

Advances in Telephone Survey Methodology

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Advances in Telephone Survey Methodology



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This monograph is dedicated to the memory of Joseph Waksberg and Warren Mitofsky, who both passed away in 2006. The Mitofsky–Waksberg method of RDD sampling that they invented and developed was the cornerstone for the spectacular growth in telephone sampling in the United States. The two were close lifelong friends and collaborators, inspirations to those who had the good fortune to interact with them, and ambassadors for the use of sound statistical methods. While they had different styles and personalities, both were totally engaging enthusiastic colleagues who will be dearly missed by all.

Joe Waksberg was born in Poland in 1915 and immigrated to the United States in 1921. After graduating from City University of New York, he worked at the Census Bureau for 33 years, retiring in 1973 as the Associate Director for Statistical Methods, Research, and Standards. He then joined Westat, where he worked and became Chairman of the Board from 1990 until his death. He also consulted with CBS news and other networks on election nights from 1967 to 2004. Among many honors, the journal *Survey Methodology* invited paper issue honored his contributions to survey methodology.

Warren Mitofsky was born in the Bronx, New York, in 1934 and moved to Monticello, New York as a teenager. After graduating from Guilford College, he studied at the University of North Carolina and the University of Minnesota. He began his career at the U.S. Bureau of the Census before going to CBS News in 1967 to work on election coverage. He started the CBS News/New York Times Poll, conducting the first election-day polls. In 1990, he formed the Voter News Service, and in 1994 he began Mitofsky International. Among many honors, he received the American Association of Public Opinion Research lifetime achievement award.

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PART I

Perspectives on Telephone Survey Methodology

CHAPTER 1

Telephone Survey Methods: Adapting to Change

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1.1 INTRODUCTION

In 1987, the First International Conference on Telephone Survey Methodology was held in Charlotte, NC. The conference generated a widely read book on telephone survey methodology (Groves et al., 1988). Although that book continues to be a standard reference for many professionals, the rapid changes in telecommunications and in telephone survey methodology over the past 15 years make the volume increasingly dated. Considerable research has occurred since 1987, including myriad advances in telephone sampling in response to changes in the telecommunication system.

The goal of the Second International Conference on Telephone Survey Methodology was to once again bring together survey researchers and practitioners concerned with telephone survey methodology and practice in order to stimulate research papers that (1) contribute to the science of measuring and/or reducing errors attributable to telephone survey design, (2) provide documentation of current practices, and (3) stimulate new ideas for further research and development. This volume presents invited papers from the conference.

This chapter provides a brief introduction to the field, where it is today, and where it might be going. It begins by reviewing where the field stood at the time of

the 1987 conference and goes on to detail changes that have taken place since that time. Besides discussing the rapid changes in telecommunications and the social and political environments over the past two decades, the chapter considers ways telephone survey methodologists have adapted to these changes and what further adaptations may be needed in the future. The final section provides a brief overview of the contents of the volume.

1.2 THE CHANGING ENVIRONMENT

1.2.1 The Picture in 1987

Survey research began in the 1930s with the use of quota samples (Elinson, 1992). The controversy over the use of quota samples versus probability sampling lasted until the early 1950s. By that time, academicians and government statisticians had convinced most in the survey industry that probability sampling was a necessary ingredient in the proper conduct of surveys (Frankovic, 1992). But during all those years and through most of the 1960s, much of the survey research was conducted either by mail or through personal visits to households. The telephone was used largely for follow-up purposes. Certainly, the most important national surveys in the United States (e.g., the Gallup Poll, the Current Population Survey, and the National Election Study) were conducted face-to-face.

By the late 1960s, however, the costs of personal visits were escalating while, at the same time, the proportion of households with telephones had grown to close to 90 percent, both in North America and Europe. Furthermore, the decline in response rates in face-to-face surveys in especially the commercial sector made the possibility of using the telephone as a collection mode more attractive (Nathan, 2001). Concerns about the methodological shortcomings of telephone surveys were satisfied by the results of several studies conducted in the 1960s and 1970s (Hochstim, 1967; Sudman and Bradburn, 1974; Rogers, 1976; Groves and Kahn, 1979). Survey organizations began relying more and more on telephones for conducting surveys once random digit dialing (RDD) was introduced (Cooper, 1964; Nathan, 2001), even though the problem of locating residential numbers among the universe of possible numbers was daunting. That problem was solved by Warren Mitofsky and Joseph Waksberg with the invention of the two-stage Mitofsky–Waksberg telephone sampling methodology that took advantage of the fact that residential numbers tended to be clustered in 100-banks (Mitofsky, 1970; Waksberg, 1978), an approach also suggested but not fully developed by Glasser and Metzger (1972) and Danbury (1975). Thus, by the 1980s, telephone surveys were a part of standard survey practice; however, along with the growing reliance on the telephone survey came a number of methodological problems that had to be addressed.

It is in this environment that the first International Conference on Telephone Survey Methodology was held. One focus of that conference was telephone coverage, both in the United States (Thornberry and Massey, 1988) and in other countries (Steel and Boal, 1988; Trewin and Lee, 1988), and the potential for biased

estimates as a result of ignoring nontelephone households, defined only as those without landline service. At the time, this was largely assumed to be a fixed state—a household always had service or it never did. A great deal of interest about within household sampling also existed (Whitmore et al., 1988; Oldendick et al., 1988; Maklan and Waksberg, 1988).

As today, there also was the focus on sample designs for telephone surveys, but the range of discussion was much more restricted. Several papers at the conference discussed refinements of the Mitofsky–Waksberg method (Burkheimer and Levinsohn, 1988; Alexander, 1988; Mason and Immerman, 1988). Treatment of list-assisted designs was mostly limited to methods for accessing individual-listed phone numbers directly, although there was some mention of the type of list-assisted design we know today (Groves and Lepkowski, 1986; Lepkowski, 1988). Dual-frame and mixed-mode designs were covered (Nathan and Eliav, 1988; Lepkowski, 1988; Sirken and Casady, 1988), but these studies dealt only with combining telephone and address frames in the context of telephone or personal visit surveys. Issues surrounding variance estimation, survey costs, and weighting were also addressed (Massey and Botman, 1988; Sirken and Casady, 1988; Mason and Immerman, 1988; Mohadjer, 1988).

One of the most important topics at the 1987 conference was computer-assisted telephone interviewing (CATI), which was relatively new at the time. As might be expected, one study compared the results from CATI and paper surveys (Catlin and Ingram, 1988). The construction of CATI questionnaires was the focus of several papers (Futterman, 1988; House and Nicholls, 1988). Designing and using CATI systems were also addressed (Sharp and Palit, 1988; Baker and Lefes, 1988; Weeks, 1988).

The administration of telephone surveys, a topic still of interest today, was also important in 1987. Of particular interest were best practices in the administration of centralized CATI centers (Whitmore et al., 1988; Berry and O'Rourke, 1988; Bass and Tortora, 1988). Other topics in this area included the performance of telephone interviewers (Pannekoek, 1988; Oksenberg and Cannell, 1988) and the optimal calling strategies (Kulka and Weeks, 1988; Alexander, 1988).

Finally, two areas of research that have grown greatly in importance over the past two decades were covered in 1987—nonresponse and measurement error. You will note that much of this research revolved around the comparison of telephone and face-to-face surveys. Certainly, this research was sparked by the growing concern over the rising costs of in-person visits. Could telephone surveys be a viable alternative?

Unit nonresponse rates were already considered a problem in 1987, and Groves and Lyberg (1988) made it clear that the situation was likely to get only worse. Refusal rates in the United States, Canada, and Britain were reported in two studies that examined the differences between face-to-face surveys and telephone surveys (Collins et al., 1988; Drew et al., 1988). A rather limited amount of research examined possible reasons for nonresponse in telephone surveys, but few definitive results were obtained. Only the effects of interviewers on nonresponse were notable. Collins and his colleagues found differences in interviewer response rates, and Oksenberg

and Cannell (1988) found that response rates differed according to interviewer vocal characteristics. Interestingly, both studies found that the interviewer's ability to project confidence and competence coincided with higher response rates.

As for measurement error, a number of papers investigated indicators of data quality. Most of them looked at differences in estimates by mode, usually face-to-face and telephone. One paper was a meta-analysis of a number of comparisons between face-to-face and telephone surveys (de Leeuw and van der Zouwen, 1988). Nathan and Eliav (1988) looked at the consistency of reporting in a panel survey depending on the mode (telephone or face-to-face), and Kormendi (1988) examined the quality of income reporting in the two same modes. Sykes and Collins (1988) reported differences in estimates, again for telephone and face-to-face surveys, for a sensitive topic—close-ended, open-ended, and scale questions concerning alcohol consumption. Bishop et al. (1988) examined differences in data quality (the effects of question order and wording) in a telephone survey compared to a self-administered one. Just looking at data quality within a telephone survey, Stokes and Yeh (1988) evaluated the effects of interviewers on survey estimates.

1.2.2 Changes in Technology

Clearly, numerous challenges to conducting telephone surveys existed in 1987; however, those challenges may seem relatively small compared to the problems faced today. In 1987, the growth in the number of telephone service providers was yet to occur. The expansion in the number of area codes, leading to a dilution in the concentration of residential numbers among all available telephone numbers, was just in the planning stages. New technologies that coincided with the economic growth during the 1990s, such as answering machines, caller ID, and mobile phones, were not on the market. Computers were not yet in enough households to be considered as a vehicle for the administration of surveys. The public's concerns about privacy and confidentiality, while certainly present, had not reached a critical level. Important changes in the demographics of the U.S. population, such as the increased immigration of Hispanics in the 1990s, had not happened.

One of the most important developments since 1987 has been the rapid changes in telephony (Tucker et al., 2002). The number of area codes, and, thus, the total number of telephone numbers in the North American system, has almost doubled. The number of valid prefixes increased by 75 percent between 1988 and 1997, and today there are 90 percent more available telephone numbers. In contrast, the number of households has increased only a bit over 10 percent. As a result, the proportion of all telephone numbers assigned to a residential unit has dropped from about 0.25 to not more than 0.12. Figure 1.1 shows the relative change in the proportion of "active banks," those with one or more listed telephone numbers, since the late 1980s. Active banks have increased, but they now are a smaller percentage of all banks. A further complication is that it became more difficult to determine if numbers were residential because telephone business offices were less forthcoming with information and often inaccurate in their determinations (Shapiro et al., 1995). Screening numbers based on tritones was also problematic particularly in the west (Rizzo et al., 1995).

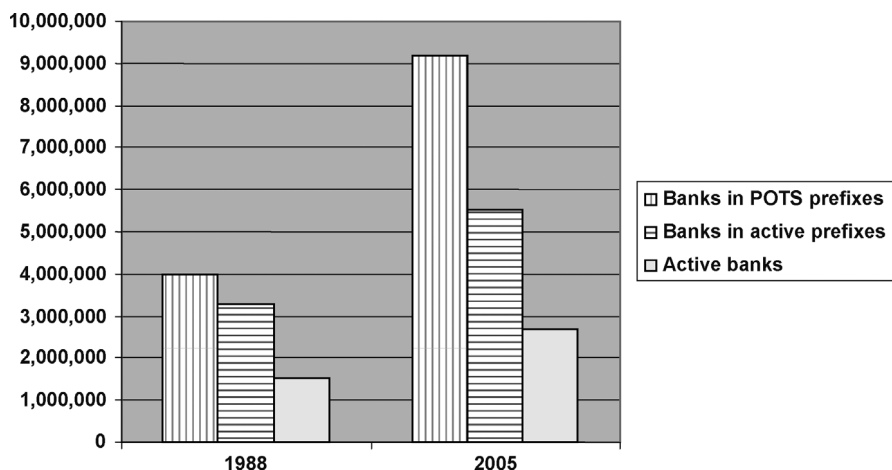


Figure 1.1. Number of 100-banks of various types in the United States, 1988 and 2005. (Source: Survey Sampling, Inc.)

There was also evidence that telephone companies appeared to be less systematic in the assignment of residential numbers across 100-banks. While the number of residences grew by just over 10 percent, the number of 100-banks with residential numbers has increased by over 50 percent. This increase in residential banks has resulted in a decline in the proportion of the numbers in a listed 100-bank that are residences. Figure 1.2 illustrates this change just for listed numbers. The decline has been from percentages in the low to middle 50s in 1990 to percentages in the upper 30s today. While the proportion of unlisted numbers is now approaching 30 percent in the United States and even higher in the United Kingdom (Collins, 1999), and largest in urban areas, this change cannot explain that much of the decline in the density of residential numbers in 100-banks.

In addition, there has been substantial growth in the number of households with multiple lines. Second lines dedicated to computers, fax machines, and home businesses have made it more difficult to distinguish noncontacts from nonworking numbers. Finally, there has been an increase in the assignment of whole prefixes to a single business customer. The identification of business numbers and the separation of those numbers from residential ones have become more problematic.

Accompanying these massive changes has been the amazing growth in telephone technology, and this has been a worldwide phenomenon. Besides fax machines and computers, call-screening devices have become commonplace in most homes. The first development in this area was the answering machine, and its presence in households grew dramatically during the 1990s (Nathan, 2001). In a recent Pew Research Center study (2006), almost 80 percent of U.S. households reported having either voice mail or an answering machine. Answering machines do have the advantage of potentially identifying residential numbers and allowing the interviewer to leave a message

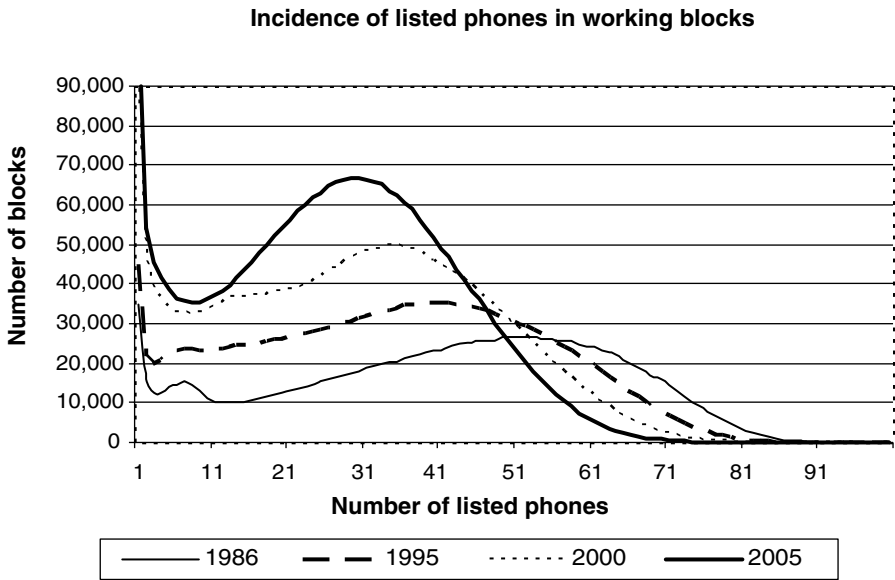


Figure 1.2. Frequency of 100-blocks by number of listed telephone numbers in the block. (*Source:* Survey Sampling, Inc.)

that distinguishes them from telemarketers, but they can also be used to screen out unwanted calls. With the advent of caller identification, or caller ID (one half of U.S. households now have it, according to the Pew Research Center (2006)), potential respondents could screen calls without waiting for a message to be left. Of course, households in countries such as Finland, which have heavy mobile-phone penetration (98 percent of adults have them (Kuusela et al., 2007, Chapter 4 in this volume)), will have voice mail and caller ID. In fact, in Italy, the prevalence of answering machines has decreased due to the switch to mobile phones (Callegaro et al., 2007), and the proportion of households with answering machines has not changed over the past 6 years in France (Nathan, 2001; Vanheuverzwyn and Dudoignon, 2006).

While answering machines could be viewed as a device to increase the ability to communicate with the outside world, it is difficult to see how caller ID would do that. Several studies (Piazza, 1993; Xu et al., 1993; Oldendick and Link, 1994; Tuckel and O'Neill, 1996; Link and Oldendick, 1999) actually found that these new technologies were not having an appreciable effect on respondent cooperation in the mid-1990s, but, of course, they were unable to ascertain the effects from those potential respondents who do not answer the telephone. Now, according to the Pew study (2006), over 40 percent of U.S. households use caller ID, voice mail, or answering machines to screen calls.

Perhaps, the invention that will prove most disruptive to traditional telephone survey methodology is the mobile telephone. Until now, most telephone survey samples have been drawn only from banks of landline numbers. However, the widespread use of mobile technology, particularly the growing number of households with only

Table 1.1. Percent Distribution of Households by Telephone Status in the United States, 2004 (Current Population Survey)

Telephone status	Percent
Mobile and landline	46.4
Landline only	42.2
Mobile only	6.0
No telephone	5.4

mobile service, makes this methodology problematic. Table 1.1 gives the estimate of mobile-phone households in the United States in 2004 based on questions asked in a special supplement of the current population survey (Tucker et al., 2007). Figure 1.3 contains these numbers for the United States as well as selected European nations (Callegaro et al., 2005). Note that, while the United States had fewer than 6 percent mobile-only households, France and Italy had over 15 percent, and more than 33 percent of Finnish households were mobile-only.¹ Those individuals living

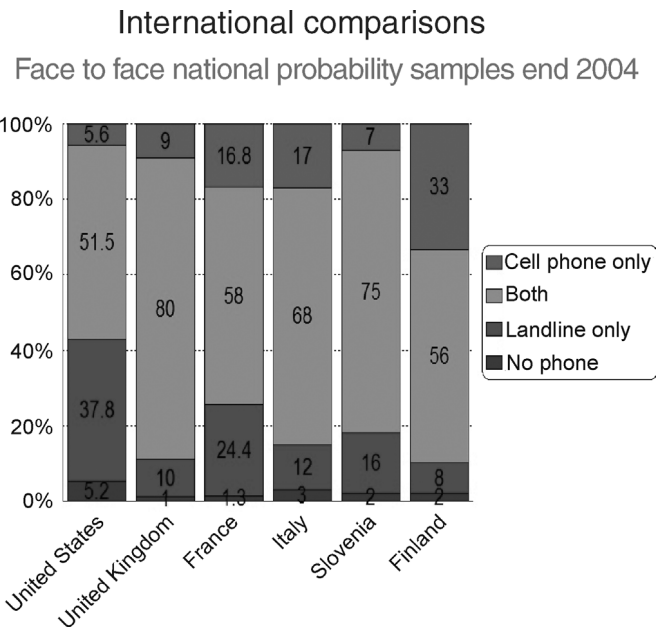


Figure 1.3. Distribution of mobile-only, landline only, mobile and landline, and phoneless households for six selected countries, 2004.

¹Projections for the United States are, by the year 2007, the portion of mobile-only households will surpass the 10 percent level, and the percentage will be much larger for certain subpopulations, such as young, single adults.

in mobile-only households are more likely to be unemployed, have inadequate health care, and engage in risky behaviors compared to those in other households (Tucker et al., 2007; Blumberg, 2005).

Another concern is that half or more of the households in these countries had both mobile and landline phones. Those with both that rely mostly on their mobile phones might also be underrepresented in telephone surveys. Tucker et al., (2007) found that those households with both types of services receiving over half of their incoming calls on a mobile phone (a third of households with both) were more likely to be urban and younger.

Other technological developments could prove problematic to the conduct of telephone surveys (Piekarski, 2005). The Pew study (2006) reported that almost 20 percent of U.S. households have some form of electronic call blocking. Another new service, number portability, may undermine the ability to geographically target telephone samples in the years to come. Not only can a potential respondent move across the country and keep the same number, but also the number can be transferred to a wireless device without the caller being aware of that fact. Number portability has the additional troublesome effect of altering the probability of selection of a household without the respondent's knowledge. Call forwarding also presents the problem of conducting interviews on mobile phones, even when a landline has been called. Finally, with the rapid growth of home computers will come the switch to voice over Internet protocol (VoIP). Steeh and Piekarski (2007, Chapter 20 in this volume) report that it is estimated that up to 75 percent of worldwide voice traffic could be handled by VoIP by 2007. VoIP could increase the uncertainty of the location of particular telephone numbers, and VoIP service, of course, will be affected by electrical outages.

The advances in technology have had an additional effect on telephone surveys. With rapid computerization, the creation of the Internet and digital technology, new modes of survey administration have become available. As of fall 2003, the U.S. Department of Commerce (2004) reported that almost 62 percent of households had a computer and about 55 percent of households had Internet access at home (20 percent had broadband). The Harris Poll Online (2006) recently reported that over 60 percent of households now have Internet access at home. The web survey is the most widely studied alternative to the telephone survey, either as a stand-alone method or as one alternative in a multimode survey that also includes telephone administration. Many web surveys, especially marketing surveys, have employed nonprobability samples (Fischbacher et al., 1999; Poynter, 2000). Some establishment surveys early on used probability-based web designs, at least in the multimode context (Nusser and Thompson, 1998; Clayton and Werking, 1998; Tedesco et al., 1999). The same was true for some household surveys (Couper, 2000b). More recently, internet households have been recruited using probability-based methods, most notably RDD (Couper, 2000b). In some cases, the survey is administered only to those with Internet access, destroying the representativeness of the sample (Flemming and Sonner, 1999). Others attempt to remain representative by providing recruited respondents not already online with Internet access (Rivers, 2000; Couper, 2000b). Two problems arise in these latter surveys. Often the recruitment rate for what are ongoing Internet panels is quite

low. In a 2003 report, Knowledge Networks (Pineau and Slotwiner, 2003) indicated that, while coverage of the U.S. population was initially 96 percent for its panels, only 37 percent of the households contacted initially agreed to participate. In addition, the recruitment process and the installation of Internet equipment can prove costly when compared to telephone surveys with response rates at the same level or higher. Amortization across the Internet panel is possible, but then there is the matter of attrition.

As summarized by Nathan (2001), other advances in electronic communication have found their way into telephone surveys. Telephone surveys can now be conducted without live interviewers (computer-assisted self-interviewing or CASI) using interactive voice recognition (IVR) and touchtone data entry (TDE). These methods, especially TDE, were tested for both establishment and household surveys at the U.S. Bureau of Labor Statistics (Werking et al., 1988; Clayton and Winter, 1992; McKay et al., 1994). Turner et al. (1998) tested the use of telephone CASI for measuring sensitive items.

1.2.3 Changes in the Sociopolitical Climate

At least in the United States, significant societal changes have accompanied the technological changes over the past two decades. Some of these changes could pose problems for those engaging in telephone survey research by increasing non-response and/or exacerbating measurement error. Table 1.2 provides information on changes that might be related to respondent cooperation. In some cases, actually little has changed. The total hours worked is about the same; although, given the change in household size, the hours per household member has gone up. This might be explained by the fact that the unemployment rate in 2004 was 0.7 percent lower than in 1987. Hours spent at home is a little less now, but hours spent in leisure is

Table 1.2. Change in Select Characteristics of Households and Persons in Households Effecting Respondent Cooperation, United States (American Time Use Survey)

Characteristic	Annual average	
	1987	2004
Total hours worked in household	126.32	125.10
Percent households with only 1 member	7.82	10.66
Percent households with Hispanic reference person	7.06	11.09
Mean household size	2.64	2.52
	1985	2003
Hours spent at home per day	6:38	6:16
Hours spent in leisure time per day	4:33	4:59
	1987	2004
Percent married, but only male working	21.3	16.9
Percent of families with only male head and in labor force	13.5	17.6
Percent of expenditures spent on eating out	37.2	39.5

higher. There is little increase in the amount of eating out, at least in terms of the percentage of food expenditure. What has changed is the characteristics of households themselves. The percentage of one-person households (with the average size of the household declining) has increased and so has the percentage of Hispanic households. The percentage of households where the woman stays at home has declined considerably, continuing a trend begun in the 1950s that accelerated in the 1970s and 1980s. Note also the growth in the number of households headed by only one worker. These changes may have led to increased time pressures within the American household and could explain the increases in noncontact rates as well as the decline in cooperation rates in telephone surveys over the past two decades. The larger percentage of Hispanic households may be just one indicator of the growing diversity among households making standardized survey procedures less effective. An important question is what is happening in other countries with respect to demographic change?

The attitudes of respondents (and of governments), especially in the areas of privacy, confidentiality, and respondent burden, have also changed over time. Singer and Presser (2007, Chapter 21 in this volume) present evidence in this volume of these attitudinal shifts based on a review of a number of studies involving mail, face-to-face, and telephone surveys. One note of caution is that studies of privacy, confidentiality, and respondent burden are plagued by the lack of information from nonrespondents, and, as we will see later, nonresponse in telephone surveys has been increasing. Singer and Presser found that the public's growing concerns about privacy and confidentiality coincided with the increased alienation and mistrust of government that began during the Vietnam War and Watergate (Westin, 1967). (For information on the explicit connection between political events and response rates, see Harris-Kojetin and Tucker (1999).) In more recent years, these concerns may have intensified with the advent of more sophisticated methods for monitoring the actions of the individual that came about as the result of computerization. The easy access to personal information, especially in the commercial sector, may have fueled the concern about privacy and confidentiality. Also, some technologies may result in more sensitivity to privacy concerns. Calling on a mobile phone may be considered more of an invasion of privacy than calling on a landline.

In general, privacy concerns in the United States have increased over the years. A good part of that increase, however, occurred prior to 1987. This is not surprising given the links to Vietnam and Watergate. Figure 1.4 shows the changes in trust of the Federal government from the National Election Studies since 1958. Note that a steady decline took place from 1964 to 1980. Although trust increased somewhat after that, it has never reached the levels recorded in the early 1960s, and, in fact, 1994 was a low point. That was the year the Republicans had the "Contract with America" and took control of the House of Representatives. There does seem to be more concern on the part of the U.S. public about privacy and confidentiality relative to the government than to business. In other countries, the findings on concerns about privacy and confidentiality vary widely by country. Some countries had increases in concern across time, and others had decreases. To the extent that privacy

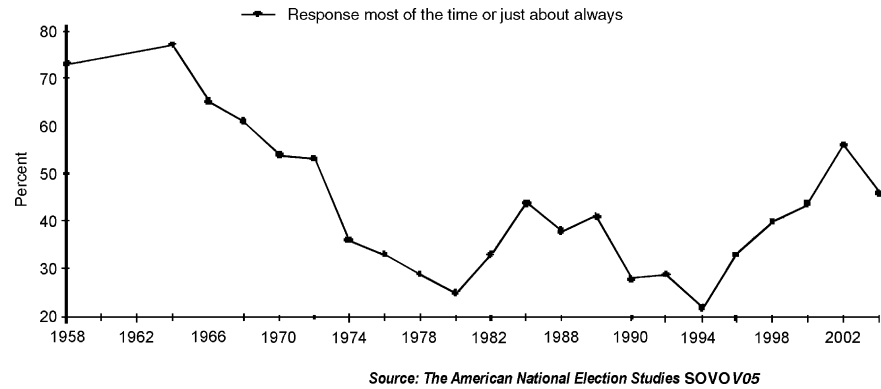


Figure 1.4. Trend in trust in U.S. federal government, American National Election Studies, 1958–2003.

concerns (and survey participation) are related to alienation and mistrust, perhaps, a more telling indicator is the decline over time in election turnout in several democracies. Figure 1.5 shows these trends, compiled largely by the International Institute for Democracy and Electoral Assistance, for selected democracies. In most of the countries, there has been a decline in turnout in general elections, with only the Netherlands and the United States countering these trends. The declines (particularly in Japan, Canada, Italy, and the United Kingdom) tend to be greater than in earlier periods.

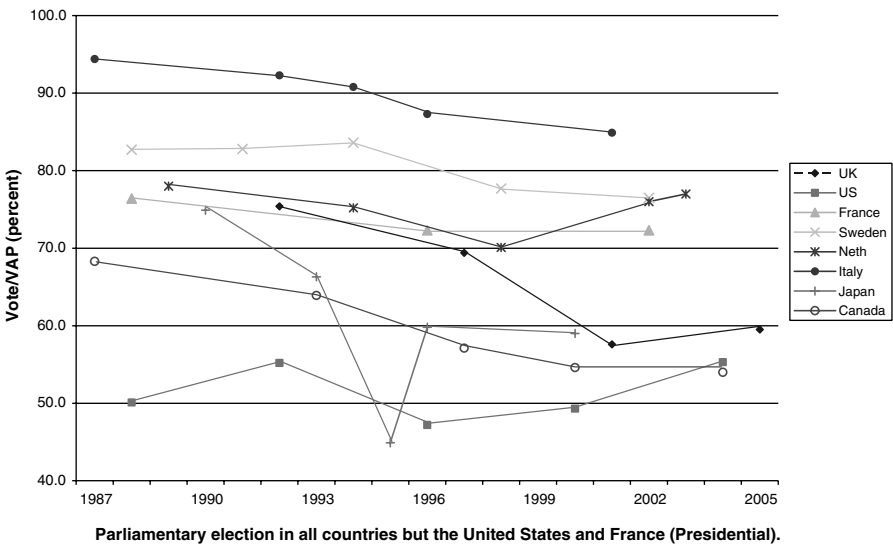


Figure 1.5. Turnout in presidential or parliamentary elections in eight selected countries, 1987–2005. Tucker, C., *Telephone Survey Methods: Adapting to Change*; © Institute for Democracy and Electoral Assistance, 2006.

Singer and Presser report that feelings about privacy and confidentiality seem to have relatively small, but detrimental effects, on a potential respondent's willingness to participate in a survey, and this effect is accentuated in the case of item nonresponse for sensitive items. But it does seem clear that the participation of those concerned about privacy and confidentiality is lower than that for those who are not. Unfortunately, assurances of confidentiality on the part of the survey organization can have either a positive or negative effect on response rates.

In terms of respondent burden, one clear finding from Singer and Presser's work is that the public either is or perceives it is receiving more survey requests today than ever before. The relationship between actual respondent burden (measured in terms of length of the interview) is less clear; perhaps, because refusals often come before the potential respondent knows the length of the survey (DeMaio, 1980). In contrast, the length of the interview could be related to the quality of the respondent's answers. Tucker et al., (1991) found this to be the case for telephone interviews collecting information about consumer expenditures. Finally, perceived burden can be much different from actual burden, and actual burden can depend on how hard a respondent is willing to work at the survey task. Tucker (1992) found that younger respondents to a consumer expenditure survey reported lower burden than older respondents, but the expenditure reports received from the older respondents were of a higher quality than those from younger respondents.

Whether or not potential survey respondents are more concerned about privacy and confidentiality today than in the past, it certainly is true that governments are. In 1991, the U.S. Congress passed the Telephone Consumer Protection Act (TCPA), and the Federal Communications Commission (FCC) issued a directive the next year restricting the use of automatic and predictive dialers (Dautch, 2005). The FCC rules apply only to telemarketers except in the case of mobile phones, where survey researchers also are prohibited from using autodialers. In 2003, the FCC established the Do Not Call (DNC) registry. Some states already had such lists. Telemarketers, but not legitimate survey researchers, were prohibited from calling the numbers placed on the list by individual consumers. The European Union (EU) passed the Directive on Data Protection in 1995 to protect the confidentiality of an individual respondent's survey data. Britain's Communications Act of 2003 provides legal recourse for those disturbed by unwanted calls, and Canada introduced similar legislation in 2004 (Singer and Presser, 2007, Chapter 21 in this volume).

Although concerns about confidentiality, privacy, and respondent burden have grown over the years (along with the decline in trust in government), there is no clearly documented correlation at the microlevel between these trends and the increases in nonresponse in telephone surveys, just as it is difficult to establish a one-to-one connection between demographic changes and changes in survey participation. In contrast, the trends do coincide over the past generation, at least in the United States, and may not bode well for the future of telephone surveys.

1.2.4 Problems Resulting from Changes

One of the more important issues resulting from the growth in the universe of telephone numbers was the increasing inefficiency of RDD designs. It became more

difficult to find residential numbers using the old methods. The problem was exacerbated by the unsystematic way numbers were now being assigned. The likelihood of locating a residential number using the Mitofsky–Waksberg design declined from just over 60 percent to less than 40 percent (Steeh and Piekarski, 2007, Chapter 20 in this volume). This situation posed a problem for production telephone surveys. Either the number of 100-banks needed or the number of numbers (k) selected per bank would have to be increased. In either case, more would have to be spent to get a given effective sample size. If the k were increased, the intraclass correlation would be larger, resulting in a greater variance, and the number of calls to reach k households would rise. In addition, a number of survey organizations were finding the Mitofsky–Waksberg method cumbersome to manage, and because it was a clustered design, the variances were greater than desired.

With the changes in technology came the increase in the number of telephone lines into the household. Besides dedicated fax and computer lines, there were now mobile phone numbers and, with the growth of telecommuting, probably more lines in the home dedicated to business. Associated with these developments was the increase in the difficulty of determining the number of lines on which respondents could actually be reached by survey organizations. Furthermore, because of dedicated computer and fax lines as well as caller ID, it was not an easy task to identify the reasons for ring-no-answers (RNAs). At least, with answering machines or voice mail, the ability to locate a residence may have reduced the number of RNAs, but this would not necessarily lead to respondent cooperation.

The explosion in technology also gave rise to the consideration of multimode surveys. In particular, the combination of a telephone survey and a Web survey seemed attractive. Weeks (1992) discussed alternative modes that had been made possible through technological advances. One problem with multimode surveys, however, is that they open up the possibility of mode effects on estimates. Secondly, it was not clear if the design of CATI surveys could be easily transferred to the Web, or whether new design principles would have to be applied. Furthermore, the Web realistically could be used only as an alternative mode for those households with Internet capabilities.

The growth in the mobile-only population posed a coverage problem, but conducting a survey over mobile phones was problematic. How easy would it be to contact residential mobile phone owners? What about the problem of finding enough mobile-only households? Given the increasing current noncontact rates, should households with both landlines and mobile service also be candidates for a mobile phone survey? Could mobile phone respondents be convinced to do the survey, especially in the United States, where the mobile phone owner pays for the call? There were also ethical issues with which to contend (e.g., the appropriateness of conducting a survey while the respondent is driving). Perhaps, the most troublesome problem was a conceptual one. Does conducting a survey on mobile phones imply changing the sampled unit from the household to the individual?

The changes in society (both technological and social) over the past 20 years made it increasingly difficult to maintain response rates in telephone surveys with the passage of time. This situation created an even greater threat of nonresponse

bias in survey estimates. Battaglia et al., (2007, Chapter 24 in this volume) illustrate the decline in response rates with examples from telephone surveys ranging from the Survey of Consumer Attitudes (SCA) (Curtin et al., 2005) to the state-based Behavioral Risk Factors Surveillance System (BRFSS). Recently, Curtin et al., (2005) showed that the overall response rate in the SCA declined considerably from 1997 to 2003 at the average annual rate of 1.5 percentage points to 48.0 percent. The National Household Education Survey (2004) reported a decline in the response rate from 72.5 percent in 1999 to 62.4 percent in 2003, an annual rate of decline of 2.5 percentage points. The U.S. Centers for Disease Control and Prevention (2003) reported that the BRFSS indicated a decline in the median response rate for the 50 states from 68.4 percent in 1995 to 53.2 percent in 2003 (an average decline of 1.9 percentage points per year). The RDD component of the National Survey of America's Families (2003) reported a decline in the overall response rate from 65.1 percent in 1997 to 62.4 percent in 1999 and to 55.1 percent in 2002 among the surveys of children, and 61.8, 59.4, and 51.9 percent among the adult surveys in 1997, 1999, and 2002, respectively. Finally (Holbrook et al., 2007, Chapter 23 in this volume), in their review of surveys from 1996 through 2003 conducted by 14 private U.S. survey organizations, found a strong negative correlation between year of the survey and response rate. They also reported that contact rates declined more than refusal rates. The same was true for face-to-face U.S. government surveys (Atrostic et al., 2001). de Leeuw and de Heer (2002) found that this trend toward increasing nonresponse rates held when looking across a number of countries.

1.3 ADAPTING TO THE CHANGING ENVIRONMENT

1.3.1 Adapting to Changing Technology

In the late 1980s, survey methodologists began searching for alternatives to the Mitofsky–Waksberg methodology. One such attempt was a dual-frame design that combined estimates from a sample of listed numbers with an RDD sample (Groves and Lepkowski, 1986). At the same time that there was growing dissatisfaction with the Mitofsky–Waksberg approach, several companies were developing sophisticated methods of processing files of residential listings, including Donnelly Marketing Information Systems. Although the listed telephone number frame itself was not suitable for direct sampling of telephone numbers because a substantial share of telephone households did not appear in the frame, by sampling numbers from 100-banks that contained listed telephone numbers, efficiencies obtained in the second stage of the Mitofsky–Waksberg could nearly be achieved. Sample selection could be simple-random, or stratified-random, selection of telephone numbers from across 100-banks containing one or more listed telephone numbers. The loss in precision due to cluster sampling was eliminated, and samples generated from list-assisted methods were less cumbersome to implement than the two-stage cluster method of Mitofsky–Waksberg. The residential hit rate for these designs was usually above 50 percent.