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ABSTRACT

The use of the internet as a method to conduct survey research has expanded rapidly over the past decade. High speeds of response and lower expenses have driven this rapid growth. Relatively low response rates, however, suggest online surveys may be compromised by high levels of non-sampling error. This paper examines a major component of non-sampling error and the consequences that may be associated with internet survey non-response. Known population parameters are compared to point estimates from a census as well as a random sample of non-respondents in order to provide insight on the magnitude and direction of non-response error. Issue salience and response latency are found to exhibit a significant relationship to self-selection and response valance biases. Specifically, lower rates of non-response were obtained from respondents who perceived the topic of the survey as more important and patterns of response were more favorable among initial study participants.

INTRODUCTION

Usage of the internet to gather survey data has expanded rapidly and continues to grow at an increasing rate. Both the penetration and scope of online research will increase as more researchers adopt the internet as a survey administration vehicle and as researchers who already conduct online research use it for a greater variety of purposes (Miller, 2001, Ray et al., 2001). The increased usage of internet based data gathering techniques is easily explained. Broad adoption of the technology is being driven by inherent advantages of low channel cost per contact, speed of response, and reduced data transcription expense (Bachmann et al., 2000, Illieva et al., 2002, Mehta and Sivadas, 1995, Weible and Wallace, 1998).

An understanding of the total error associated with online survey methods is, however, somewhat more difficult to ascertain. Total survey error is composed of sampling error and non-sampling error. Sampling error is well behaved, and methods for controlling its magnitude are straightforward, i.e. increase the sample size and/or carefully follow the sampling plan. Non-sampling error is much less predictable as well as the major source of total survey error (Assael and Keon, 1982). Non-sampling error is made up of response errors, such as normative response, interviewer bias, or population specification error. Another very important component of non-sampling error is non-response error. Non-response error occurs when sample members who do not respond cause the overall responses to be unrepresentative of the target population. A good example would be a survey on soft drink purchase where consumers who do not purchase soft drinks fail to respond. This would result in the over estimation of the per capita consumption of soft drinks.

Initial concerns regarding internet non-sampling error focused primarily on the completeness and accuracy of the sample frame with regard to the population. Email addresses were often not available for all members of a population of interest (no address or inaccurate addresses). In other cases, internet surveys used email lists that included individuals who were not members of the population or did not control for multiple addresses (Dillman and Bowker, 2000). More recently, as the profile of internet users has become more consistent with the population characteristics of the United States and other nations (Cobanoglu et al., 2001, Kehoe et al., 1998), the focus on internet survey methodology has shifted to concerns over response rate.

Response rates for internet surveys, with few exceptions, are relatively low and are expected to drop even further in the future. For example, the average response rate to mail surveys has been estimated to be 55.6 percent

(Baruch, 1999). In a meta-analysis of web surveys, Cook et al. (2000) reported an average response rate of 34.6 percent. The latter authors also note that this response rate may be artificially inflated because papers with lower response rates were either more likely to have been rejected or not submitted for review. The lowest observed response rate for a published internet study was 7 percent (Tse, 1998).

Any further decline in online response rates may be caused, in large part, by the success of the medium. As the prevalence of email solicitations for survey participation and other purposes increase, any novelty effect will begin to wear thin and response rates could be further reduced. As unsolicited e-mail or Spam continues to increase (Marchewaka, et. al., 2003) Internet survey requests will become viewed as just another irritating source of "junk mail" to which only a small proportion of the population may be expected to respond (cf. Bickart and Schmittlein, 1999). Such an outcome would not be a problem if the lower number of responses were still representative of the population of interest. The representativeness of a sample, however, does not typically increase as non-response rate increases and a smaller percentage of those studied respond to an inquiry.

The generalization of internet survey results whenever respondents are not representative of the target population is, of course, unwarranted. Online survey data may have entertainment value in this circumstance but be of little merit otherwise. Inaccurate information can negatively affect customer satisfaction as well as the quality of management decision making (cf. Bose, 2002, Hassan, 2003, Hedelin and Allwood, 2002). An assessment of the magnitude and direction of internet survey non-response error is therefore a necessary precondition before any application of information gained online is used for decision making.

This paper examines two potential sources of non-response error that may affect the representativeness of an internet survey. A census was conducted to explore the impact of topic salience on self-selection and any corresponding variations in response. Thereafter, responses between initial census respondents and a subsequent random sample of non-respondents were compared to test for discrepant outcomes due to response latency. The results of both inquiries are presented and some suggestions for online survey methodology are summarized in the conclusion.

Internet Survey Non-response

As the e-commerce market continues to develop, studies of internet business activities are justifiable without regard to individuals who may not use the internet. For example, internet retail sales have shown strong growth and are becoming a significant factor in the overall retail market. The U.S. Census Bureau estimates that internet retail sales in 2002 exceeded $45 billion. This represents a 28.2% growth rate for internet sales as opposed to a 1.6% growth in total retail sales (U.S. Census Bureau, 2003). Online U.S. retail sales are forecast to grow even more rapidly in the future and approach $230 billion or 10% of total retail sales by 2008 (Johnson et al., 2003).

International growth in e-commerce, both business to consumer and business to business, may be expected to keep pace with or exceed the U.S. growth rate of internet retail sales (cf. Attaran, 2001, Trappey and Trappey, 2001). Most internet research studies, however, are not conducted in a manner that would ensure that reliable and valid data on internet market behavior is obtained. Researchers largely ignore non-response error, and instead seem to rely on large sample sizes as a surrogate indicator of survey quality.

Large sample sizes can mask some response rate issues by minimizing sampling error, but cannot eliminate the problems associated with an unrepresentative sample. To the contrary, large sample sizes tend to exacerbate non-response errors. Any sense of precision gained by increasing the number of respondents is likely to be quite misleading. Internet researchers often do not contact non-respondents and therefore have no way to assess whether participant responses are consistent with those of non-respondents or the target population. As a consequence, there is every reason to believe that the answers of people who do not respond to a survey may differ in some material respect from the answers provided by individuals who do complete a questionnaire. This is the classic definition of a non-response error.

Exit polling in the 2000 U.S national election provides a useful illustration of the effects of non-sampling error. Major television networks and the print news media combined resources so that forecasters could predict election night results with a high degree of statistical precision (Konner, 2003, Johnson, 2002). The public debacle that ensued over flawed electoral predictions occurred despite huge sample sizes and elaborate sampling plans.

Several forms of non-response error have been suggested as plausible explanations for the results, e.g. an increasing numbers of absentee voters, increasing non-response at exit polls. Response error in the form of false reporting of voting behavior may also have contributed.

However, non-response error need not be a fatal flaw of online research. The same survey implementation and design features that have been found to reduce non-response error in other methods of survey administration can be adapted to reduce internet survey non-response error. For example, non-response rates for internet surveys should decline as the length of a survey decreases. Although the length of an internet survey is probably more closely related to the number of screen views rather than the number of pages in a mail survey (Sheehan and McMillan, 1999). Telephone pre-notification has also proven effective in lowering non-response to an Internet survey (Hudson, et al., 2004). Inadequate questionnaire design, lack of respondent pre-notification, incentives, topic salience, and the number of follow-up contacts are some other factors that can be expected to affect internet survey non-response error. Of these, this study explores two important determinants of survey non-response: topic salience and the number of attempts used to contact potential respondents.

Previous research on internet survey non-response has shown that issue salience has a strong influence on response rate. Response rates have been found to be higher whenever respondent interest in the topic of the research inquiry is greater (Van Kenhove et al., 2002). Topics that deal with current issues and which are regarded by potential respondents as more important are considered salient (Martin, 1994). Thus, the distribution of response rates among alternative segments of a population with diverse preferences is expected to reflect the relative salience of the survey topic. The first hypothesis examines this possibility.

H1: Survey non-response error will increase among segments of a heterogeneous population that consider the focal object of a survey less salient.

The discrepant views of under or over represented segments of a target population are just one potential source of non-response error. Schaefer and Dillman (1998) report that the average response rate for internet surveys varied from 28.5 percent for a single contact to 57 percent for three or more contacts. Variations in respondent perceptions may also lead to non-response error whenever the views of early respondents are somehow different from later respondents. The speed of response and the relatively low costs associated with repeated internet contact would make the benefits associated with internet surveys even more desirable if such non-response bias could be reduced through follow-up solicitations. The inherent advantages of internet surveys would be less compelling when increases in response rate have little or no impact on non-response error.

Response time has been shown to provide an indication of the strength of associations in memory as well as the stability of related behaviors (Haaijer et al., 2000, Lowrey et al., 2001). Individuals with more extensive knowledge structures exhibit faster reaction times than people with less elaborate memory associations. Behaviors were also less predictable whenever the latency of survey response suggested respondents had spent less time thinking about a subject. Hypothesis 2 examines whether or not response latency may result in response variations among respondents that are otherwise similar.

H2: Survey non-response error will decrease as the distribution of respondent viewpoints becomes more discrepant due to response latency.

METHODOLOGY

The entire faculty, staff, and student body of a small private university located in the Pacific Northwest of the U.S.A. was surveyed. The population consisted of five thousand seven hundred and forty subjects. This population was chosen for study for two primary reasons: every member of the university community possessed a current email address and each potential respondent had known characteristics which could be compared to survey responses.

A list of potential respondents was constructed from the university directory and an initial contact was made via email. A cover letter from the University Vice President of Mission asked each community member to participate in an accreditation survey and included a link to the internet survey site. The questionnaire was administered using internet survey software provided by Sawtooth Software. Every population member was

provided with a unique user identification number to ensure that only designated individuals could participate in the study and that no person could respond more than once.

The survey instrument asked a series of questions about perceptions of the University Mission Statement as well as specific goals associated with the mission statement. This topic was selected because the university was currently undergoing an accreditation review and some strong opinions regarding the direction of the university had been expressed across campus. To encourage participation, the survey was kept very simple and required only about ten minutes to complete.

Twenty-nine questions were used to measure respondent perceptions of the university mission and goals. These questions utilized a five-point Likert scale to which respondents indicated their degree of agreement or disagreement with related belief statements. The remaining two questions were categorical and asked respondents to self identify their school affiliation and their status at the University, e.g. faculty, staff, or student.

Two weeks after the census was completed, a random sample of four hundred people was taken from the population and the survey was re-administered to non-respondents. Previous non-respondents were contacted with a reminder email that included an embedded survey link. A subsequent follow-up phone call was made to each of the non-respondents during the week. Phone callers stressed the importance of the study to the University, as well as potential participants, and sought a commitment to complete the online study by a specific date.

RESULTS

A three-item Likert scale was utilized to assess potential respondents self identification and involvement with the university mission (cf. Maltz and Kohli, 1996). The declarative portion of the summated scale consisted of the following statements: The University mission has a great deal of personal meaning for me, I do not feel a strong sense of belonging to the University, and I enjoy discussing the University mission with people outside the school.

This separate manipulation check indicated that potential respondents had significant differences in their involvement with the university mission ($F = 7.2$, $p < .01$). Not too surprisingly, involvement with the university mission appears to have a high correspondence with participant's divergent roles. Regular faculty and staff were relatively more concerned with university mission and goals than undergraduate students. Undergraduate student were more concerned with university mission and goals than either adjunct faculty or graduate students.

Less than twelve percent of the University population responded to the initial census (670). Twenty percent of the sampled non-respondents (79) complied with subsequent follow-up requests to complete the mission statement questionnaire. Table I summarizes the distribution of status in the population as well as the corresponding response to the status question in the census. A Goodness-of-Fit test indicates significant differences exist between the distribution of the known university population parameter and the census results ($X^2 = 211.6$, $p < .01$).

Table 1: Population Versus Achieved Distribution of University Status.

University Status	Population	Census
Undergraduate Students	3,501 (60.9%)	402 (60.0%)
Graduate Students	1,188 (20.7%)	49 (07.3%)
Regular Faculty	302 (05.3%)	70 (10.5%)
Adjunct Faculty	193 (03.4%)	4 (0.6%)

Administrative Staff	556 (09.7%)	145 (21.6%)
Population Total	5,740	670

As expected, adjunct faculty and graduate students were much less likely to participate in the study than regular faculty and staff. The latter employees responded at several times the level that would be expected by their distribution in the population. Adjunct faculty and graduate students responded to the census at a fraction of the level that would be expected by their proportion in the population. Undergraduate students responded in almost direct proportion to their representation in the population.

Of course, differences in response rate by status alone may not lead to non-response error if the answers of respondents reflect the attitudes of non-respondents. A MANOVA was conducted to assess whether position on mission related issues varied by population segments with different response rates. Self-selection significantly affected stated positions on mission related issues (Wilk's Lambda = .592, $p < .01$). Differences in response rate by status do appear to lead to non-response error. The answers of respondents were not consistent across population segments with different response rates.

The former findings lend credence to Hypothesis 1. Regular faculty and administrative staff may have self-selected to participate in the census because they had a much stronger commitment to the university than either adjunct faculty or graduate students. The self-selection process led to significantly different responses across the twenty-nine university mission questions.

A MANOVA was also performed to see if position on mission related issues differed by the time period in which people responded (census respondents or sampled non-respondents). Response latency significantly affected the stated positions on mission related issues (Wilk's Lambda = .703, $p < .05$).

Significant differences were observed between census respondents and the responses of sampled non-respondents. Later respondents when compared to similar individuals who had completed the census two weeks previously tended to have more negative appraisals of mission related issues. Almost eighty percent of sampled non-respondent question means were more negative than the corresponding values from the census participants.

Table 2: Discriminant Analysis Classification Results: Predicting Group Membership Using Response Latency.

Original Group	**Number of Cases**	**Predicted Group Membership**	
		Sample of Census Respondents	**Sample of Non-respondents**
Sample of Census Respondents	60	39 (65.0%)	21 (35.0%)
Sample of Non-respondents	77	11 (14.3%)	66 (85.7%)

The lower mean values that were associated with response latency represent less favorable evaluations of mission related issues and support Hypothesis 2. Individual responses to mission related issues were also significant when used to predict whether respondents were initial census respondents or sampled non-respondents who complied with subsequent requests to complete the mission survey (Wilk's Lambda = .703, $p < .05$). The

discriminant analysis results are provided in Table 2. The model correctly predicted 76.6% of cases in contrast to a chance level of 50%. Time lapse in responding to the survey seems to reflect how the respondent thought about mission related issues.

CONCLUSIONS

Too little consideration of survey non-response error appears to be taking place among practitioners of online research. In this study, significant non-response error was observed when the overall response rate exceeded 37 percent. Responses in the census and non-respondent sample were not consistent with either the known population distribution of status or with one another when alternative population segments and response latency were considered. These findings are disturbing because the average reported response rate for internet surveys is 34.6 percent and the general perception seems to be that this level of response is acceptable.

No statistical adjustment process is sufficient to compensate for non-response error of unknown magnitude and direction. The only viable solution is to reduce the possibility of this type of non-sampling error occurrence within internet surveys.

Whenever a sample frame represents a relatively heterogeneous population with discrepant preferences, self-selection bias due to topic salience can be expected to cause problems. This self selection is a trade off between the cost in time and energy needed to respond versus the perceived benefit to ones self, or a salient reference group. There is always the possibility that differences in response rate between different waves of a survey may be due to different motivations. Early responders with high topic salience may respond due to the value they place on the survey, while later respondents may be motivated by negative factors. This second wave of respondents may respond through motivation to avoid repeated requests by researchers. Therefore their responses may contain response error due to their lack of motivation and identification with the study. Separating out this combination of non-response bias and response error may be problematic.

Designing survey instruments and administration processes which elicit more universal respondent interest and motivate participation can help eliminate some non-response error. Limiting samples to populations with high topic salience is another approach. Repeated contact with potential respondents, however, appears to be a most effective method of increasing response rate and reducing the extent of non-response error. Another promising technique is to approach non-respondents with alternative methods. Where possible the original survey method should be tailored to fit the requirements of different strata. If adjunct faculty cannot be adequately reached by the Internet they should be contacted by an alternate method. In addition, follow-up contact with non-respondents by mail, phone and finally personal interview, while expensive, has proven very effective in minimizing non-response from those who do not use the Internet as their main source of communication (Dillman, 1978).

Other design elements such as disguising the true purpose of a study and promising confidentiality may be even less effective means of eliciting survey participation. Many consumers who refuse to participate in internet surveys are unlikely to even open an email from an unknown source or click through a pop-up solicitation to take an internet survey. People may simply make online survey non-response their normal behavior in reaction to the overwhelming volume of spam they receive.

High levels of internet survey non-response may not be a problem in special situations like experiments where population homogeneity is desirable. Future research should investigate the possibilities for questionnaire design methods which will increase response rate. Some of the potential benefits associated with the internet as a promising survey administration tool may otherwise be lost if individuals and organizations are left to pursue their own interests without guidance.

It is not suggested that all Internet surveys will necessarily suffer from significant non-response bias. In fact a study by Hudson et al. (2004) showed no significant non-response. However, it is suggested that this issue be strongly considered in the design of all Internet studies. The results of this study should serve as a precautionary note to internet survey researchers. Although many people will be tempted to use internet survey methodology due to the relatively low cost and speed of response, internet survey results may not be particularly useful even when sample frame coverage of the population is adequate.

This statement is not meant to suggest that there are no longer frame issues that must be considered before undertaking an internet survey. Web surveys may still not be appropriate whenever a population of interest does not have ubiquitous access to the internet and/or a true random sample of the population cannot be drawn. The potential problems of over and under representation will, however, continue to diminish as more people use and have access to the internet.

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