample population.

Step 8. *Analyze the data*. Once the data is gathered, the researcher must determine the appropriate method for analysis. The appropriate form of analysis is dependent on the research questions, hypotheses, or types of question used in the survey instruments. The available approaches are qualitative, quantitative, or mixed methods.

Step 9: *Interpret the finding*. Like many research results, the interpretation of survey data can be in the eye of the beholder as what the results mean. When results are in question, it may point to the need for further research. One of the best aids in interpreting results is the literature review. What have results from prior work pointed out? Are these results in line with those prior researches? Or, do the results highlight something new?

Step 10: *Communicate the results to the appropriate audience*. Finally, the results of any survey research must be packaged for the intended audience. For academic purposes, this may mean

a scholarly paper or presentation. For commercial organizations, this may mean a white paper for system developers or marketing professionals.

Each of these steps can be challenging. However, designing a survey instrument (e.g., steps 4 and 5) can be the most difficult aspect of the survey research. We address this development in more detail in the following section.

DESIGNING A SURVEY INSTRUMENT

Before designing a survey instrument, the researcher must have a clear understanding of the type of data desired and must keep the instrument focused on that area. The key to obtain good data via a survey is to develop a good survey instrument that is based on the research questions. The researcher should develop a set of objectives with a clear list of all needed data. These research goals and list of needed data will serve as the basis for the questions on the survey instrument.

A survey instrument is a data collection method that presents a set of questions to a respondent. The respondent's responses to the questions provide the data sought by the researcher. Although seemingly simple, it can be very difficult to develop a set of questions for a survey instrument. Some general guidelines for developing survey instruments are:

- **Provide instructions for completing the survey instrument:** To assist in ensuring that one collects valid survey results, include instructions on how to respond to questions on the survey instrument. Generally, there is a short introductory set of instructions usually at the top of the survey instrument. Provide additional instructions for specific questions if needed.
- **Place question concerning personal information at the end of the survey:** Demographic information is often necessary for survey research. Place these questions at the end of the survey. Providing personal data may annoy some respondents, resulting in incomplete or inaccurate responses to the survey instrument.
- **Group questions on the instrument by subject:** If the survey instrument has more than ten or so questions, the questions need to be grouped by some classification method. Generally, grouping the questions by subject is a good organization method. If the instrument has multiple groups of questions, each group should have a heading identifying the grouping. Grouping questions allows the respondents to focus their responses around the central theme of the group of questions.
- **Present each questions and type of question in a consistent structure:** A consistent structure makes it much simpler for respondents and increases the likelihood of valid data. Explain the proper method for responding to each question and ensure that the response methods for similar questions are consistent throughout the instrument.

There are three general categories of survey questions, (1) multiple-choice, (2) Likert-scale, and (3) open-ended questions.

Multiple-Choice Question

Multiple-choice questions have a closed set of response items for the respondents to select. Multiple-choice questions are used when the researcher has a thorough understanding of the range of possible responses.

The items for multiple-choice questions must cover all possible alternatives that the respondents might select and each of the items must be unique (i.e. they do not overlap). Since presenting all possible alternatives is a difficult task, the researcher should include a general catch-all item (e.g., *None of the abov*e or *Don't know*) at the end of a list of

Examples of multiple-choice questions

What is your gender? a. Male b. Female	Which features of Instant Messaging programs do you find most useful when it comes to sharing information with teammates? a. Real-Time Chat b. File Sharing c. Chat logs d. None

Example of a Likert-scale rating question

On a scale of 1-7, would you search individually or together with your workmates if you do not know anything about the problem?

Individual					Collaborate	
1	2	3	4	5	6	7
*	*	*	*	*	*	*

Example of a Likert-scale ranking question

On a scale of 1-5 (1-never used, 5 - use every day), how experienced are you with using the following communication / collaboration applications for group projects?

a. _____ Email
b. _____ Instant messaging
c. _____ Face-to-face meetings
d. _____ Telephone
e. _____ Others (please elaborate)

item choices. This approach helps improve the accuracy of the data collected.

Likert-Scale Question

With Likert-scale questions, the items are arranged as a continuum with the extremes generally at the endpoints. Likert-scale questions may have the respondent indicate the degree to which they agree with a statement or rank a list of items.

Open-Ended Question

Open-ended questions have no list of items for the respondent to choose from.

Open-ended questions are best for exploring new ideas or when the researcher does not know the any of the expected responses. As such, the open-ended questions are great for qualitative research. The disadvantages to using open-ended questions are that it can be much more time consuming and difficult to analyze the data if one is doing quantitative research, as each question must be coded into order to derive variables.

If the researcher knows a partial list of possible responses, one can create a partially open-ended question.

Example of an open-ended question

As part of your project, I believe that you must have confronted a situation when you did not really know how to proceed in order to solve a problem or perform a task on the Web.

(a) Can you speak about a specific instance of your project work of this nature?

_____

Example of a partially structured question

Which features of Instant Messaging programs do you find most useful when it comes to sharing information with teammates?

a. Real-Time Chat
b. File Sharing
c. Chat logs
d. Others _____
e. None

A CASE STUDY USING SURVEY METHODOLOGY

Referring to the nine-step method outlined above for designing and conducting survey research and the procedures for developing a survey instrument, we present a case study of the survey research from the Pew Internet & American Life Project.

Pew Internet & American Life Project

Since December 1999, the Pew Research Center based in Washington, D.C., USA regularly reports findings on subjects such as teenagers' and senior citizens' use of the Internet, broadband adoption, trends in email use, employment of search engines, use of the Internet to gather news (especially about politics), blog creation and readership, and trends in music and movie file sharing. The Pew Internet & American Life Project (the Project) has examined how people's Internet use affects their families, communities, health care, education, civic involvement, political life, and work places. Additionally, the Project uses regular surveys to track online life.

As of 2007, the Project has issued more than 100 reports based on social issues and online activities. It also has focused research on important public policy questions such as public attitudes about trust and privacy online, development of e-government, intellectual property issues, the impact of spam, and the status of digital divides. The Project is non-partisan and takes no positions on policy matters. All of its reports and datasets are available online for free at: http://www.pewinternet.org.

Exploratorium Survey Overview

Sponsored by the Pew Internet and American Life Project, the Exploratorium Survey obtained telephone interviews with a nationally representative sample of 2,000 adults age 18 and older living in the continental United States (US) telephone households. The survey was constructed by Princeton Survey Research Associates International (PSRAI). The interviews were conducted in English by Princeton Data Source, Limited Liability Company (LLC) from 9 January to 6 February 2006. Statistical results are weighted to correct known demographic discrepancies. The margin

of sampling error for the complete set of weighted data is ±2.5%. The number of adult Internet users is 1,447 with a margin of sampling error of ±2.9%. Details on the design, execution and analysis of the survey are discussed below.

Design and Data Collection Procedures

Sample Design

The sample was designed to represent all continental US. telephone households. The telephone sample was provided by Survey Sampling International, LLC according to PSRAI specifications. The sample was drawn using the standard *list-assisted random digit dialing* (RDD) methodology. Active blocks of telephone numbers (area code + exchange + two-digit block number) that contained three or more residential directory listings were selected with probabilities in proportion to their share of listed telephone households. After selection, two more digits were added randomly to complete the number. This method guarantees coverage of every assigned phone number regardless of whether that number is directory listed, purposely unlisted, or too new to be listed. After selection, the numbers were compared against business directories to match numbers purged.

Contact Procedures

Interviews were conducted from 9 January to 6 February 2006. As many as 10 attempts were made to contact every sampled telephone number. The sample was released for interviewing in replicates, which are representative sub-samples of the larger sample. Using replicates to control the release of sample ensures that complete call procedures are followed for the entire sample.

Calls were staggered over times of day and days of the week to maximize the chance of making contact with potential respondents. Each household received at least one daytime call in an attempt to find someone at home. In each contacted household, interviewers asked to speak with the youngest adult male currently at home. If no male was available, interviewers asked to speak with the oldest female at home. This systematic respondent selection technique has been shown to produce samples that closely mirror the population in terms of age and gender.

Weighting and Analysis

Weighting is generally used in survey analysis to compensate for patterns of non-responsiveness that might bias results. The weight variable balances the interviewed sample of all adults to match national parameters for sex, age, education, region based on US Census definitions, race, Hispanic origin, and population density. The White, non-Hispanic subgroup was also balanced on age, education and region. These parameters came from a special analysis of the U.S. Census Bureau's 2005 Annual Social and Economic Supplement (ASEC) that included all households in the continental US having a telephone.

Weighting was accomplished by using sample balancing, a special iterative sample weighting program that simultaneously balances the distributions of all variables using a statistical technique called the *Deming Algorithm*. Weights were trimmed to prevent individual interviews from having too much influence on the final results. The use of these weights in statistical analysis ensures that the demographic characteristics of the sample closely approximate the demographic characteristics of the national population. Table 2 compares weighted and un-weighted sample distributions to population parameters.

Effects of Sample Design on Statistical Inference

Post-data collection statistical adjustments require analysis procedures that reflect departures from simple random sampling. PSRAI calculates the

Table 2. Sample demographics

2005 PARAMETER		UN-WEIGHTED	DEMING WEIGHT (WEIGHT)
Gender			
Male	48.1%	44.9%	48.2%
Female	51.9%	55.2%	51.8%
Age			
18-24	12.6%	6.5%	12.4%
25-34	17.7%	12.6%	18.0%
35-44	19.9%	18.2%	19.9%
45-54	19.5%	20.8%	19.3%
55-64	13.8%	17.8%	13.5%
65+	16.5%	24.1%	16.8%
Education			
Less than HS Grad.	15.0%	8.9%	12.8%
HS Grad.	36.1%	31.9%	35.6%
Some College	23.1%	24.0%	24.0%
College Grad.	25.8%	35.2%	27.6%
Region			
Northeast	19.0%	17.5%	19.0%
Midwest	23.1%	25.7%	24.1%
South	35.9%	36.9%	35.2%
West	22.0%	20.0%	21.6%
Race/Ethnicity			
White/not Hispanic	71.2%	82.7%	73.5%
Black/not Hispanic	10.9%	8.8%	11.1%
Hispanic	12.1%	6.0%	10.7%
Other/not Hispanic	5.8%	2.4%	4.8%
Population Density			
1 - Lowest	20.1%	26.5%	20.9%
2	20.0%	22.8%	20.6%
3	20.1%	21.4%	20.5%
4	20.2%	15.6%	19.5%
5 - Highest	19.6%	13.8%	18.4%

effects of these design features so that an appropriate adjustment can be incorporated into tests of statistical significance when using these data. The so-called "design effect" or *deff* represents the loss in statistical efficiency that results from systematic non-response. The total sample design effect for this survey is 1.28.

PSRAI calculates the composite design effect for a sample of size n, with each case having a weight, w_i as:

$$deff = \frac{n\sum_{i=1}^{n} w_i^2}{\left(\sum_{i=1}^{n} w_i\right)^2} \quad (1)$$

In a wide range of situations, the adjusted *standard error* of a statistic should be calculated by multiplying the usual formula by the square root of the design effect ($\sqrt{deff}$). Thus, the formula for computing the 95% confidence interval around a percentage is:

$$\hat{p} \pm \left(\sqrt{deff} \times 1.96 \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \right) \quad (2)$$

where $\hat{p}$ is the sample estimate and n is the unweighted number of sample cases in the group being considered.

The survey's margin of error is the largest 95% confidence interval for any estimated proportion based on the total sample— the one around 50%. For example, the margin of error for the entire sample is ±2.5%. This means that in 95 out every 100 samples drawn using the same methodology, estimated proportions based on that the entire sample will be no more than 2.5 percentage points away from their true values in the population. The margin of error for estimates based on adult Internet users is ±2.9%. It is important to remember that sampling fluctuations are only one possible source of error in a survey estimate. Other sources, such as respondent selection bias, questionnaire wording and reporting inaccuracy, may contribute additional error of greater or less magnitude.

Response Rate

Table 3 reports the disposition of all sampled telephone numbers ever dialed from the original telephone number sample. The response rate estimates the fraction of all eligible respondents in the sample that were ultimately interviewed. At PSRAI, it is calculated by taking the product of three component rates:

- **Contact rate:** The proportion of working numbers where a request for interview was made – of 78 percent
- **Cooperation rate:** The proportion of contacted numbers where a consent for interview was at least initially obtained, versus those refused – of 43 percent
- **Completion rate:** The proportion of initially cooperating and eligible interviews that were completed – of 88 percent

Thus, the response rate for this survey was about 30 percent.

A complete exploratorium survey is presented in Appendix 1.

CONCLUSION

Transaction logs are an excellent means for recording the behaviors of system users and the responses of those systems. However, transaction logs are ineffective as a method of gaining an understanding of the underlying motivations, affective characteristics, cognitive factors, and contextual aspect that influence these behaviors. Used in conjunction with transaction logs, surveys can be an effective method for investigating these aspects. The combined methodological approach can provide a richer picture of the phenomenon under investigation.

In this chapter, we have reviewed a ten-step procedure for conducting survey research, with explanatory notes on each step. We then discussed the design of a survey instrument, with examples of various types of questions. Finally, we ended the chapter with a case study highlighting the telephonic survey.

Table 3. Sample disposition

CATEGORY	OCCURRENCE/PERCENTAGE
Total Numbers Dialed	**13,087**
Business	1,156
Computer/Fax	891
Cell Phone	22
Other Not-Working	2,385
Additional Projected	757
Working Numbers	7,876
Working Rate	**60.2%**
No Answer	185
Busy	47
Answering Machine	1,276
Callbacks	74
Other Non-Contacts	132
Contacted Numbers	6,163
Contact Rate	**78.2%**
Initial Refusals	2,762
Second Refusals	749
Cooperating Numbers	2,652
Cooperation Rate	**43.0%**
No Adult in Household	25
Language Barrier	355
Eligible Numbers	2,272
Eligibility Rate	**85.7%**
Interrupted	272
Completes	2,000
Completion Rate	**88.0%**
Response Rate	**29.6%**

REFERENCES

Abdinnour-Helm, S. F., Chaparro, B. S., & Farmer, S. M. (2005). Using the end-user computing satisfaction (eucs) instrument to measure satisfaction with a Web site. *Decision Sciences, 36*(2), 341-364.

Couper, M. (2000). Web surveys: A review of issues and approaches. *Public Opinion Quarterly, 64*(4), 464-494.

Dillman, D. A. (1978). *Mail and telephone surveys*. New York: John Wiley & Sons.

Fink, A. (1995). *The survey handbook (vol. 1)*. Thousands Oaks, CA: Sage Publications.

Fowler, F. J. (1995). *Improving survey questions: Design and evaluation (vol. 38)*. Thousand Oaks, CA.: Sage Publications.

Graziano, A. M., & Raulin, M. L. (2004). *Research methods: A process of inquiry* (5th ed.). Boston: Pearsono.

Hargittai, E. (2002). Beyond logs and surveys: In-depth measures of people's web use skills. *Journal of the American Society for Information Science and Technology, 53*(14), 1239-1244.

Huang, M.-H. (2003). Designing website attributes to induce experiential encounters. *Computers in Human Behavior, 19*(4), 425-442.

Huizingh, E. K. R. E. (2002). The antecedents of Web site performance. *European Journal of Marketing, 36*(11/12), 1225-1247.

Jansen, B. J. (2006). Search log analysis: What is it; what's been done; how to do it. *Library and Information Science Research, 28*(3), 407-432.

Jansen, B. J., & McNeese, M. D. (2005). Evaluating the effectiveness of and patterns of interactions with automated searching assistance. *Journal of the American Society for Information Science and Technology, 56*(14), 1480-1503.

Jansen, K. J., Corley , K. G., & Jansen, B. J. (2006). E-survey methodology: A review, issues, and implications. In J. D. Baker & R. Woods (Eds.), *Encyclopedia of electronic surveys and measurements (eesm)* (pp. 1-8). Hershey, PA.: Idea Group Publishing.

Jeong, M., Oh, H., & Gregoire, M. (2003). Conceptualizing Web site quality and its consequences in the lodging industry. *Hospitality Management 22*(2), 161-175.

Kehoe, C. M., & Pitkow, J. (1996). Surveying the territory: Gvu's five WWW user surveys. *The World Wide Web Journal, 1*(3), 77-84.

Kellar, M., Watters, C., & Shepherd, M. (2007). A field study characterizing Web-based information seeking tasks. *Journal of the American Society for Information Science and Technology, 58*(7), 999-1018.

Kiesler, S., & Sproull, L. S. (1986). Response effects in the electronic survey. *Public Opinion Quarterly, 50*, 402-413.

Kim, S., & Stoel, L. (2004). Apparel retailers: Website quality dimensions and satisfaction. *Journal of Retailing and Consumer Services 11*(2), 109-117.

Koufaris, M. (2002). Applying the technology acceptance model and flow theory to online consumer behavior. *Information Systems Research 13*(2), 205-223.

Krosnick, J. A. (1999). Survey research. In *Annual review of psychology* (Vol. 50, pp. 537-367): Annual Review.

Kurth, M. (1993). The limits and limitations of transaction log analysis. *Library Hi Tech, 11*(2), 98-104.

McKinney, V., Yoon, K., & Zahedi, F. (2002). The measurement of Web-customer satisfaction: An expectation and disconfirmation approach. *Information Systems Research, 13*(3), 296-315.

Mehta, R., & Sivadas, E. (1995). Comparing response rates and response content in mail vs. Electronic mail surveys. *Journal of the Market Research Society, 37*(4), 429-439.

Rose, G. M., Meuter, M. L., & Curran, J. L. (2005). On-line waiting: The role of download time and

other important predictors on attitude toward e-retailers. *Psychology & Marketing Research, 22*(2), 127-151.

Spink, A., Bateman, J., & Jansen, B. J. (1999). Searching the Web: A survey of excite users. *Journal of Internet Research: Electronic Networking Applications and Policy, 9*(2), 117-128.

Sproull, L. S. (1986). Using electronic mail for data collection in organizational research. *Academy of Management Journal, 29*(1), 159-169.

Sudman, S., Bradburn, N. M., & Schwarz, N. (1996). *Thinking about answers: The application of cognitive processes to survey methodology*. San Francisco: Jossey-Bass Publishers.

Treiblmaier, H. (2007). Web site analysis: A review and assessment of previous research. *Communications of the Association for Information Systems, 19*, 806-843.

Tse, A. C. B., Tse, K. C., Yin, C. H., Ting, C. B., Yi, K. W., Yee, K. P., et al. (1995). Comparing two methods of sending out questionnaires: E-mail vs. Mail. . *Journal of the Market Research Society, 37*(4), 441-446.

Waite, K., & Harrison, T. (2002). Consumer expectations of online information provided by bank websites. *Journal of Financial Services Marketing 6*(4), 309-322.

Zipf, G. K. (1949). *Human behavior and the principle of least effort*. Cambridge, MA: Addison-Wesley Press.

KEY TERMS

Electronic Survey: Is one in which a computer plays a major role in both the delivery of a survey to potential respondents and the collection of survey data from actual respondents.

Survey Instruments: A data collection procedure that one can use in a variety of research designs.

Survey Research: A method for gathering information by directly asking respondents about some aspect of themselves, others, objects, or their environment.

APPENDIX

Presented below are the questions from the survey that address aspects of the Web or Web usage. See the Pew Internet & American Life Website for a complete and updated version of the survey.

This the Exploratorium Survey as of 14 February 2006 designed by the Princeton Survey Research Associates International for the Pew Internet & American Life Project. The sample (n) was 2,000 adults 18 and older. Margin of error is plus or minus 3 percentage points for results based on the full sample [n=2,000]. Margin of error is plus or minus 3 percentage points for results based on Internet users [n=1,447].

Q1 Overall, are you satisfied or dissatisfied with the way things are going in this country today? (note: see the Pew Internet Life Project Website for details on each of the samples used for each survey implementation).

	Satisfied	Dissatisfied	Don't know/ refused
Current	36	55	8
Nov/Dec 2005	35	56	9
September 2005	32	61	8
May/June 2005	36	54	10
February 2005	41	49	10
January 2005	41	48	11
November 23-20, 2004	45	47	9
November 2004	46	46	8
May/June 2004	33	56	11
February 2004	40	50	10
November 2003	43	49	9
July 2003	46	45	9
June 2003	49	42	9
April/May 2003	54	37	8
March 12-19, 2003	42	49	10
March 3-11, 2003	41	51	8
February 2003	38	54	9
December 2002	41	47	11
November 2002	43	48	10
October 2002	40	49	11
September 2002	44	45	10
July 2002	45	43	11
March/May 2002	52	37	11
January 2002	58	33	9
December 2001	61	29	10
November 2001	62	28	9

continued on following page

October 2001	57	33	10
September 2001	46	44	11
August 2001	44	46	10
February 2001	53	38	10
December 2000	50	42	8
November 2000	50	41	9
October 2000	53	39	8
September 2000	51	40	9
July/August 2000	52	39	9
May/June 2000	51	41	8
March/April 2000	50	41	9

Q2 I'm going to read you a few statements. For each one, please tell me if this describes you very well, somewhat well, not too well, or not at all.

		Very well	Somewhat well	Not too well	Not at all	Don't know/ Refused
a	After I gather all the facts about something, I make up my mind pretty quickly					
	Current	55	31	8	4	1
	June/July 2004	52	32	9	5	1
b	I like to read about a lot of different things					
	Current	54	28	9	7	1
	June/July 2004	61	26	7	6	1
c	I find it difficult to make up my mind when I have too much information about something					
	Current	12	23	21	43	1
	June/July 2004	14	22	19	45	1
d	I enjoy learning about science and new scientific discoveries					
	Current	43	31	12	13	1

Q5 Do you use a computer at your workplace, at school, at home, or anywhere else on at least an occasional basis?

	Yes	No	Don't know/ Refused
Current	74	25	
Nov/Dec 2005	68	31	
September 2005	74	26	0
May/June 2005	72	28	

continued on following page

February 2005	70	30	
January 2005	69	31	
November 23-20, 2004	70	30	0
November 2004	68	32	0
May/June 2004	71	29	
February 2004	73	27	
November 2003	72	27	
July 2003	71	29	
June 2003	71	29	
April/May 2003	69	31	
March 20-25, 2003	70	30	
March 12-19, 2003	65	35	0
March 3-11, 2003	71	29	
February 2003	70	30	0
December 2002	68	32	0
November 2002	70	30	
October 2002	69	31	
September 2002	68	32	
July 2002	69	31	
March/May 2002	69	31	
January 2002	67	33	0
December 2001	64	36	
November 2001	65	35	
October 2001	62	38	
September 2001	63	37	
August 2001	66	34	0
February 2001	65	35	0
December 2000	69	31	
November 2000	65	35	
October 2000	64	36	
September 2000	62	38	
July/August 2000	63	37	
May/June 2000	60	40	
March/April 2000	63	37	

Q6a Do you use the internet, at least occasionally?

Q6b Do you send or receive email, at least occasionally?

	Uses Internet	Does not use Internet
Current	73	27
Nov/Dec 2005	66	34
September 2005	72	28
May/June 2005	68	32
February 2005	67	33
January 2005	66	34
November 23-20, 2004	59	41
November 2004	61	39
May/June 2004	63	37
February 2004	63	37
November 2003	64	36
July 2003	63	37
June 2003	62	38
April/May 2003	63	37
March 20-25, 2003	58	42
March 12-19, 2003	56	44
March 3-11, 2003	62	38
February 2003	64	36
December 2002	57	43
November 2002	61	39
October 2002	59	41
September 2002	61	39
July 2002	59	41
March/May 2002	58	42
January 2002	61	39
December 2001	58	42
November 2001	58	42
October 2001	56	44
September 2001	55	45
August 2001	59	41
February 2001	53	47
December 2000	59	41
November 2000	53	47
October 2000	52	48
September 2000	50	50
July/August 2000	49	51
May/June 2000	47	53
March/April 2000	48	52

Q12 About how many years have you been an Internet user?

Q12.1 About how many months is that?

Based on Internet users [N=1,447]

	Six months or less	A year ago	Two or three years ago	More than				Don't know/ Refused
				Three years ago	Four years ago	Five years ago	Six or more ago	
Current	2	3	9	85	7	14	64	1
November/ December 2005	1	4	12	80	5	14	61	3
September 2005	1	3	11	83	5	16	62	1
May/June 2005	2	4	14	79	7	14	58	1
February 2005	2	4	11	82	7	14	61	1
January 2005	2	4	12	81	8	17	56	1
November 23-30, 2004	1	4	11	83	6	17	60	2
May/June 2004	2	4	15	78	9	16	54	1
February 2004	2	3	14	79	10	16	53	2
November 2003	2	4	16	77	9	19	49	1
July 2003	2	5	19	74	9	20	44	1
June 2003	2	5	19	73	12	19	42	2
April/May 2003	2	5	18	74	11	19	45	1
March 20-25, 2003	3	6	16	74	10	18	46	1
March 12-19, 2003	2	7	16	74	12	18	44	1
March 3-11, 2003	2	5	14	77	12	20	45	1
February 2003	1	4	19	73	9	18	46	1
December 2002	1	6	23	68	13	19	36	2
November 2002	2	5	23	70	12	19	39	1
October 2002	3	6	22	68	12	18	38	1
September 2002	2	5	23	68	13	18	38	1
July 2002	2	6	24	65	13	19	33	2
March/ May 2002	7	10	31	52	10	15	25	
January 2002	8	13	36	43	8	13	21	
December 2001	6	13	34	47	10	14	20	
November 2001	7	12	34	47	12	12	20	
October 2001	5	15	32	47	12	14	19	1
September 2001	7	15	34	44	11	14	17	
August 2001	10	15	32	43	10	13	18	

continued on following page

February 2001	11	16	37	35	10	11	13	1
December 2000	12	19	35	34	n/a	n/a	n/a	
November 2000	11	19	33	37	n/a	n/a	n/a	
October 2000	12	20	33	35	n/a	n/a	n/a	
September 2000	11	21	37	31	n/a	n/a	n/a	
July/August 2000	14	21	33	32	n/a	n/a	n/a	
May/June 2000	15	19	33	33	n/a	n/a	n/a	
March/April 2000	18	20	32	30	n/a	n/a	n/a	
October 1999	15	22	32	31	n/a	n/a	n/a	0
November 1998	20	26	34	19	n/a	n/a	n/a	1
October 1996	26	38	24	12	n/a	n/a	n/a	

Q16 About how often do you go online from (INSERT) — several times a day, about once a day, 3-5 days a week, 1-2 days a week, every few weeks, every few months, or less often?

Based on Internet users [N=1,447]

	Several times a day	About once a day	3-5 days a week	1-2 days a week	Every few weeks	Less often	(VOL) Never	Don't know/ refused
a Home								
Current	29	25	17	12	5	6	6	
May/June 2005	27	22	15	13	6	7	10	
June/July 2004	27	27	17	13	5	5	7	
March 2004	29	24	15	13	6	5	8	
b Work								
Current	35	8	5	3	2	7	40	1
May/June 2005	35	9	5	4	2	6	39	
June/July 2004	28	12	5	4	1	5	44	
March 2004	28	10	5	6	2	4	44	
c Someplace other than home or work								
Current	3	3	4	5	9	21	56	
March 2004	3	3	3	6	6	15	64	1

BLG1 Have you, personally, ever created an online journal, a web log or "blog" that others can read on the web?

Based on internet users [N=1,447]

	CURRENT		NOV/DEC 2005	SEPT 2005	FEB 2005	JAN 2005	NOV 2004	FEB 2004	SEPT 2002	JULY 2002
%	13	Yes	8	9	9	10	6	5	7	3
	87	No	92	90	91	89	93	94	93	96
		Don't know/ Refused		1		1		1	1	

BLG2 Have you ever read someone else's online journal, web log or blog?

Based on internet users [N=1,447]

	CURRENT		SEPT 2005	FEB 2005	JAN 2005	NOV 2004	FEB 2004
%	39	Yes	27	23	27	27	17
	61	No	71	75	71	71	82
		Don't know/ Refused	2	2	2	1	1

Q18 Next, please tell me if you ever get news or information from each of the following sources. (First/Next)…

Q19 Did you happen to gets news or information from this source YESTERDAY, or not?

		Total EVER USE SOURCE	Total USED SOURCE Yesterday	Total NEVER USE SOURCE	Don't know/ refused
a	Newspapers				
	Current	85	49	15	
	June/July 2004	85	51	15	0
b	Television				
	Current	90	76	10	0
	June/July 2004	92	74	8	
c	Magazines				
	Current	56	21	44	0
	June/July 2004	56	21	44	
d	The radio				
	Current	72	54	28	
	June/July 2004	73	54	27	
e	The internet				
	Current	53	38	47	0
	June/July 2004	51	30	49	

EXPL1 On a slightly different topic…If you had to rate your own basic understanding of SCIENCE, would you say it is very good, good, just fair, or poor?

	CURRENT	
%	20	Very good
	38	Good
	32	Just fair
	9	Poor
	1	Don't know/Refused

EXPL2 Overall, how WELL INFORMED would you say you are about new scientific discoveries: very well informed, somewhat informed, not too informed, or not at all informed?

	CURRENT	
%	11	Very informed
	58	Somewhat informed
	23	Not too informed
	8	Not at all informed
		Don't know/Refused

EXPL3 In general, would you say you have a good idea of what it means to study something SCIENTIFICALLY, or are you not really sure what that means?

	CURRENT	
%	66	Have a good idea what it means
	33	Not really sure
	1	Don't know/Refused

EXPL4 In your own words, could you tell me what it means to study something scientifically?

Based on those who know what it means to study something scientifically [N=1,357]

	CURRENT	
%	93	Gave response
	6	Don't really know/Not sure what it means
	1	Refused

EXPL5 Please tell me if you strongly agree, agree, disagree or strongly disagree with each of the following statements.

		Strongly agree	Agree	Disagree	Strongly disagree	Don't know/ refused
a	Developments in science help make society better	31	58	8	1	3
b	In order to live their daily lives, people need a good understanding of basic scientific concepts and principles	19	58	18	2	2
c	Most scientific theories are eventually proven wrong and replaced by new theories	5	39	42	5	9
d	Scientific research is essential to improving the quality of human lives	35	56	7	1	2

continued on following page

e	Science creates more problems than solutions for us and our planet	3	19	52	19	6
f	Scientific research today doesn't pay enough attention to the moral values of society	11	38	36	7	8
g	To be a strong society, the United States needs to be competitive in science	39	50	8	1	2

EXPL6 We're interested in where you get your SCIENCE news and information. Do you ever get science news or information from the following sources?

		Yes	No	Don't know/ refused
a	Television	88	12	
b	Newspapers	69	31	
c	The radio	46	54	
d	Magazines	63	37	
e	The internet	54	46	

EXPL7 Where do you get MOST of your science news and information?

	CURRENT	
%	41	Television
	20	The internet
	14	Magazines
	14	Newspapers
	4	Radio
	7	Other/None of these
	1	Don't know/Refused

EXPL8 Next, please tell me if you have ever used the internet to do the following things. Have you ever used the internet to…?

Based on internet users [N=1,447]

		Yes	No	Don't know/ refused
a	Look up the meaning of a particular scientific term or concept	70	30	
b	Look for an answer to a question you have about a scientific concept or theory	68	31	1
c	Check the accuracy of a scientific fact or statistic	52	47	1
d	Compare different or opposing scientific theories	37	62	1
e	Download scientific data, graphs or charts	43	57	
f	Learn more about a science story or scientific discovery you first heard or read about offline	65	34	1
g	Complete a science assignment for school, either for yourself or for a child	55	45	
	Total yes to any item	87		

EXPL9 Which of the following comes closest to describing WHY you use the internet to get science news and information?

Based on those who get science news or information online [N=1,282]

	CURRENT	
%	71	Because getting science information online is easy and convenient
	13	Because you can get more accurate science information online
	12	Because you can get science information online that is not available anyplace else
	1	Some other reason (VOL)
	3	Don't know/Refused

EXPL10 Do you ever do any of the following to check the reliability of the science information you find online? Do you ever…?

Based on those who get science news or information online [N=1,282]

		Yes	No	Don't know/ refused
a	Compare it to other information you find online to make sure it's correct	62	38	1
b	Compare it to an OFFLINE source like a science journal or encyclopedia	54	46	
c	Look up the original source of the information or the original study it's based on	54	45	1
	Total yes to any item	80		

EXPL11 Is the internet usually the FIRST place you go when you want science news and information, or do you usually look someplace else first? IF OTHER SOURCE: Where do you usually look FIRST for science information?

Based on those who get science news or information online [N=1,282]

	CURRENT	
%	61	Internet first place respondent goes
	34	Go to other source first
	5	Magazines
	5	Books/Textbooks
	4	Library
	4	Television
	3	Encyclopedia/Periodicals
	3	Newspaper
	1	Journals
	9	Other
	3	Depends (VOL)
	2	Don't know/Refused

EXPL12 When using the internet, do you ever come across science news and information when you may have been going online for some other purpose?

Based on internet users [N=1,447]

	CURRENT	
%	65	Yes
	34	No
	1	Don't know/Refused

EXPL13 As I read a short list of science topics, please tell me if you are very interested, somewhat interested, or not at all interested in each topic.

		Very interested	Somewhat interested	Not at all interested	Don't know/ refused
a	The origins of the universe	29	37	33	1
b	The origins of life on this planet	35	40	24	1
c	Stem cell research	31	40	26	3
d	Global warming and changes in the Earth's climate	42	39	18	1
e	The human genome and DNA	36	41	22	1
f	Space and space exploration	31	41	28	1
	Total at least somewhat interested in one of the above items	96			

MODULE Distribution of respondents across follow-up modules

	CURRENT	
%	26	Stem cell module
	38	Global warming module
	29	Origins of life module
	7	No follow-up module

Stem Cell Module

SC1 How closely do you follow stories about stem cell research – very closely, fairly closely, not too closely, or not at all closely?

Based on those in stem cell module [N=539]

	CURRENT	
%	18	Very closely
	48	Fairly closely
	28	Not too closely
	6	Not at all closely
		Don't know/Refused

SC2 Do you ever get news or information about stem cell research from the INTERNET or through EMAIL?

Based on internet users in stem cell module [N=420]

	CURRENT	
%	38	Yes
	62	No
		Don't know/Refused

SC3 Can you recall any specific websites where you have gotten news or information online about stem cell research?

Based on internet users who get news/information about stem cell research online [N=159]

	CURRENT	
%	49	Gave response
	50	Can't recall
		Refused

SC4 How often do you get news or information about stem cell research from the Internet or through email – everyday day or almost everyday, several times a week, several times a month, or less often?

Based on internet users who get news/information about stem cell research online [N=159]

	CURRENT	
%	3	Everyday or almost everyday
	8	Several times a week
	32	Several times a month
	56	Less often
	1	Don't know/Refused

SC5 Where have you gotten MOST of your news and information about stem cell research? From school, from television, from newspapers, from radio, from magazines, or from the Internet and email?

Based on those in stem cell module [N=539] NOTE: Table exceeds 100% due to multiple responses

	CURRENT	
%	42	Television
	25	Newspapers
	20	The internet and email

continued on following page

	17	Magazines
	7	Radio
	5	School
	4	None of these/Someplace else (VOL)
	1	Don't know/Refused

SC6 Based on what you've heard or read, please tell me if you think the following statements about stem cell research are true or false. If you aren't sure, just say so and I'll move to the next item.

Based on those in stem cell module [N=539]

		True	False	Don't know	Refused
a	There are two major types of stem cells, adult stem cells and embryonic stem cells	54	18	27	1
b	Adult stem cells have been used for many years to treat cancers such as lymphoma and leukemia	37	27	36	1
c	There are over 100 stem cell lines available to federally-supported researchers in the United States	27	21	52	1

SC7 Overall, would you say it is EASY or DIFFICULT to find the scientific information you need to understand stem cell research?

Based on those in stem cell module [N=539]

	CURRENT	
%	56	Easy to find
	30	Difficult to find
	14	Don't know/Refused

SC8 If you wanted to learn more about stem cell research, where would you go FIRST for more information?

Based on those in stem cell module [N=539]

	CURRENT	
%	67	The internet
	11	Library
	4	Science magazines
	3	Scientific journals
	2	Television
	2	Newspapers
	2	Doctor
	5	Other
	4	Don't know
	0	Refused