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The Effect of Answering Machines on the Representativeness of Samples in Telephone Surveys

Robert W. Oldendick[1]

Abstract: The increased incidence of answering machines has raised questions about the extent to which potential respondents in telephone surveys are using such devices to screen unwanted calls, and the effect that this may have on the representative character of samples in telephone surveys. This study examined the extent to which answering machines are used for screening purposes, the effect of repeated attempts to contact such households, and the demographic characteristics associated with answering machine use. The results indicate that while some such screening does take place, at this point it does not appear to be a major threat to the representativeness of telephone samples, and that repeated attempts to reach households with telephone answering machines result in successful contact in a large proportion of cases. Households with higher family incomes, those in urban areas, and those comprised of younger adults are more likely to use such devices for screening purposes.

Key words: Telephone answering machines; sampling; telephone methodology; representativeness; response rates.

1. Introduction

One of the great advantages of survey research relative to other methods of data collection is that information gathered from a well-drawn probability sample provides for generalization to some larger population of interest. Much of the history of survey research in the past half century has been defined by developments in our ability to collect data from representative samples, from the acceptance of quota sampling techniques following the *Literary Digest* fiasco of 1936, through the continued refinement of cluster techniques for selecting representative household samples, and the development of random digit dialing (RDD) procedures for telephone samples (Bradburn and Sudman 1989, pp. 18–20). In addition to the development of procedures for selecting representative samples, survey researchers have given considerable attention to other factors that affect representativeness, including respondent selection within households (Kish 1949; Troldahl and Carter 1964; Bryant 1975; Salmon and Nichols 1983; O'Rourke and Blair 1983; Oldendick, Bishop, Sorenson, and Tuchfarber 1988) and eliciting cooperation from respondents

[1] Survey Research Laboratory, Institute of Public Affairs, University of South Carolina, Columbia, SC 29208, U.S.A.

(Groves and Kahn 1979; Groves and Magilavy 1981).

Although many of the changes that have occurred during the past two decades, such as increased telephone coverage, the development of RDD, and the refinement of procedures for selecting respondents within households, have facilitated the representativeness of samples for telephone surveys, a number of more recent changes have made contacting such samples more difficult. For example, concerns about privacy and confidentiality, and increasing requests for information from survey researchers as well as those conducting "pseudo-polls" have been posited as factors in increased refusal rates (Steeh 1981; Bradburn and Sudman 1989). Moreover, societal factors – such as more single parent and two wage-earner households, concerns about how information will be used or why it is needed at all – that led to expectations for a lower cooperation rate in the 1990 U.S. Census are also likely to have a depressing effect on response rates for telephone surveys. The concern of the research to be presented here is the effect that one seemingly innocuous factor – the increased use of telephone answering machines – may be having on the capacity of survey researchers to reach a representative sample of the general population in telephone surveys.

While telephone answering machines are not a new technological development, their use has increased significantly over the last several years. Estimates are that about one-quarter of the households in the United States have a telephone answering machine, and this percentage is expected to continue to increase (Piekarski 1990; Tuckel and Feinberg 1991). Our concern is the extent to which such answering machines are used to screen unwanted calls, including those from survey researchers interested in everything from the brand of peanut butter used in the household to "important public policy issues facing the area where you live."

Previous research on this topic (Baumgartner 1990; Piekarski 1990; Tuckel and Feinberg 1991) has indicated that a substantial proportion of telephone answering machine households are accessible to survey

Table 1. Incidence of telephone answering machines for those households in which an interview was completed

	Fall 1989		Spring 1990	
	N	%	*N*	%
Completed interviews				
No telephone answering machines	443	75.7	612	74.5
Telephone answering machine	142	24.3	210	25.5
Completed on first attempt	39	6.7	58	7.1
Completed on second attempt	37	6.3	52	6.3
Completed on third attempt	15	2.6	35	4.3
Completed on fourth attempt	16	2.7	19	2.3
Completed on fifth attempt	9	1.5	12	1.5
Completed on sixth attempt	13	2.2	16	1.9
Completed on seventh attempt	4	0.7	7	0.8
Completed on eighth attempt	4	0.7	2	0.2
Completed on ninth attempt	2	0.3	3	0.4
Completed on ten or more attempts	3	0.5	6	0.7

researchers. The present study attempts to replicate the findings on the accessibility of answering machine households with a different, though diverse, population and to extend this research by examining the demographic characteristics associated with answering machine use and the effect that repeated attempts to answering machine households has on establishing contact with them.

2. Data and Methods

The data for this study are from two random digit dialed telephone surveys of the adult (18 and over) population of South Carolina, U.S.A. Respondents within households were selected using the last birthday method (O'Rourke and Blair 1983; Oldendick et al. 1988). The first survey of 585 respondents was conducted in November 1989, and included questions on the most important problem facing the state, budget priorities and taxes, abortion, selection of judges in the state, beachfront management, the effects of Hurricane Hugo, and race relations. The estimated response rate for this survey was 65.3%. The second survey was conducted in April 1990, and contained items on perceptions of higher education in the state, recycling, outdoor recreation, the role of the federal government in providing jobs, health insurance, and aiding minority groups, foreign policy, and abortion. The estimated response rate for this survey was 66.6%.[2] The final questions asked in each of these surveys were (1) "Does your household have a telephone answering machine?" and, for those households that reported having such a device, (2) "Does anyone in your household ever use this telephone answering machine to screen out unwanted calls?" Telephone numbers that produced any contact with an answering machine were tracked to determine the extent to which such numbers resulted in completed interviews, were never contacted, or were otherwise disposed.

Table 1 provides a breakdown of the telephone answering machine status of those households for which an interview was completed. These data indicate that about 25% of households have a telephone answering machine.

An alternative way to estimate the incidence of telephone answering machine households is to include other households – e.g., where an interview was refused, where the respondent was ill or not available during the fielding period, or where there was repeated contact with an answering machine – which were known to have telephone answering machines as telephone answering machine households. Including such households would have provided an estimate of telephone answering machine households of 29.8% in November 1989 and 32.9% in spring 1990. As one reviewer of this manuscript has noted, however, such procedures provide an overestimate in that the households that refuse, where the respondent is not available, etc., that do *not* have an answering machine are not included in the denominator.

In addition, basing the estimate of telephone answering machine households only on those households in which an interview was completed produces a biased estimate if the incidence of such devices is significantly different in households where an

[2] In calculating response rates for these surveys, the proportion of "never answered" numbers that were counted as households was assumed to be the same as that for those numbers where a household determination was made. In the November 1989 survey, this proportion of household numbers was 69.4% (817/1177) while in the April 1990 survey it was 70.1% (1164/1659). The potential range of response rates – assuming that all of the "never answered" numbers were households or that none of them were – is 62.7%–72.0% for the November 1989 survey and 64.5%-72.0% for April 1990.

Table 2. Call dispositions for estimated households

	Fall 1989		Spring 1990	
	N	%	*N*	%
Never Answered[1]	84	9.3	93	7.4
Busy	8	0.9	6	0.5
Answering Machine	20	2.2	26	2.1
Refusal	134	14.9	196	15.6
Ill/Senile	20	2.2	25	2.0
Ineligible	5	0.6	23	1.8
Call-Back	37	4.1	52	4.1
Partial	8	0.9	14	1.1
Completed	585	64.9	822	65.4
Totals	901	100.0	1,257	100.0

[1] The number of "never answered" telephone numbers used in these calculations is an estimate based on the assumption that the proportion of such numbers that were actually households is the same as the proportion for those numbers where a household determination was made (see Footnote 1).

interview was refused, where the respondent was ill or senile, or where an interview was not completed for other reasons. At the extremes, if *none* of the excluded households had such devices, the estimate of the percentage with telephone answering machines would be 20.0% in fall 1989 and 23.1% in spring 1990; if *all* excluded households had such machines the estimate in both surveys would be 52.8%. Overall, we feel that basing this estimate on those cases for which complete information is available provides the best estimate since there is no a priori reason to believe that such usage would differ significantly in those households that were excluded. The incidence of telephone answering machines in the state, therefore, is similar to estimates of the incidence of telephone answering machines reported for the United States (Piekarski 1990; Tuckel and Feinberg 1991).

Table 2 displays the final call disposition for estimated households. Of particular interest for this research is the percentage of cases that result in consistent contact with a telephone answering machine. As these data indicate, in slightly more than 2% of the cases, attempts to reach these households result in consistent contacts with a telephone answering machine.

This figure is somewhat lower than that (5.7%) reported by Tuckel and Feinberg (1991, pp. 206–207) for two reasons. First, in their study most households were called up to a maximum of three times before final disposition, while in the current study numbers were attempted a minimum of six times. The second involves a difference in the way in which the "answering machine" disposition is defined. They include in this disposition not only consistent answering machine contacts, but also those cases in which a number yielded a call-back on one attempt followed by an answering machine on a subsequent call attempt. In the current study, the "answering machine" disposition includes only those cases in which no contact was made with a person; that is, all attempts yielded contact with an answering machine or a combination of answering machine contacts and no answers.

From these data, therefore, it appears

that about 2% of households employ the telephone answering machine consistently to screen out calls. While any such usage is a potential detriment to the representativeness of samples in telephone surveys, it does not appear that this usage has yet reached the point where such samples are seriously biased by non-response due to screening by answering machines.

These results correspond with those of previous research on this topic noted earlier. For example, Tuckel and Feinberg (1991, p. 216) estimated the percentage of households with telephone answering machines to be about 25% and found "that a substantial proportion of answering machine households are accessible to telephone survey researchers." Similarly, Baumgartner (1990, p. 9) reported that most households with telephone answering machines are able to be contacted, and Piekarski's (1990) findings replicate the results of these two studies.

3. Contacting Answering Machine Households

One approach to contacting households with telephone answering machines is to make numerous attempts to these numbers. Repeated attempts increase the likelihood of reaching both "connectors" (those who may be away from home regularly and use the answering machine as a means for receiving messages) and those "cocooners" (who use the machine as a screening device), who do not screen their calls *all* the time (Tuckel and Feinberg 1991, p. 205). In the initial design of these surveys, consistent answering machine contacts were treated in the same way as consistent no answers; that is, they were attempted six times (varying the day and time of call), and then retired if no contact had been established. Given the concern with the potential effect of answering machine use, additional calls were attempted to these numbers. It appears that such additional attempts are justified. In each additional attempt (between seven and ten tries) about 0.5% of the total interviews for the study were completed (see Table 1), a finding similar to that reported by Piekarski (1990).

In some ways, the decision of how many calls to make to numbers that repeatedly reach an answering machine parallels that of how many attempts to make to consistent "no answer" numbers, which varies across survey organizations. Research on this issue describes the trade-off between increased representativeness and increased costs involved in additional attempts to make contact at such numbers. Tuchfarber and Klecka (1976) suggest that attempting such numbers more than six times results in few additional completed interviews, while Groves and Kahn (1979, p. 55) found that ten or more calls can be effective in increasing contact with working household numbers. The main difference, of course, is that a certain percentage of numbers that are never answered are "ring, no answer" numbers that have no chance of producing a completed interview (Groves and Kahn 1980, pp. 48–52), while calls answered by a machine are likely to be to households. Given this consideration, additional attempts to complete interviews with "answering machine" households may be justified, and attempting such numbers ten or more times may be effective in terms of the representativeness of the sample.

Some indication of how such additional attempts might affect the representativeness of the sample is provided by examining the demographic characteristics of those telephone answering machine households contacted on the first attempt, the second attempt, and so forth, the assumption being that households reached on later attempts are more likely to reflect

the characteristics of households that are never reached. In examining the relationships between number of contacts required to reach a telephone answering machine household and the demographic characteristics employed in this study, no statistically significant relationships were detected, though this may be due partly to the fact that – as shown in Table 1 – the number of cases in each category is relatively small, even when these data are pooled across surveys. As will be demonstrated later, background characteristics primarily affect whether or not a household has a telephone answering machine, not whether this device is used for screening.

What is the best time to attempt calls to these households? While the number of cases in these studies is small, and not standardized for the total number of calls made during different time periods, the largest number of contacts with households with answering machines were made during the early evening hours, between 6:00 p.m. and 9:00 p.m.; these data parallel those on the optimal time for attempting to reach any telephone household (Weeks, Jones, Folsom, and Benrud 1980; Vigderhous 1981). Other research has also shown that weekday evenings are generally better than weekends for reaching telephone answering machine households, and that Saturday is the worst day to complete an interview in such households (Tuckel and Feinberg 1991, p. 214; Piekarski 1990).

4. Self-Reports of Answering Machine Use

Tracking the disposition of calls made to households with answering machines indicates that the use of these devices to screen unwanted calls does not appear to be widespread, and that with some persistence a contact can be made in these households. In order to examine how these data corresponded with self-reports of the use of answering machines to screen unwanted calls, respondents whose households had an answering machine were asked if their household ever used it for such purposes. In the fall survey 9.4% of the households (38.3% of those with answering machines) reported that the answering machine was sometimes used to screen unwanted calls, while in the spring survey this percentage was 11.0% (41.4% of households with answering machines).

This is in one way an underestimate, since those that were never reached (about 10% of those households with answering machines) may be using it for this purpose; if these households are included among those that use answering machines to screen calls, these percentages increase to 12.5% in the fall survey and 13.8% in the spring. This is counterbalanced to some extent by the broad nature of the question: Does anyone in your household ever use this telephone answering machine to screen out unwanted calls?; obviously they were not doing it all the time or we would never have reached them. While there is evidence, therefore, that some people may be using a telephone answering machine for screening, the proportion doing so does not appear to be large.

5. Demographic Correlates of Use

To the extent that telephone answering machines are used to screen calls, what demographic groups are more likely to be missed? Are certain characteristics associated with the use of telephone answering machines, particularly for screening purposes? Table 3 shows the percentage of respondents in various groups who reported that their household had a telephone answering machine and that someone in

Table 3. Demographic correlates of telephone answering machine use

	% with answering machines		% use for screening	
	Fall 1989	Spring 1990	Fall 1989	Spring 1990
Total sample	24.3	25.6	9.4	11.0
Household characteristics				
Total family income				
Under $10,000	8.4	7.4	3.2	3.1
$10,000–19,999	17.9	16.5	7.9	6.6
$20,000–29,999	26.8	25.9	9.6	11.1
$30,000–39,999	27.8	42.8	11.4	16.0
$40,000 and over	42.3	40.1	15.3	18.9
Significance test[1]	<.001	<.001	<.05	<.001
Household size				
One	24.5	19.9	11.3	11.1
Two	24.0	27.9	9.9	12.2
Three	25.3	30.0	9.2	10.9
Four	22.3	29.3	6.8	11.5
Five	27.3	18.8	6.6	1.0
Six or more	17.9	11.0	7.7	7.6
Significance test	N.S.[2]	<.05	N.S.	N.S.
Urban/rural area				
Urban	30.0	—	11.9	—
Rural	18.4	—	6.2	—
Significance test	<.01	—	<.05	—
Individual characteristics				
Education				
Less than H.S. diploma	13.6	16.1	2.9	4.2
High school diploma	18.6	24.7	4.7	9.9
Some college	32.5	25.8	16.3	11.1
College degree	34.9	41.9	15.2	17.0
Significance test	<.001	<.001	<.001	<.01
Age				
18–29	35.7	29.8	16.5	13.6
30–45	22.0	30.4	8.3	13.5
46–64	24.6	22.8	6.9	4.9
65 and over	5.0	9.7	0.0	1.9
Significance test	<.001	<.001	<.001	<.001
Race				
White	29.6	29.6	10.8	12.2
Black	12.2	15.5	6.1	4.1
Significance test	<.001	<.001	N.S.	<.01

[1]Based on a chi-squared test of significance.
[2]Not significant at the .05 level.
— Not asked in this survey.

the household used this device to screen unwanted calls.[3]

Examining the effect of household characteristics, family income has a significant effect on use of a telephone answering machine to screen calls. Less than 5% of those with incomes under $10,000 report such usage, while among those with incomes above $40,000 such call screening falls in the 15%–20% range. Whether the respondents described the area in which they lived as urban or rural also made a significant difference in the use of answering machines. About 12% of those who characterized the area in which they lived as urban reported some screening of calls, compared to 6.2% of those who said they lived in a rural area. This difference may be particularly important for studies conducted in urban areas. While there was some evidence that larger households use answering machines less for call screening, the effect of household size on answering machine use is slight and not systematic across surveys.

Inspecting the effect of the characteristics of individuals residing in telephone answering machine households demonstrates that education, age, and race are associated with households in which telephone answering machines are used to screen calls. Individuals with higher levels of education, particularly those with some college or more, report that their household uses an answering machine to screen calls. Similarly, higher percentages of younger people report call screening in their household. While the effect of age is slightly different in these two surveys, the results indicate more screening among households where the respondent was under 45 than among those with older respondents. A significantly higher percentage of whites than blacks reported some use of a telephone answering machine to screen calls in the spring 1990 survey; in the fall 1989 data, this difference was in the same direction, though not statistically significant.

The effect of demographic characteristics on telephone answering machine use is primarily upon the type of household that has such a device; there appears to be little additional effect of such factors on whether those households which have such machines use them to screen unwanted calls. Socioeconomic status is most strongly associated with ownership and use of a telephone answering machine. Those households with higher family incomes (and whose members have more years of schooling) are more likely to use such machines to screen calls. Households in urban areas and "younger" households are also more likely to use telephone answering machines to screen calls. Similarly, whites are more likely than blacks to use such devices.

6. Conclusion

The concern underlying this research was the extent to which potential survey respondents use telephone answering machines to screen calls and the effects of such screening on the representativeness of telephone samples. These results show that while there is some use of answering machines for this purpose, it does not appear to be widespread. Persistent attempts to reach households where an answering machine is encountered have resulted in successful contacts with a large proportion of them. These

[3]In examining these data it should be kept in mind that the procedures used in identifying telephone answering machine households – i.e., "Does your household have a telephone answering machine?" and "Does anyone in your household ever use this telephone answering machine to screen out unwanted calls?" – measure incidence and use at the household level. It is not appropriate, therefore, to infer that the individual level characteristics described here are directly related to answering machine ownership or the use of such devices to screen calls. Rather, this analysis indicates the individual characteristics of those living in households that have an answering machine and that use these machines for screening.

data support previous investigations of this topic which concluded that substantial proportions of households with a telephone answering machine are accessible to survey researchers (Baumgartner 1990; Tuckel and Feinberg 1991).

While these results are generally reassuring from a research perspective, they do contain some cautions. Certain characteristics, such as higher family incomes or households comprised of younger adults, are associated with the use of telephone answering machines to screen unwanted calls. The representativeness of the samples in studies that focus on these groups may be more affected by such screening than those involving the general population. Similarly, households in urban areas are more likely to use answering machines to screen calls, so that surveys in these areas or in other geographic regions where the incidence of answering machine screening is higher may be affected more adversely.

As the number of households with telephone answering machines continues to grow, research on the use of such devices for screening will be of continued importance. Changes in the socio-demographic characteristics of answering machine ownership may change the extent to which such devices are used to screen calls, as may the continued increase in the extent to which the telephone is used for telemarketing sales calls and other types of solicitations. Further research in the area should not only monitor trends in ownership and the extent to which screening occurs, but also examine ways in which contact with the household may be gained, for example by leaving a message concerning the nature of the study or requesting the household to return the call (Baumgartner 1990). While research in this area has begun, a continuing effort must be made in order to determine the effects which technological developments, such as telephone answering machines or features that enable the number called to view the number from which the call is originating, are having on the representativeness of telephone samples on which many survey researchers have come to rely.

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