DEVELOPMENT OF A STANDARD E-MAIL METHODOLOGY
RESULTS OF AN EXPERIMENT

DAVID R. SCHAEFER
DON A. DILLMAN

Abstract Review of past E-mail surveys indicates that a methodology to achieve consistently high response rates similar to those that can be obtained by traditional mail has not been developed. In addition, researchers have tended to use E-mail surveys only for populations with universal E-mail access. This study utilizes knowledge from past mail-survey research to develop an E-mail procedure. Further, an experiment is conducted to assess the potential for using a multimode strategy to obtain responses from individuals unreachable through E-mail. The multimode approach proved to be successful and techniques shown to be effective in standard mail surveys were also found to be appropriate for an E-mail survey.

Introduction

Electronic mail and the Internet provide a promising means for conducting future surveys as the proportion of people accessible through E-mail or the Internet continues to rise. It is estimated that 45 percent of households now have computers, and the proportion on the Internet is 22 percent (Witt 1997). Although these percentages are much too small for conducting general population surveys by E-mail, access has reached nearly 100 percent for some groups of survey interest, such as company employees and association members. Thus far, the use of E-mail surveys has been restricted by the tendency of researchers to apply it only to such popula-

DAVID R. SCHAEFER is a teaching assistant in the Department of Sociology. DON A. DILLMAN is professor of sociology and rural sociology and deputy director of the Social and Economic Sciences Research Center (SESRC). The authors wish to thank John Pierce, who was dean of the College of Liberal Arts at the time this research was conducted, for his financial support of this experiment. Renee Shatos Petrie and other staff at the SESRC also contributed significantly to the conduct of this study. This research was supported by the College of Liberal Arts, SESRC, and the Agricultural Research Center (USDA-CSREES regional research project W-183) at Washington State University.

Public Opinion Quarterly Volume 62:378–397 0033-362X/98/6203-0004$02.50

tions with nearly universal E-mail access. The risk of coverage error has prevented researchers from applying an E-mail methodology to other groups. However, an E-mail strategy might be utilized with much more diverse populations if it is incorporated into a mixed mode design. E-mail can be used to survey individuals with E-mail access, while more expensive methods can be used to survey those without access.

The advantages of E-mail for surveying are enticing. It offers the possibility of very rapid surveying, an attribute well documented by past research (Bachmann, Elfrink, and Vazzana 1996; Kittleson 1995; Mehta and Sivadas 1995; Sproull 1986). E-mail surveys can be done faster than telephone surveys, especially for large samples, where the number of telephones and trained interviewers limit the number of completions per day. The method is also inexpensive, since it eliminates postage, printing, and/or interviewer costs.

To realize such benefits, it is important that a methodology be developed that can ensure acceptable levels of response quantity and quality. It is evident that such a general protocol for achieving high response rates and data quality to E-mail surveys has not yet been developed and tested as has been done for mail surveys (e.g., Dillman 1978).

Our purpose in this article is to report on the development and testing of alternative sets of procedures for conducting E-mail surveys that build on knowledge of how to improve response to mail surveys. While the technology for E-mail is vastly different from established mail surveying methods, the communication itself is similar to self-administered questionnaires (SAQs) delivered by postal mail. Thus, applying knowledge from previous research on mail SAQs to E-mail is a logical place to begin developing an E-mail methodology.

Results from an experimental test of three mixed mode, multiple contact E-mail procedures are compared to one another and to a similar mail survey control group within the same population. The elements of these E-mail procedures were formulated on the basis of proven methods for designing and implementing self-administered or mail surveys. Further, in an attempt to eliminate coverage error, the E-mail procedure is augmented by a mail version for individuals who are unreachable by E-mail. Limited information on data quality are also reported.

Past Research

A review of the literature reveals that, to date, a method to consistently achieve response rates as high as those obtained with mail surveys has not been developed. As presented in the appendix, electronic mail has generally failed to meet the standard set by comparable mail techniques.

For instance, in a study of federal agency employees, Couper, Blair, and Triplett (1997) found an E-mail survey obtained an average response rate of 42.6 percent compared to 70.7 percent for mail, a difference ranging from 13.5 percent to 28.1 percent lower for each subsample. The only published study to report an acceptably higher response by E-mail, as compared to regular mail, is Parker's (1992) study of AT&T employees. She reports a 63 percent response rate for E-mail versus a 38 percent response rate for traditional mail. The higher E-mail response rate is attributed to the fact that (1) E-mail was (at the time) more carefully examined when it arrived, as opposed to company ''junk'' mail, which was typically thrown out ''without a single qualm or backward glance'' (p. 54); and (2) the high-tech ''allure'' and ''novelty'' of E-mail. While these perceptions may have been responsible for the difference, they seem inadequate for development of a standard E-mail methodology.

MULTIPLE CONTACTS

Research in mail, telephone, and face-to-face interviewing has universally found that the most powerful determinant of response rates is the number of attempts made to contact a sample unit (Dillman et al. 1974; Goyder 1985, 1987; Heberlein and Baumgartner 1978; Scott 1961). The more attempts made to reach people, the greater the chances of them responding. Thus, for an E-mail survey to be successful, it seems important that multiple contacts be made.

Indeed, evidence exists that multiple contacts increase response rates in E-mail surveys as well. Studies by Mehta and Sivadas (1995) and Smith (1997) compared a single contact E-mail survey with multiple contacts. Smith achieved a 5.3 percent higher response rate with E-mail using multiple contacts and Mehta and Sivadas gained 20 percent with multiple contacts combined with personalization, the exact nature of which was not reported. Of surveys reported in the literature, the average response rate for E-mail surveys with a single contact is 28.5 percent, compared with 41 percent for two contacts, and 57 percent for three or more contacts (see the appendix for studies). While this is a crude comparison, it does not contradict the assertion that multiple contacts are effective in increasing response rates to E-mail surveys.

PERSONALIZATION

Personalization has also been reported to be an important element in increasing the response rate in mail surveys (Dillman 1978, 1991). A personalized letter addressed to a specific individual shows the respondent that he or she is important. This technique can also be applied to E-mail. E-mail has evolved, so that some E-mail is personal and other E-mail is

not (e.g., listservs and mailings to multiple addresses). This information is immediately visible when one opens an E-mail message, much in the way that recipients of a mail survey can immediately discern a ''Dear Citizen'' salutation versus their name as a salutation on a personal letter. In order to let individuals know that they are individually important, and not just an item on a list, it seems important that E-mail messages be sent directly to individual respondents, not part of a mailing list. An added benefit to personalized E-mail messages is that individuals are prevented from responding to the other recipients of the survey, thus helping to ensure confidentiality.

MIXED MODE

It seems likely that some populations will be completely accessible by E-mail in the near future. For other groups, a large proportion of members will have E-mail access, yet some will not. For these populations, a mixed-mode survey strategy needs to be considered—using E-mail when possible and other methods when not possible. Thus, a proposed method for E-mail surveys, to be generally useful, must take into account a way of reaching people whose E-mail addresses are not available and those who simply do not have or use them.

In addition to decreasing costs and providing more timely data, a mixed-mode survey strategy can reduce coverage error (Dillman and Tarnai 1988). This is critical with an emerging form, such as E-mail, which has yet to be adopted by the majority of the population. The cost and speed advantages of E-mail make it ideal for a first mode of contact in surveys. Researchers can begin with an E-mail approach and use progressively more expensive methods for nonrespondents until an acceptable response level is reached. In addition, with E-mail, researchers know immediately whether members of the sample have valid addresses. Thus, alternative methods can be implemented much sooner than with traditional mail. Finally, it has been argued that individuals may have a mode preference and that offering an alternative response format may improve response rates (Goyder 1987; Groves and Kahn 1979).

DATA QUALITY

For an E-mail methodology to become feasible, it is necessary to demonstrate that the quality of data is equivalent to that of other survey methods. It is not yet known whether people tend to comprehend and respond to questions differently by E-mail compared to mail methods. Mail and E-mail surveys are both SAQs and, as such, rely on an individual's comprehension of written text. Hence, response order effects, such as primacy and recency, should not be noteworthy between modes. It also seems fea-

sible that item nonresponse to E-mail surveys could be lower if the answer format is convenient. Finally, because entering answers on a keyboard may be easier for some people than writing by hand, it seems plausible that response to open-ended questions may be more complete.

Previous studies report varied results when comparing the data quality of E-mail to mail surveys. In experimental studies comparing E-mail and mail surveys, Sproull (1986) and Bachmann, Elfrink, and Vazzana (1996) report a higher nonresponse for E-mail items. However, Mehta and Sivadas (1995) and Tse et al. (1995) report no difference in data quality between the two modes. Finally, Bachmann, Elfrink, and Vazzana (1996) also found that length of answers to open-ended questions was higher with the E-mail version. These mixed reports demonstrate the need to develop a method that can be relied on to provide consistent results.

A second concern, especially when sensitive issues are involved, is the virtual lack of anonymity that characterizes E-mail. It is difficult for E-mail respondents to remove all identifying information from their returned surveys. Thus, E-mail surveys must rely on researchers' assurances of confidentiality. Further, organizations that provide E-mail have the potential to monitor their employees' messages, which limits confidentiality guarantees. Nevertheless, research by Couper, Blair, and Triplett (1997) indicates that this may not be as much of a problem as it seems. The present study does not deal with a particularly sensitive issue; thus, assurances of confidentiality should be more than adequate.

Experimental Design

POPULATION

The permanent faculty of Washington State University (WSU) was the population for this experiment. A previous 1996 survey of WSU faculty had found that nearly 89 percent of the faculty had E-mail access (Carley 1996), thus suggesting that coverage error from an E-mail survey, while higher than desirable, might be acceptable. The 904 faculty members in the survey population were randomly divided into four groups. Each group received four contacts (prenotice, questionnaire, thank you/reminder, and replacement questionnaire), the only differences being the mode of contacts (see table 1).

TREATMENTS

Group 1 was designated to receive ''all paper'' contacts. No attempt was made to locate E-mail addresses for these individuals. This group served two purposes, as a comparison group for the E-mail groups and as a hypo-

Table 1. Treatment Groups

	Group 1 All Paper	Group 2 All E-mail	Group 3 Paper Prenotice	Group 4 Paper Reminder
Prenotice	Paper	E-mail	Paper	E-mail
Letter and survey	Paper	E-mail	E-mail	E-mail
Thank you/reminder	Paper	E-mail[a]	E-mail[a]	Paper
Replacement survey	Paper	E-mail	E-mail	E-mail

[a] The E-mail reminders included another questionnaire.

thetical portion of the population assumed not to have E-mail addresses. This allows us to examine how well a multimode strategy will work for those populations without universal E-mail access. Individuals in this group received paper versions of the preletter, questionnaire, thank you/reminder postcard, and replacement questionnaire, each by campus mail.[1] This is a procedure that is regularly used by the Social and Economic Sciences Research Center (SESRC) for faculty surveys, of which several are conducted each year. This method has demonstrated the potential to achieve response rates of 60–75 percent for most surveys.[2]

Group 2 was designated as the "all E-mail" group. These individuals received four contacts by E-mail, modeled after those sent by paper in group 1 (i.e., a preletter, questionnaire, thank you/reminder, and replacement questionnaire).[3] One difference between the four contacts in group 1 and group 2 was that a replacement questionnaire was included with the group 2 thank you/reminder whereas the traditional paper method used a postcard reminder (Dillman 1978). It was reasoned that there was no additional cost for including a replacement questionnaire by E-mail and that it would be more convenient for respondents. In effect, there was no downside to adding the questionnaire to the E-mail reminder. Group 2 served as a comparison group to the next two mixed-mode groups.

Group 3 was labeled the "paper prenotice" group. Members of this group received essentially the same treatment as group 2, except they were sent a paper prenotice via campus mail. The preletter notified them

1. To encourage faculty to respond, the prenotice letter/E-mail was sent by the dean of liberal arts, whose office was sponsoring this study.
2. Based on six surveys of Washington State University faculty conducted by the SESRC over the past 2 years.
3. With E-mail, we know immediately whether an individual has replied. Thus, it would not be appropriate to send the traditional thank you/reminder postcard, which states, "If you have already replied, thank you; if not, please do." Instead a message repeating the importance of the study and requesting participation was sent.

of the upcoming questionnaire on E-mail and offered them the chance to complete a paper version of the questionnaire by returning a postcard. Those who returned the postcard were given the same treatment as group 1 (all paper contacts) for the remainder of the study. Those who did not return the postcard were sent three E-mail contacts; the questionnaire, reminder with questionnaire, and replacement. This treatment was designed with the goal of reaching those respondents who had working E-mail accounts but did not use them or did not check them regularly. It was reasoned that the letter would give individuals incentive to check their E-mail, as well as provide a means for those not using E-mail to obtain a questionnaire. The mixed-mode contacts and choice of response format was reasoned to lead to a higher response rate for this group than the ''all E-mail'' group.

Group 4 was designated the ''paper reminder'' group. Individuals in this group were given virtually the same treatment as group 2, the exception being that a paper reminder was sent via campus mail. The basis for this approach was that as many responses as possible would be obtained with the simpler, cheaper E-mail before using campus mail to reach those who do not use their E-mail accounts. However, we would preserve a regular mail contact to encourage people to check their E-mail for the questionnaire. This group received an E-mail prenotice, E-mail questionnaire, paper reminder, and E-mail replacement questionnaire.

As with virtually any population of interest, we expected that some individuals in the sample destined to receive E-mail contacts would not have valid E-mail addresses or that we would not be able to obtain them. Thus, each group would have members we could not contact by E-mail. The desire to obtain a representative sample requires that those people still be given the chance to respond. In order to include them, a second mode of the survey was used. Those individuals for whom E-mail addresses could not be found, or whose E-mail addresses were invalid (realized during the first E-mail contact), were sent paper versions of each contact. For all practical purposes, they were given the same treatment as group 1.

IMPLEMENTATION STRATEGY

We decided not to utilize any of the commercially available software designed specifically for E-mail surveys. Rather, the form was developed and sent out using the program Eudora. Returned E-mail surveys were printed out on paper and later entered into the SESRC's CATI system.

For experimental purposes, two versions of the survey were developed. The paper form was created first. It contained 46 questions and was printed on both sides of a folded $8\frac{1}{2} \times 11$ inch sheet of paper. The E-mail version was as similar as possible to the paper version with these

exceptions. A 5-point Likert on the mail version was reduced to 3 points for the E-mail version to allow question stems and response boxes to fit on the same line. In addition, to help ensure that the text of the message would appear the same to all recipients (i.e., the lines would not wrap around) and in a legible format, a maximum line length of 70 characters was chosen.

Great care was taken in deciding exactly how respondents would be asked to indicate their answers on the E-mail version. The concern at this point was that they must type something, somewhere, and it had to be easy to do. The traditional SAQ procedures of circling an answer or checking a box are impossible with E-mail, yet we wanted the E-mail survey to resemble a paper version as closely as possible. By using a familiar format, the cognitive burden placed on the respondent is reduced. Respondents must only comprehend a new method of entering their answers, not a new method of determining where to place them. Thus, brackets ''[ ]'' were placed in front of each answer choice on closed-ended questions. Respondents were asked to place an X anywhere in the box. Boxes were also used for open-ended questions. They were placed on the line following the question and, once again, respondents were asked to type their answers in the box. While boxes were not necessary here (respondents could have just typed in the blank lines), using them provided respondents with a consistent answer format, further reducing their cognitive burden. Finally, skips were handled by placing statements at the beginning of the question asking those respondents who fit the relevant criteria to skip the next set of questions and scroll down to the appropriate question.

The directions for responding to the E-mail version were as straightforward as possible. Respondents were asked to create a reply message that contained the message we sent. Then, all they needed to do was type in their responses in that version and ''send'' it to us. They were also told that they could print the E-mail and return it via campus mail or contact the SESRC and request a paper version be sent to them. They were given an E-mail address and telephone number to call if they had any questions.

All E-mail contacts were personalized to the extent possible. Since we did not want the names of multiple recipients to appear at the top of the screen, we decided against using the carbon-copy function or sending a group message. The blind-carbon-copy feature, which conceals the names of the other recipients, was also inappropriate in that the ''To:'' line reads ''To: Undisclosed Recipients'' when received. Rather, each individual in the sample was sent a separate E-mail message addressed only to him or her. This process took only slightly more time than using a list or the blind-carbon-copy feature, owing mainly to the cut-and-paste features of modern computer applications. In addition, using individual E-mail messages had the benefit of preventing respondents from accidentally sending their reply message to each of the other recipients.

The process of obtaining E-mail addresses for the three E-mail panels was a multistage endeavor since the university does not maintain a list of faculty E-mail addresses. The first step was to look up professors' names in the university's electronic phone book. To help remove the possibility for error, E-mail addresses were cut-and-pasted from the phone book to the sample list. A total of 414 addresses (61 percent) were found here. The second step was to contact individual departments and ask secretaries for the addresses and to search department and individual web sites. This proved to be successful; an additional 222 E-mail addresses were obtained (33 percent). The second step was repeated for those E-mail addresses that were found to be incorrect after the initial E-mailing. In the end, all but 42 addresses were found. It was later discovered that 17 E-mail addresses were incorrect, with messages being returned as ''undeliverable.'' The inability to locate correct addresses for these 17 faculty members left 619 (of a possible 678) usable E-mail addresses for the E-mail treatment groups. It is important to note that we avoided contacting the individual professors to ask for their addresses since it was reasoned that we would have to explain our purpose and so doing would disrupt the experimental procedure.

Results

Three criteria are used to judge the success of each of the E-mail survey treatments. First, the response rates from the E-mail groups are compared with the response rate from the standard mail group. Second, the quality of data obtained is compared (operationalized as item nonresponse and length of response to an open-ended question). Finally, speed of response is compared across modes.

RESPONSE RATES

The overall response rate for the study was 55.1 percent (see table 2). The response rate for the control group (group 1), which received a standard mail approach, was 57.5 percent.[4] Group 2, which received all E-mail contacts when possible (or paper contacts when E-mail was not appropriate), had a response rate of 58 percent. A chi-square test revealed no significant difference between these two response rates (p = .924). The response rate for group 3, which received the paper prenotice, was 48.2 percent. This was significantly lower than both groups 1 and 2, (p = .048/.038). Group 4, which received a paper reminder, had a re-

4. A separate mail survey of the same population at the same time achieved the similar response rate of 60.5 percent.

Table 2. Response Rates Utilizing the Multimode Strategy

	Group 1 All paper	Group 2 All E-mail	Group 3 Paper Prenotice	Group 4 Paper Reminder	Total
N:	226	226	226	226	904
Invalid E-mail addresses		18	20	21	59
Requested paper version			6	5	11
Completes:	130	131	109	123	498
Returned by paper	130	9	14	18	176
Returned by E-mail	0	114	84	98	296
Returned by printed E-mail	0	8	11	7	26
Overall response rate (%):	57.5	58	48.2	54.4	55.1
Portion paper	57.5	4.0	6.2	8.0	19.5
Portion E-mail (includes printed E-mail)		54.0	42.0	46.5	35.6

NOTE.—Five surveys were returned anonymously (identification labels were removed). Thus, treatment group was impossible to determine.

sponse rate of 54.4 percent, which, although lower, was not significantly different than groups 1 and 2, (p = .507/.448). Finally, a response rate of 58.6 percent was achieved for the set of individuals who received a paper survey on their request or because they were unreachable by E-mail. This was not significantly different from the response rate for the ''all paper'' group 1 (p = .877), indicating that the availability of such individuals did not differ from the rest of the population as represented by group 1.

It is also important to note the response rates that would have been achieved had we not sent a paper version to those unreachable by E-mail. The simplest way to do this would be to remove those individuals from each E-mail group who completed a paper version and then compare response rates. However, groups 3 and 4 were given the opportunity to return a postcard requesting a paper version of the survey. There is no way of knowing how many of them would have returned the E-mail version of the survey. However, with an estimate based on the actual E-mail response rates of groups 3 and 4, an electronic response rate of 48.2 percent is obtained, which is significantly less than the 53.5 percent achieved with the multimode strategy (p = .05). Thus, the multimode strategy led to a 5.3 percent higher response rate.[5] The difference would have been greater under the assumption that those requesting a paper version would not have completed an E-mail version.

In order to test the effectiveness of using a paper prenotice versus using an E-mail prenotice with an E-mail questionnaire, a chi-square test was conducted comparing the number of responses to the first mailing of the questionnaire. Groups 2 and 4 (which utilized an E-mail prenotice) included a total of 184 out of 409 completed responses to the first questionnaire mailing (45 percent). Group 3, using a paper prenotice, achieved 61 completes out of 202 (30 percent). The two rates were significantly different (p = .001). Thus, the E-mail prenotice was much more effective in increasing response rate to an upcoming E-mail questionnaire than the regular mail prenotice.

RESPONSE QUALITY

Overall, the E-mail version obtained more complete returned questionnaires. An examination of the total number of questions left unanswered reveals that 69.4 percent of those responding to the E-mail version completed at least 95 percent of the survey, while only 56.6 percent of those responding to the paper version completed 95 percent. In addition, the

5. The response rate for group 3 after removing those requesting a paper survey (N = 6) was 43.2 percent; group 4 (N = 5) was 47.5 percent. These percentages were multiplied by the number requesting the survey in each group to estimate how many of them would have returned the electronic version.

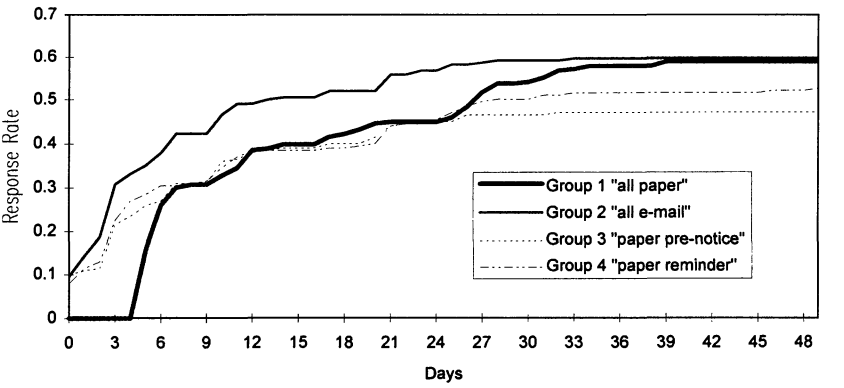

Figure 1. Response rate over time by group (for all groups, the reminder postcard/E-mail was sent on day 7 and the replacement survey was sent on day 21).

E-mail version had a lower item nonresponse than the paper version. Of 44 questions asked, 30 had higher completion rates on the E-mail version than on the paper version. A series of chi-square tests revealed that six of the questions had a significantly higher completion rate on the E-mail version, while only one question was significantly more complete on the paper version.

A closer examination of responses to open-ended questions reveals more important differences between E-mail and paper mail. Four of the questions obtaining significantly higher completion rates by E-mail were open-ended. The last question on the survey, which asked for additional comments achieved a 12 percent higher completion rate on the E-mail version ($p = .004$). Further, the E-mail version achieved much longer responses to open-ended questions than the paper version. On average, open-ended responses on the E-mail version contained 40 words, while open-ended responses on the paper version contained 10 words.

RESPONSE TIME

The average time required to receive a completed questionnaire, from the day they were sent out, was 9.16 days for E-mail and 14.39 days for paper (see fig. 1 for a plot of returns over time). A two-tailed t-test revealed a significant difference between the response times ($t = -5.718, p < .0001$). Fifty-seven E-mail questionnaires were returned the same day they were sent out (17.6 percent of all received). Over 50 percent of all completed

E-mail questionnaires were received before the first completed paper questionnaire was returned.

Discussion and Conclusions

Results of this experiment showed that for this population, comparable response rates can be obtained for regular mail surveys and electronic mail surveys (57.5 percent and 58 percent, respectively) when a mixed-mode strategy is used to obtain responses by mail for sampled individuals who do not have E-mail addresses. Certain potential advantages of E-mail surveys were also evident from these results. Returns came in more quickly by E-mail than from the paper survey, a slightly lower item nonresponse was achieved, and more complete answers were given to an open-ended question. In addition, through the inclusion of a paper element in a mixed-mode design, the problem of coverage error was eliminated. The equal success of modes demonstrates that researchers can take advantage of the capabilities and benefits of an E-mail methodology for populations without universal E-mail access.

Coverage error will continue to be a problem for E-mail surveys, at least into the foreseeable future. Thus, its inclusion into a mixed-mode design is probably essential. In addition, just as adoption of telephone survey methodology encouraged changes in protocol (e.g., shorter questions), it seems useful to make certain adjustments in procedures based on the peculiar characteristics of E-mail. One such change is sending replacement questionnaires with each subsequent contact, rather than the traditional postcard thank you/reminder. It is also apparent that one needs to take into account the way people handle E-mail. Some potential respondents may want to print their questionnaire, and so a return mailing address should be included in the E-mail version of the questionnaire.

Other results were more unexpected and confounding. While the response rates for the ''all paper'' and ''all E-mail'' groups were nearly identical, contrary to expectations, the response rate for the ''paper prenotice'' group 3 was significantly lower. For some reason, the paper prenotice was not as effective as the E-mail prenotice in encouraging responses to the E-mail survey. It could be that the prenotice was thrown away or otherwise disregarded. Perhaps respondents did not cognitively connect the paper prenotice with the electronic questionnaire, thus the paper prenotice failed to serve its purpose of familiarization. In such cases, when the questionnaire was received, it was easier to ignore. This coincides with the findings of Mehta and Sivadas (1995) who concluded that unsolicited E-mail surveys are unacceptable. They found that people who received an E-mail questionnaire without a prior E-mail notification or request for participation were less likely to respond. If some respondents did not con-

nect the paper prenotice with the subsequent E-mail questionnaire then, in effect, the E-mail survey was unsolicited.

The ''paper reminder'' group 4 had a response rate similar to the ''all E-mail'' group. Thus, it appears that a paper reminder did not achieve its purpose of increasing response rate above that of the ''all E-mail'' group by encouraging non-E-mail users to check their E-mail. Part of this lack of effect could be due to the already high use of E-mail within the population. A 1997 survey of the same faculty later revealed that 95 percent used E-mail and that 93 percent of E-mail users checked their E-mail at least five times a week (Carley-Baxter 1997). Thus, the use of the paper reminder to increase response rate would only be appropriate for the 5 percent of faculty who do not use E-mail and the 7 percent of E-mail users who do not check it at least five times per week. Differences in such a small subpopulation would not be noticeable in the response rate of group 4.

A second reason for the lack of effect could be due to the number of questionnaires sent to each group. The ''all E-mail'' group received a questionnaire with the reminder E-mail. In addition to the initial and replacement questionnaires, a total of three questionnaires was sent to the ''all E-mail'' group. In contrast, the ''paper reminder'' group received only two copies of the questionnaire—the initial questionnaire and the replacement. While the reminder may have been effective in motivating people to check their E-mail and respond, had such individuals already deleted the questionnaire they did not have anything to respond to. It may have been helpful to send another E-mail questionnaire to them at the same time the paper reminder was sent (four people in that group actually sent E-mails requesting another copy). Such an effort would require more time and money, but it may be appropriate considering the relative ease of sending an E-mail questionnaire. Future research is needed to determine the optimum allocation of mailings, both paper and E-mail.

The lengthier responses to open-ended questions on the E-mail version was not surprising. It was reasoned that a convenient format in the E-mail version and the relative ease of typing a longer response (compared with writing by hand) would elicit more detailed responses. The lower item nonresponse to E-mail might be explained by the proposition that moving visually through an E-mail message requires more effort than filling out a paper questionnaire. Since individuals can only view a few questions at a time (fewer than in the paper version), each question may be less likely to be overlooked.

The identification of different rates of item nonresponse between the two modes suggests that discrepancies in item quality may also exist. However, since both modes are self-administered, the mode effects that are evident between mail and telephone surveys (see Dillman et al. 1996) should not be present. Nevertheless, if a mixed-mode design is to be effec-

tive, then the equivalency of the two modes must be demonstrated through further empirical research.

The speed of responses in favor of E-mail realized in this study may indicate the opportunity for a change in protocol for E-mail surveys. Because over 76 percent of all completed E-mail questionnaires were returned within 4 days of their mailing, it may be helpful to compress the time frame of the survey. For example, the questionnaire could follow the prenotice by 2–3 days; reminders could be sent a couple days later; and replacements could be sent a week after the reminder. This is possible because the time delay in the transmission of E-mail messages is virtually nonexistent and researchers know immediately when someone has responded. However, there are potential drawbacks to compressing the time frame. People who are away from their E-mail for a couple of weeks would not be contacted within the shorter time span of the survey, whereas with a 7-week survey they would be reached. Additional research should explore the optimal amount of time between the contacts.

This study suggests the viability of a standard E-mail method based on techniques found successful in mail survey research, that is multiple, carefully timed, and personalized contacts (Dillman 1991). However, the questionnaire we used was relatively short, not exceedingly complex, and contained few skip patterns. Research by Couper, Blair, and Triplett (1997) indicates that the technological factors involved in a longer questionnaire could make them more problematic. In addition, unlike many populations, the population utilized in this study had very high coverage. Thus, it is important to test these procedures with more heterogeneous populations and those with lower rates of E-mail access. It is also important to test them with larger, more elaborate questionnaires containing more complex skip patterns.

Development of this experiment revealed to us the possibility that E-mail surveys represent only an interim surveying technology. The difficulties of setting up a format that will appear the same on all users' screens are substantial. In addition, the format of E-mail surveys can be cumbersome to navigate, leading some individuals not to reply. Internet-based surveys, on the other hand, can be designed to appear nearly the same on all screens and, due to their interactive nature, may be easier for people to navigate (Dillman and Tortora 1998). Further, the web enables researchers to utilize complex question formats and skip patterns while making the survey appear simple to the respondent. Some E-mail users now have software that enables them to use a ''double-click'' to shift from E-mail to an Internet address in order to respond to a survey. However, others must leave E-mail, open a web browser, and type or paste a complete address in order to access a web survey. The complexity of this requirement seems likely to decrease web survey response rates significantly. In addition, usage of the Internet might not be as prevalent as E-

mail usage. For instance, it was apparent from the 1997 survey of WSU faculty that they were not only more likely to use E-mail than the Internet (95 percent vs. 88 percent), but they also spent more time on E-mail than on the Internet (51 minutes per day vs. 29; Carley-Baxter 1997; Carley-Baxter and Dillman 1997). Nevertheless, as Internet access and use become more prevalent, it seems likely that the ease and speed of Internet-based surveys will lead to more widespread utilization. Meantime, E-mail surveys with a mixed-mode component to reduce coverage error represent an important addition to the arsenal of survey techniques. Data can be collected from important survey populations at lower costs with no reductions in response rates and improved data quality, compared to traditional mail surveys.

Appendix

Table A1. Summary of Previous Studies Using E-mail

Author	Year	Number of Contacts (E-mail/mail)	*N* (E-mail/mail)	Response Rate (%) (E-mail/mail)	Item NR (%) (E-mail/mail)	Speed (in days) (E-mail/mail)	Population
Sproull[a]	1986	2	30/30	73/87	1.4/.2	5.6/12	Department of Fortune 500 company
Parker	1992	2	100/40	63/38	N.A.	N.A.	AT&T employees
Walsh et al.[b]	1992	3	300	76	N.A.	N.A.	Subscribers to on-line user group
Schuldt and Totten	1994	1	343/200	19.3/56.5	N.A.	[c]	Marketing and MIS faculty at U.S. universities
Kittleson	1995	1	153/153	28.1/76.5	N.A.	2.88/12.6	International Directory for Health Educators
Mehta and Sivadas	1995	1;3;3/1;3	60;122;172/202;107	43;63;64/45;83	No difference	2/21	Users of electronic bulletin board
Opperman[b]	1995	2	665	48.8	N.A.	[c]	American Association of Geographers
Tse et al.	1995	2	200/200	6/27	No difference	8.09/9.79	Staff at Chinese University of Hong Kong

Bachmann, Elfrink, and Vazzana	1996	1	224/224	52.5/65.6	3.1/0.7	4.68/11.18	Business school deans in the United States
Besser	1997	1	86/109	19.8/15.6	N.A.	N.A.	Former members of the Rural Sociological Society
Couper, Blair, and Triplett[d]	1997	4/5	4,066/4,187	42.6/70.7	N.A.	N.A.	Employees of U.S. government statistics agencies
Smith[b]	1997	1; 2	150;150	8; 13.3	N.A.	N.A.	Members of web consultants assocation
Williams, Morphew, and Nusser[a]	1997	4	200/226	26.5/74.6	N.A.	N.A.	Iowa State University students

NOTE.—N.A. = not available.
[a] The E-mail method was compared with a phone method.
[b] Only an E-mail method was used.
[c] The response time was given, but in an incomparable format.
[d] The final contact for each mode was by telephone.

References

Bachmann, Duane, John Elfrink, and Gary Vazzana. 1996. "Tracking the Progress of E-mail versus Snail-Mail." *Marketing Research* 8:31–35.

Besser, Terry L. 1997. "Non-Renewing Member Survey." Unpublished report to the Rural Sociological Society, Toronto.

Carley, Lisa R. 1996. "Faculty Use of Computer-Related Technologies: A Baseline Study of All WSU Instructional Faculty." Data Report no. 96-51. Social and Economic Sciences Research Center, Pullman, WA.

Carley-Baxter, Lisa R. 1997. "How Are Computer Related Technologies Changing Faculty Work at WSU? A 1997 Survey of All WSU Instructional Faculty." Data Report no. 97-39. Social and Economic Sciences Research Center, Pullman, WA.

Carley-Baxter, Lisa R., and Don A. Dillman. 1997. "1997 Faculty Use of Computer Technology with 1996 Comparisons." Summary Report no. 97-40. Social and Economic Sciences Research Center, Pullman, WA.

Couper, Mick P., Johnny Blair, and Timothy Triplett. 1997. "A Comparison of Mail and E-mail for a Survey of Employees in Federal Statistical Agencies." Paper presented at the annual conference of the American Association for Public Opinion Research, Norfolk, VA.

Dillman, Don A. 1978. *Mail and Telephone Surveys: The Total Design Method.* New York: Wiley-Interscience.

———. 1991. "The Design and Administration of Mail Surveys." *Annual Review of Sociology* 17:225–49.

Dillman, Don A., J. A. Christenson, E. H. Carpenter, and R. Brooks. 1974. "Increasing Mail Questionnaire Response: A Four-State Comparison." *American Sociological Review* 39:744–56.

Dillman, Don A., Roberta L. Sangster, John Tarnai, and Todd H. Rockwood. 1996. "Understanding Differences in People's Answers to Telephone and Mail Surveys." *New Directions for Evaluation* 70:45–61.

Dillman, Don A., and John Tarnai. 1988. "Administrative Issues in Mixed Mode Surveys." In *Telephone Survey Methodology,* ed. Robert M. Groves, pp. 509–28. New York: Wiley.

Dillman, Don A., and Robert Tortora. 1998. "Principles for Constructing Respondent-Friendly WEB Surveys and Their Influence on Response." Paper for presentation at the 1998 American Statistical Association Meeting, Dallas.

Goyder, J. C. 1985. "Face-to-Face Interviews and Mail Questionnaires: The Net Difference in Response Rate." *Public Opinion Quarterly* 49:234–52.

———. 1987. *The Silent Majority: Nonrespondents on Sample Surveys.* Boulder, CO: Westview Press.

Groves, Robert M., and Robert Kahn. 1979. *Survey Research by Telephone.* New York: Academic Press.

Heberlein, Thomas, A., and Robert Baumgartner. 1978. "Factors Affecting Response Rates to Mailed Questionnaires: A Quantitative Analysis of the Published Literature. *American Sociological Review* 43:447–62.

Kittleson, Mark J. 1995. "An Assessment of the Response Rate via the Postal Service and E-mail." *Health Values* 18:27–29.

Mehta, Raj, and Eugene Sivadas. 1995. "Comparing Response Rates and Response Content in Mail versus Electronic Mail Surveys." *Journal of the Market Research Society* 37:429–39.

Opperman, Martin. 1995. "E-mail Surveys: Potentials and Pitfalls." *Marketing Research* 7:29–33.

Parker, Lorraine. 1992. "Collecting Data the E-mail Way." *Training and Development* (July): 52–54.

Schuldt, Barbara A., and Jeff W. Totten. 1994. "Electronic Mail versus Mail Survey Response Rates." *Marketing Research* 6:36–39.

Scott, Christopher. 1961. ''Research on Mail Surveys.'' *Journal of the Royal Statistical Society* 124:143–205.
Smith, Christine B. 1997. ''Casting the Net: Surveying an Internet Population.'' *Journal of Communication Mediated by Computers* http://www.usc.edu/dept/annenberg/vol3/issue1/.
Sproull, Lee S. 1986. ''Using Electronic Mail for Data Collection in Organizational Research.'' *Academy of Management Journal* 29:159–69.
Tse, Alan C. B., Ka Chun Tse, Chow Hoi Yin, Choy Boon Ting, Ko Wai Yi, Kwan Pui Yee, and Wing Chi Hong. 1995. ''Comparing Two Methods of Sending Out Questionnaires: E-mail versus Mail.'' *Journal of the Market Research Society* 37: 441–46.
Walsh, John P., Sara Kiesler, Lee S. Sproull, and Bradford W. Hesse. 1992. ''Self-Selected and Randomly Selected Respondents in a Computer Network Survey.'' *Public Opinion Quarterly* 56:241–44.
Williams, Andrew N., Christopher C. Morphew, and Sarah M. Nusser. 1997. ''Some Considerations for Conducting an Electronic Mail Study with University Students.'' Paper presented at the annual conference of the American Association for Public Opinion Research, Norfolk, VA.
Witt, Karlan J. 1997. ''Best Practices in Interviewing via the Internet.'' Paper presented at the Sawtooth Software Conference, Seattle.