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# Measuring Political Knowledge in Telephone and Web Surveys: A Cross-National Comparison

**Zan Strabac[1] and Toril Aalberg[1]**

**Abstract**

Fast pace of technology changes makes conduction of high-quality web surveys increasingly easy, and performance of web surveys should be continuously monitored. In this article, a comparison is made of the results of telephone and web surveys of items measuring international news knowledge. The authors compare web surveys of general populations conducted in the United States and Norway in January 2009 with their telephone replications conducted in the same month. Results show rather small differences between web and telephone surveys, particularly in Norway. The authors discuss the results and make recommendations for use of web surveys and for future methodological research.

**Keywords**

web surveys, telephone surveys, political knowledge, USA, Norway

## Introduction

In recent years, web surveys have attracted considerable interest of both academic researchers and survey research professionals. There are good reasons for this interest. Web surveys are very cost efficient and provide a wide range of new possibilities for data collection and for incorporation of complex visual information into the questionnaire. Thus, as Tourangeau (2004) puts it: "Given this marriage of low cost and high capabilities, it is hardly surprising that the growth in Web surveys has been explosive" (p. 792). However, there have also been, and still are, important challenges and problems connected to use of web surveys. In applications of web surveys for analyses of national populations, problems of representativeness occur. There are two main aspects to these problems (cf. Berrens, Bohara, Jenkins-Smith, Silva, & Weimer, 2003). The first is related to still incomplete Internet coverage of the general household population and systematic differences between that part of population that has Internet access and that which does not. (For further details, see Fricker, Galesic, Tourangeau, & Yan, 2005 and Sills & Song, 2002.) The second aspect is related

[1]Norwegian University of Science and Technology (NTNU), Trondheim, Norway

**Corresponding Author:**
Zan Strabac, Norwegian University of Science and Technology (NTNU), Trondheim N7491, Norway
Email: zan.strabac@samfunn.ntnu.no

to difficulties in drawing random samples required in the use of standard inferential statistical techniques in analyses of web samples.

Arguably, problems of representativeness related to web surveys are diminishing quickly. Internet coverage of the general population is improving rapidly and is at a very high level in developed countries. Additionally, survey agencies are developing evermore sophisticated techniques to provide samples that are as close as possible to the high-quality samples obtained by traditional surveying techniques. Thus, there is a need for continuous monitoring of performance of web surveys to estimate how large influence the problems of representativeness have on the survey results at a particular moment in time. Obviously, one needs to distinguish between different uses of web surveys, different web surveying techniques, and ways to assess the quality of surveys. It is also desirable to assess how country-specific the results are, as it is reasonable to assume that there are sizable differences between the countries due, among other things, to large differences in Internet coverage levels.

Here, the main focus is on knowledge questions in web surveys. We use data collected in January 2009 to evaluate the quality of web surveys conducted in Norway and the United States. Because the bulk of methodological research on web surveys is conducted in the United States, we find it useful to compare U.S. results with the results obtained in another economically developed country with large Internet penetration rate. For reasons explained below, we compare similar web and telephone surveys to assess the quality of web surveys. Our main research question is therefore: How well do web surveys perform as instruments for measurement of knowledge, compared with telephone surveys? We analyzed use of web and telephone surveys to produce estimates of absolute levels of knowledge in general populations, as well as use of these surveys to study determinants of knowledge in general populations.

## Comparing Web and Telephone Surveys

When a researcher considers whether to use a web survey, she or he often weighs the benefits and disadvantages of web surveys against those of alternative methods of surveying. In many practical situations, the most viable alternative to the web survey is a telephone survey. In the fairly common case of a large target population comprising individuals or households, and of survey questionnaire not containing complex visual information, web and telephone surveys are the most direct competitors. Both surveying methods have the advantage of relatively low costs and the short time required to collect the data.

Probably, the most important argument against use of web surveys concerns apprehension about the representativeness of the sample and inability to draw a probability sample.[1] In theory, telephone surveys do not suffer from these problems, but in practice, there have been concerns about representativeness of telephone survey samples. Particularly, in the last couple of decades, three different developments have contributed to concerns about the quality of telephone surveys. First, growth of "cell phone only" population raises questions regarding possible noncoverage bias of traditional "landline only" telephone samples (e.g., Blumberg & Luke, 2009; Lavrakas, Shuttles, Steeh, & Fienberg, 2007). Second, declining response rates for all kinds of surveys have contributed to concerns over nonresponse bias (e.g., de Leeuw & de Heer, 2002; Tourangeau, 2004).[2] Third, a series of technological developments in telephone communications (caller ID, answering machines, etc.) have made it more difficult to reach respondents in telephone surveys (Fricker et al., 2005).

Although conducting high-quality telephone surveys has become increasingly challenging, recent empirical evidence suggests that the "new" problems with telephone surveys are still relatively modest. Regarding the influence of growing numbers of households and individuals possessing only cell phones, a comprehensive study by Keeter, Kennedy, Clark, Tompson, and Mokrzycki (2007) shows nearly identical general population estimates for "cell only" and random digit dialing (RDD) landline samples (though authors do find some biased estimates for population of young adults). Growing substitution of landlines by cellular phones will probably make simple landline samples increasingly problematic, but solutions such as "dual frame" sampling (Kennedy, 2007) are already being implemented. Concerning of nonresponse rates, the nonresponse bias has been a matter of concern in survey research for more than half a century and has naturally been even more in focus recently due to the observed decline in response rates (cf. Singer, 2006). However, findings from several recent studies do not indicate a noteworthy increase in nonresponse bias (see summaries of findings in Curtin, Presser, & Singer, 2005, p. 97; Keeter, Kennedy, Dimock, Best, & Craighill, 2006, pp. 777–778; Merkle & Edelman, 2002, pp. 255–256). Regarding technological changes in telephone communications, different kinds of call screening devices might have contributed to an increased rate of noncontacts (Curtin et al., 2005). However, the increase in noncontact rate has slowed down recently, and refusals are now a more important reason behind the decrease in response rates than noncontacts (Singer, 2006).

If we assume that a professionally conducted telephone survey is still of acceptable quality for many purposes, a simple check of the quality of a web survey is to compare the results with those of a telephone survey, which closely resembles it. This approach has an additional advantage in that it compares the two survey methods that a researcher often has to choose between. Previously mentioned problems with the representativeness of web surveys remain a matter of serious concern, but one should also note that technological changes contribute to lessening apprehension about the representativeness of web surveys. The Internet penetration rate is increasing monotonically. Latest available data for the two countries in our study show that 87.7% of Norwegian population had Internet access in August 2007, whereas the corresponding number for the United States was 72.3% as of June 2008 (Internet World Stats, 2009).[3] By comparison, only 57% of the population in the United States had Internet access in December 2000 (Best et al., 2001). Thus, technological changes appear to contribute to the improvement of the quality of web surveys while they complicate conducting of high-quality telephone surveys.

## Surveying Political Knowledge Questions

Although factual knowledge items were included in the pioneer work of early U.S. election studies (Berelson, Lazarsfeld, & McPhee, 1954), similar studies have long avoided items that tap into public knowledge of political affairs (Delli Carpini & Keeter, 1993; Hansen, 2009). There are several reasons for this: one being that the early studies of political behavior forcefully painted a picture of a disengaged, unformed public, strongly infused with non-attitudes and with a very low level of political sophistication (Campbell, Converse, Miller, & Stokes, 1960; Converse, 1964). Another and equally important reason has been the fear of scaring respondents who might be willing to state their opinions on political issues but who dislike having their knowledge tested. To avoid humiliating respondents and/or provoking them into quitting the interview, questions on factual matters have rarely been used in surveys. When they have been used, the number of questions has been limited and the questions often formulated as attitudinal questions (cf. Sudman & Bradburn, 1982, chap. 4). In recent years, however, political knowledge is perceived to be one of the cornerstones in contemporary studies of political and electoral behavior (Delli Carpini & Keeter, 1993; Jenssen 2009; Milner 2002; Westholm, Lindquist, & Niemi, 1990; Zaller, 1992). Moreover, Delli Carpini and Keeter (1996, p. 295) also found proof that the fears of damaging effect of knowledge testing on the respondent's willingness to cooperate has been exaggerated. Therefore, more studies both in the United States and in Europe now include at least some sort of political knowledge items together with standard sociodemographic variables to understand political behavior (Hansen, 2009).

Traditionally, political knowledge is measured by a simple additive index of correct answers to closed-ended factual questions; that is, correct answers are coded as "1" and incorrect and don't knows are coded as "0." The questions are typically a combination of knowledge of political institutions' formal arrangements and their decision-making procedures, current political/policy facts and politicians' party identification. Previously, political knowledge questions tended to focus mainly on domestic politics, but recently there has been increased interest relating to public's awareness of foreign affairs and international news knowledge (see e.g., Curran, Iyengar, Lund, & Salovaara-Moring, 2009; Curran, Salovaara-Moring, Cohen, & Iyengar, 2010; Iyengar, Hahn, Bonfidelli, & Marr, 2009). There are several reasons for this. For the U.S. case, Kull, Ramsay, and Lewis (2004) found that more than a quarter of the U.S. public believed that Iraq possessed weapons of mass destruction a considerable time after the end of the Iraqi War. In the ensuing period 2004–2006, these proportions actually increased despite the way in which information became publicly available, which clearly demonstrated the falsity of these perceptions (Castells, 2009). Other studies have also suggested that Europeans are very much better informed about world events than Americans (Dimock & Popkin, 1997, p. 223). The foreign affairs and international news knowledge items have also typically included questions about current political/policy facts but from an international angle (asking about foreign politicians, organizations, or events; Curran et al., 2009, 2010; Iyengar et al., 2009).

From a validity perspective, a good knowledge index measures the actual level of political knowledge among the respondents. Thus, systematic bias in the knowledge indicator should obviously be avoided. Furthermore, the knowledge indicator must also be able to differentiate different levels of political knowledge. In other words, it is important to identify the range of political knowledge among respondents. To identify the range, the level of difficulty on the items needs to vary—some need to be difficult, others easy, and yet others in the midrange. Thus, it has been suggested to vary the level of difficulty between 30% and 70% correct answers on the items included in the index (Delli Carpini & Keeter, 1993, p. 1187).

Both open-ended and closed-ended items have been included in national election studies across the world. However, on the basis whereby people have different propensities to guess, Mondak (2001) and Nadeau and Niemi (1995) argue that closed-ended are superior to open-ended questions because these items have fewer "don't know" answers (DKs).[4] Furthermore, there might be more ambiguity in what should be considered as the correct answer in open-ended items. Finally, there is a problem concerning how partially correct answers in open-ended items are to be included or excluded.[5] Thus, closed-ended items seem to be most appropriate solution in most situations.

## Data and Method

Our analyses are based on four different surveys: two telephone surveys of general adult populations (aged 18 and over) in Norway and the United States and two web surveys of the same populations in these two countries. All four surveys were conducted by large and well-established survey organizations: the telephone surveys were conducted by Gallup, whereas the web surveys were conducted by YouGov/Polimetrix. Separate contracts were awarded for telephone surveys in the United States (via Gallup Europe) and Norway where the survey was conducted by TNS Gallup Norway. The web surveys in the United States and Norway were conducted as a part of a larger six-nation survey contract awarded to YouGov/Polimetrix.[6] There were considerable cost differences between telephone and web surveys; price per respondent was three to four times lower in the web surveys than in corresponding telephone surveys.

Samples for the two telephone surveys are nationally representative RDD—sampling-based probability samples, whereas the samples for the two web surveys are based on the "Large-Panel Assembly" approach pioneered by Harris Interactive (cf. Berrens et al., 2003, p. 5). In general terms, this approach tries to mimic a random probability sample of general population by taking a point of departure in a large "pool" (panel) of respondents who have agreed to participate in Internet surveys conducted by the survey organization. Regarding our surveys, the panel used in the United States comprised of 1.1 million opt-in respondents, whereas the YouGovZapera panel used in Norway consisted of 140,000 respondents. To ensure that the respondents in the panel are as diverse as possible, they are recruited by various means, mostly through different forms of online advertising, but also by telephone-to-web and mail-to-web recruitment.[7] From this large panel, a pseudoprobability sample is drawn using two-stage procedure, called matching by Yougov/Polimetrix. First, a true probability sample of target population is drawn from a large, high-quality source such as the American Community Survey. (In our case, the target populations are general populations of adults in the United States and Norway.) This sample is called the target sample. Thereafter, for each member of the target sample, one or more matching individuals from the pool of the pre-recruited respondents are drawn. This sample is called the matched sample. Matching is accomplished using a set of background variables, typically involving age, sex, education, race, political party preferences, and so on.[8] Technically, the matching is conducted by an algorithm minimizing a multidimensional distance function of the attributes involved in matching, selecting the closest matching individual from the panel for each individual in the target sample. In other words, the matched sample is selected such that it resembles the target sample as closely as possible on those attributes included in the matching procedure.

In both telephone and web samples, weights were provided by survey agencies to correct for imbalances in distribution ages, gender, and education. The weights were calculated with a starting point in the known distributions of these variables in the general populations of Norway and the United States. As we shall see, application of weights has some interesting effects on the results of our analyses, discussed in more detail below.

Because our surveys were relatively long (about 15 min) and contain knowledge questions, response rates in telephone surveys were fairly low. The response rate in the Norwegian telephone survey was 16% and 21% in the U.S. survey. The term "response rate" does not apply in the same manner to web surveys due to complex and nonrandom sampling procedures. YouGov/Polimetrix usually invites about twice as many respondents in the "matched sample" as being necessary to fill the quota requested by the client. Thus, the company expects minimum "response rate" of about 50%.

## *Variables*

Our primary measures of knowledge are six multiple choice format survey questions asking respondents to identify items typically mentioned in international news sections of the mass media. Four answer alternatives (of which one was correct) were offered to respondents in randomized order. The answer alternatives were simultaneously shown on screen in the web surveys while they were read to respondents in telephone surveys. To reduce the possibility of "cheating" in web surveys, a 30 s limit on answering the questions was imposed. If a question was not answered within the time limit, the next question appeared on screen and respondents were not able to browse back in the on-screen questionnaire. The English version of the six questions is presented below with correct answers in parentheses. Full questions are presented in Appendix A.

The knowledge questions are as following:

1) Who is Nicolas Sarkozy? (President of France)
2) Who is Robert Mugabe? (President of Zimbabwe)
3) Who is Hamid Karzai? (President of Afghanistan)
4) What is OPEC? (Organization of Oil-Exporting Countries)
5) What is Hang Seng? (Stock market index in Hong Kong)
6) What is Hamas? (Palestinian political party and paramilitary organization)

As can be seen, three of the six questions asked respondents to identify public persons (Sarkozy, Mugabe, and Karzai). These questions are similar to the international news knowledge items used by Iyengar et al. (2009) and Curran et al. (2009, 2010). In the web surveys, the survey samples were split into two equally large random subsamples with regard to these questions. The first subsample was presented with the names of the three presidents, while the second subsample was presented with their photos. The second subsamples were removed from our analyses because the question format diverges significantly from the question format in telephone surveys (where names were presented to the whole sample, for obvious reasons).

To further explore differences between telephone and web samples, we create an additive index of knowledge. First, we create a preliminary index with values varying from zero to six, where zero indicates that the respondent did not answer any of the questions correctly and six indicates that the respondent answered all six questions correctly. To facilitate intuitive understanding of differences in values of the knowledge index, we rescale this preliminary index so that its values range from 0 (none of the six questions answered correctly) to 100 (all of the six questions answered correctly). The rescaling is conducted simply by multiplying the preliminary version by 100/6. Thus, the values of our knowledge index show how large percentage of the total number of questions was answered correctly by the respondent.

One problem related to use of web surveys in studying knowledge is the possibility that respondents use their Internet browsers to look up answers on the Internet and thus "cheat" in answering the knowledge questions. In our case, we conducted some simple tests by asking our students and colleagues to try to find the answer on the Internet within our 30 s limit. It seems that it is possible to find the answer to at least some of the questions, if one has another window of the Internet browser open and the respondent is moderately capable of using Internet search engines. Nevertheless, trying to find the answers on the Internet within a 30 s limit for all of the questions in larger question batteries would probably be fairly stressful. To shed more light on this question, we analyzed differences in answers on text and picture versions of our three knowledge items, which concerned presidents of France, Zimbabwe, and Afghanistan. Recall that we split our samples into two random subsamples, presenting the first subsample with picture of the person, while we presented the second subsample with the name of the person. When names are presented (text version of the questionnaire), it is very easy to find the correct answers on the Internet using a search engine. However, when pictures are presented, it is very difficult to find correct answers on the Internet within 30 s. Thus, if our respondents were cheating, we expect to find a consistently higher proportion of correct answers in subsamples that were presented with the text version of the questionnaire. However, the results showed that this was not the case. In only three of the six comparisons undertaken were the differences statistically significant and in two of these it was actually the subsample that was presented with the picture that provided a higher proportion of correct answers. Therefore, our data indicate that the possibility of cheating on knowledge questions is not a problem when a 30 s time limit on answering a knowledge question is imposed. Complete results of picture–text comparisons are presented in Table B1 in Appendix B.

Turning back to web–telephone differences, in addition to simple comparisons of proportions of correct answers, we conducted regression analyses with the knowledge index used as a dependent variable. For selection of independent variables, we follow the approach of a recent article (Curran et al., 2009) that analyses knowledge items very similar to the ones we use. The following variables were used as independent variables: *Education* (values: 1—primary, to 4—second stage of tertiary); *Female* (1—female; 0—male); *Age* (measured in years); *Interest in politics* (based on a survey question: "How interested would you say you are in politics?" values: 1—"Not at all interested" to 4—"Very interested"). In addition, four measures of self-reported media exposure are included in the regression models. These are based on these survey questions: "In a typical week, how often do you:" (a) "Watch TV news?" (variable: *TV news*); (b) "Read a newspaper?" (variable:

**Table 1.** Proportions of Correct Answers in Telephone and Web Surveys and the Difference Between the Two (Unweighted Data)

| | $p_{\text{tel.}}$ (%) | $p_{\text{web}}$ (%) | $p_{\text{tel.}} - p_{\text{web}}$ | $p$ Value |
|---|---|---|---|---|
| Norway | | | | |
| Item 1 (Sarkozy) | 76.6 | 75.5 | 1.1 | .659 |
| Item 2 (Mugabe) | 63.1 | 68.5 | −5.4 | .037 |
| Item 3 (Karzai) | 36.3 | 37.4 | −1.1 | .697 |
| Item 4 (OPEC) | 83.8 | 81.9 | 1.9 | .351 |
| Item 5 (Hang Seng) | 24.4 | 33.0 | −8.6 | .000 |
| Item 6 (Hamas) | 86.2 | 84.3 | 1.9 | .322 |
| United States | | | | |
| Item 1 (Sarkozy) | 41.3 | 50.1 | −8.8 | .001 |
| Item 2 (Mugabe) | 28.1 | 36.7 | −8.6 | .001 |
| Item 3 (Karzai) | 38.3 | 38.3 | 0.0 | 1.000 |
| Item 4 (OPEC) | 87.6 | 86.4 | 1.2 | .515 |
| Item 5 (Hang Seng) | 33.6 | 26.6 | 7.0 | .006 |
| Item 6 (Hamas) | 62.7 | 66.3 | −3.6 | .174 |

*Note.* $p$ values based on Fisher's exact test (H0: $p_{\text{tel.}} = p_{\text{web}}$). Norway: $N_{\text{tel.}} = 1{,}000$; $N_{\text{web}} = 530$. United States: $N_{\text{tel.}} = 1{,}000$; $N_{\text{web}} = 507$.

*Newspapers*); (c) "Listen to radio news?" (variable: *Radio news*); and (d) "Read news at Internet web sites?" (variable: *Internet news*). Values for all four variables are varying from 1—"Seldom or never" to 5—"Every day".

## Results

We start by analyzing differences between telephone and web samples regarding proportions of respondents that provided correct answers on our six knowledge questions. The results for unweighted telephone and web samples in our two countries are presented in Table 1.

Looking at two Norwegian samples first, we see that the differences between web and telephone samples do not seem to be large. In three of the six questions, the respondents from the telephone sample were slightly more knowledgeable, whereas the web sample respondents were somewhat more knowledgeable in the remaining three questions. However, only two of the differences are statistically significant at the conventional .05 level. In these two, web respondents exhibited more knowledge. Substantively, differences are fairly small, with four of the six being smaller than 2% and with the highest value being still relatively modest 8.6%. Thus, the general impression is that the differences between the samples are small.

Looking at American samples, one can see that differences between web and telephone samples seem to be somewhat larger than in Norwegian case, but there is still no clear pattern in the data. Only three of the six differences are statistically significant at the .05 level. In two of these, the web respondents were more knowledgeable, whereas the telephone respondents were more knowledgeable in the remaining one.[9] Arguably, U.S. differences may also be considered relatively modest, with no difference being larger that 10%.

As we have seen, no clear pattern in web–telephone differences emerged in the unweighted Norwegian and U.S. samples, and the differences were generally small. However, if we look at the corresponding numbers from weighted samples presented in Table 2, a different picture arises. Beginning with the Norwegian sample as before, there are still only two of the six differences that are statistically significant and the differences are generally fairly small. However, there is now a

**Table 2.** Proportions of Correct Answers in Telephone and Web Surveys and the Difference Between the Two (Weighted Data)

| | $p_{tel.}$ (%) | $p_{web}$ (%) | $p_{tel.} - p_{web}$ | $p$ Value |
|---|---|---|---|---|
| Norway | | | | |
| Item 1 (Sarkozy) | 71.0 | 73.3 | −2.3 | .336 |
| Item 2 (Mugabe) | 57.2 | 64.0 | −6.8 | .010 |
| Item 3 (Karzai) | 31.0 | 32.0 | −1.0 | .683 |
| Item 4 (OPEC) | 77.3 | 80.2 | −2.9 | .189 |
| Item 5 (Hang Seng) | 22.4 | 29.7 | −7.3 | .002 |
| Item 6 (Hamas) | 81.7 | 83.1 | −1.4 | .480 |
| United States | | | | |
| Item 1 (Sarkozy) | 32.4 | 48.4 | −16.0 | .000 |
| Item 2 (Mugabe) | 24.8 | 35.4 | −10.6 | .000 |
| Item 3 (Karzai) | 30.3 | 37.0 | −6.7 | .009 |
| Item 4 (OPEC) | 80.7 | 85.2 | −4.5 | .032 |
| Item 5 (Hang Seng) | 29.7 | 25.4 | 4.3 | .080 |
| Item 6 (Hamas) | 54.1 | 64.7 | −10.6 | .000 |

*Note.* $p$ values based on Fisher's exact test (H0: $p_{tel.} = p_{web}$). Norway: $N_{tel.} = 1{,}000$; $N_{web} = 530$. United States: $N_{tel.} = 1{,}000$; $N_{web} = 507$. Real sample sizes in both Norway and United States.

clear pattern regarding the sign of the differences—all of the differences are negative, meaning that larger proportion of the web respondents provided correct answers on all six questions. Looking at the American samples in Table 2, as in the Norwegian case, there is a clear pattern in the data: web respondents seem to be more knowledgeable. Signs of the five of the telephone–web differences are negative and are statistically significant at the .05 level (although only three differences are significant at the .05 level, if we apply the Bonferroni correction for the multiple comparison). For only one question (Hang Seng) did a larger proportion of the telephone respondents provide the correct answer, but this difference is not statistically significant. In the American samples, web–telephone differences are clearly larger than prior to weighting, although they do not seem to be extremely large. We will comment more on these findings in the concluding section of the article.

Let us now turn our attention to the composite measures of knowledge. In the Data and Method section, we described our additive knowledge index. Recall that its values range from 0 to 100, which show the percentage of questions answered correctly by the respondent. Average values of the index in our four surveys and the appropriate differences between the averages are presented in Table 3. We present the results for both weighted and unweighted samples in the same table.

As one can see, the differences between unweighted telephone and web samples in our two countries are very small. Looking at the values of the knowledge index, we see that the web–telephone differences in both countries are only about two percentage points and are not statistically significant. The conclusion is therefore that there are no differences in knowledge between unweighted telephone and web samples, neither in Norway nor in the United States. Looking at weighted samples, things are a bit different. In Norway, the mean value of the knowledge index for the telephone respondents is about four percentage points lower than the corresponding scores for web respondents and the difference is statistically significant at .05 level (although not at .01 level). In the United States, the corresponding difference is about seven percentage points in favor of web respondents and this result is highly statistically significant. Thus, in weighted samples in both countries, web respondents tend to be somewhat more knowledgeable. Regarding the size of these differences, the authors are inclined to view differences that are less than five percentage points as small, while one might view differences larger than five, but smaller than ten percentage points, as modest. Applying

**Table 3.** Mean Values of the Knowledge Index and the Difference Between Them

| | Telephone | Web | Telephone−Web | *p* Value |
|---|---|---|---|---|
| Norway, unweighted data | | | | |
| Knowledge index (0–100) | 61.73 | 63.43 | −1.70 | .200 |
| United States, unweighted data | | | | |
| Knowledge index (0–100) | 48.60 | 50.72 | −2.12 | .218 |
| Norway, weighted data | | | | |
| Knowledge index (0–100) | 56.75 | 60.39 | −3.64 | .015 |
| United States, weighted data | | | | |
| Knowledge index (0–100) | 41.99 | 49.35 | −7.36 | .000 |

**Table 4.** Mean Values of Variables Measuring Gender, Age, and Education (Values for Unweighted and Weighted Samples in all Four Surveys)

| | Norway | | | | United States | | | |
|---|---|---|---|---|---|---|---|---|
| | Telephone | | Web | | Telephone | | Web | |
| | Unweighted | Weighted | Unweighted | Weighted | Unweighted | Weighted | Unweighted | Weighted |
| Female | 0.51 | 0.50 | 0.49 | 0.50 | 0.47 | 0.49 | 0.50 | 0.50 |
| Age | 50.18 | 46.05 | 41.44 | 44.47 | 55.97 | 48.24 | 47.06 | 46.61 |
| Education | 2.63 | 2.22 | 2.56 | 2.23 | 2.60 | 2.29 | 2.31 | 2.26 |

this rule of thumb, we observe small knowledge differences in Norway and modest in the United States. In both countries, web respondents seem to be more knowledgeable.

We have seen that weighting of the samples influences the results considerably. Percentages of respondents answering correctly are generally lower in weighted samples in all four surveys. This means that knowledge estimates in all unweighted samples are somewhat upward biased. Notice further that differences between weighted and unweighted results are larger for telephone surveys than for web surveys, particularly in the United States. In telephone surveys, the decrease in mean value of knowledge index after weighting is around five percentage points in Norway and about seven percentage points in the United States. The corresponding post-weighting decrease in web samples is approximately three percentage points in Norway and about one percentage point in the United States.[10]

Now, let us have a closer look at reasons for differences in results between weighted and unweighted samples. Recall that weights in all four survey samples are corrected for bias in distributions of gender, age, and education. Mean values of variables measuring these three sociodemographic traits are presented in Table 4.

Looking at the mean values of *Female*, we see that the application of weights does not generally have a noteworthy strong effect. Because mean values of *Female* dummy variable represent proportion of females in the sample, we see that there are about 50% females in all our samples. If we look at means of *Age* and *Education*, we see that changes after weighting are somewhat larger. Regarding age, in the Norwegian telephone sample, mean age is decreased after weighting, whereas it is increased after weighting of Norwegian web sample. This indicates that there is an overrepresentation of older respondents in the unweighted telephone sample. However, younger respondents tend to be overrepresented in the unweighted web sample. In the U.S. data, post-weighting decrease in mean age in telephone sample indicates overrepresentation of older respondents in the unweighted sample. The unweighted U.S. web sample seems to be unbiased with regard to age as weighting does not alter the mean value to any noteworthy extent.

**Table 5.** Parameter Estimates From Regression Analyses of News Knowledge in Norway (0–100 Knowledge Index; Telephone and Web Samples, Weighted)

| | Telephone | | | Web | | |
|---|---|---|---|---|---|---|
| | *b* | SE | Beta | *b* | SE | Beta |
| (Intercept) | −1.82 | 4.39 | | 12.27 | 6.28 | |
| Education | 4.73*** | 0.93 | .141 | 6.81*** | 1.37 | .191 |
| Female | −10.67*** | 1.51 | −.196 | −14.02*** | 2.02 | −.272 |
| Age | 0.22*** | 0.05 | .138 | 0.21** | 0.08 | .117 |
| Interest in politics | 13.83*** | 1.08 | .377 | 12.21*** | 1.47 | .351 |
| Media exposure measures | | | | | | |
| TV news | 0.56 | 0.71 | .024 | 0.51 | 0.92 | .026 |
| Newspapers | 0.06 | 0.59 | .003 | −0.31 | 0.78 | −.018 |
| Radio news | 0.34 | 0.46 | .020 | −0.77 | 0.70 | −.048 |
| Internet news | 1.34** | 0.49 | .083 | 0.67 | 0.91 | .028 |
| Adjusted $R^2$ | .31 | | | .33 | | |

*Note.* $N_{tel.} = 1{,}000$; $N_{web} = 530$. *b*—unstandardized regression coefficients; Beta—standardized regression coefficients.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

With regard to education, from Norwegian samples, we can see that the highly educated tend to be overrepresented in both telephone and web surveys because mean values of weighted samples are lower. The positive bias in the distribution of education seems to be only slightly stronger in the telephone sample. In U.S. samples, the same picture emerges: both telephone and web samples seem to be positively biased with regard to education. However, in American case, the educational bias seems to be much stronger in telephone sample.

So, to summarize, sociodemographic biases in our samples are primarily to be found in distribution of age and education. To answer the question why weighting leads to larger knowledge differences between web and telephone samples (particularly in American data), we have to look at the associations between knowledge and these two traits. Recall that the increase in web–telephone knowledge differences observed after weights are applied is mainly a result of stronger decrease in post-weighting values of knowledge index in telephone samples than in web samples. Because both age and education are positively associated with knowledge, and they both decrease more strongly in post-weighted telephone samples, both these measures could be causes of increased knowledge differences.[11] However, as we shall see in regression models presented later in this article, education tend to have considerably stronger effects on knowledge than age does and stronger overrepresentation of highly educated in telephone samples seem therefore to be the main reason for increased knowledge differences after application of weights.[12]

This upward bias in distribution of education has, of course, been a common finding in surveys for decades (e.g., Lowe & McCormick, 1955). In our surveys, additional characteristic is that educational bias is stronger in telephone surveys than in web surveys. More biased educational distributions in telephone samples are most probably caused by differences in sampling procedures between telephone and web surveys. In both telephone and web surveys, the starting points are samples that are not biased with regard to education. In telephone samples, this is so because probability sampling procedures are used, while in web samples this is so because education is one of individual traits used in "matching" of the web sample. Because respondents with lower education are less likely to complete the survey, telephone and web samples of respondents who actually completed the survey contain upward educational bias. However, telephone surveying companies meet larger problem

**Table 6.** Parameter Estimates From Regression Analyses of News Knowledge in the United States (0–100 Knowledge Index; Telephone and Web Samples, Weighted)

| | Telephone | | | Web | | |
|---|---|---|---|---|---|---|
| | *b* | SE | Beta | *b* | SE | Beta |
| (Intercept) | −13.97*** | 3.91 | | −20.13** | 6.20 | |
| Education | 7.02*** | 1.00 | .208 | 10.03*** | 1.63 | .229 |
| Female | −8.45*** | 1.52 | −.151 | −12.27*** | 2.32 | −.202 |
| Age | 0.15** | 0.05 | .097 | 0.13 | 0.08 | .064 |
| Interest in politics | 9.03*** | 0.86 | .313 | 14.29*** | 1.54 | .404 |
| Media exposure measures | | | | | | |
| TV news | 0.16 | 0.61 | .008 | −0.07 | 0.80 | −.004 |
| Newspapers | 0.73 | 0.49 | .043 | −0.42 | 0.73 | −.022 |
| Radio news | 0.68 | 0.46 | .040 | 0.12 | 0.70 | .007 |
| Internet news | 2.94*** | 0.48 | .180 | 1.44 | 0.86 | .070 |
| Adjusted $R^2$ | .31 | | | .41 | | |

*Note.* $N_{tel.}$ = 1,000; $N_{web}$ = 507. *b*—unstandardized regression coefficients; Beta—standardized regression coefficients.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

in this regard: they need to convince lowly educated respondents from general population to participate, while web survey companies contact lowly educated respondents from their "pool" of individuals that already agreed to participate in surveys. Thus, it is reasonable to expect less skewed samples in web surveys.

One of the most important uses of survey data is to examine relationships among variables, with multivariate regression models being, perhaps, the most common form of analyzing the data. We therefore analyze differences in results of identical regression models based on telephone and on web survey data. We take a point of departure in a fairly common way of analyzing knowledge items, with a composite measure of knowledge (knowledge index) used as a dependent variable in the regression model. We present only analyses of weighted samples as these are most commonly used in practice. Because we analyze politically relevant news knowledge ("hard news" knowledge), appropriate independent variables include education, news exposure, and political interest, as these can be expected to influence knowledge. In addition, we include common sociodemographic controls, age and gender. The results of regression analyses of our knowledge index based on Norwegian telephone and web survey data are presented in Table 5.[13]

Comparing the models based on telephone and web survey results, we see that they are fairly similar. In both models, education, interest in politics, and age have a positive effect on knowledge, while women seem to be less knowledgeable. The explained variance in the models is also similar, with values of the adjusted coefficient of determination equalling .31 in the telephone data model and .33 in the web data model. With regard to measures of media exposure, three of the four measures do not have any significant effect on knowledge, while exposure to Internet news has a significant effect in the telephone data model but not in the web data model. The difference in effects of Internet news exposure is the only notable difference between web and telephone data models. Apart from being nonsignificant in the web data model, the strength of the effect is only about half of that in telephone data model. We will comment on this difference more thoroughly, but let us first look at the web–telephone differences in U.S. data. These are presented in Table 6.

Again, there are similarities between the models: Education, gender, and interest in politics have effects on knowledge that are highly statistically significant and have the same sign in both models.

Notice, however, that the strength of these effects is generally larger in our web data model. This is reflected in the amount of explained variance in the models. Although 31% of the variance in knowledge is explained by the predictor variables in telephone data model, the corresponding number is higher in our web data model, equalling 41%. Regarding the effect of age, this is significant in the telephone model but not in the web model. However, looking at the regression coefficients and their standard errors, we see that age effects are of similar strength, although the standard error in the web survey model is much higher. This is hardly surprising when we recall that the sample size in our web survey is about the half the sample size in the telephone survey and that the standard errors of its coefficients are therefore about 30% lower, ceteris paribus. Thus, the conclusion is that the difference in statistical significance of age effects is most probably the result of different sample sizes.

Looking at the news exposure items, we see that the results are similar to those of our Norwegian surveys. None of the items has any statistically significant effect in the web data model, whereas Internet news exposure has a positive effect on knowledge in the telephone data model. The effect of Internet news exposure is more than twice as strong in the telephone data model as compared with our web data model. Because this difference in the effect of Internet news exposure is the largest one in both the U.S. and Norwegian models, we explore news exposure in our telephone and web surveys in more details. It turns out that the web–telephone differences in media exposure are generally small with one exception: web sample respondents in both Norway and the United States are much more exposed to Internet news (mean values of all relevant items are presented in Table B2 in Appendix B). Because web respondents are often recruited through Internet advertising, it is hardly surprising that they tend to read a lot of news on the Internet. Therefore, an important difference between the telephone and web samples seems to be that web sample respondents are much heavier consumers of Internet news (and probably also heavier users of the Internet in general).

## Summary and Discussion

In this article, we have analyzed differences between telephone and web surveys with regard to knowledge estimates. The general impression is that these differences are rather small. Regarding absolute levels of knowledge, measured by single items and by indices, we find a mild but rather consistent upward bias in web surveys. In other words, web survey respondents are somewhat more knowledgeable, and web surveys are therefore most probably producing slightly upward biased estimates of levels of knowledge in general populations.[14] It is important to notice that weighting to correct for the ubiquitous overrepresentation of highly educated respondents in telephone samples is necessary for good web–telephone comparisons. Otherwise, stronger upward educational bias and associated higher levels of knowledge in telephone surveys might cover up web–telephone differences in knowledge estimates.

With regard to analyses of the relationship between variables in our regression models, there is hardly any difference between telephone and web surveys. If we take a point of departure in a hypothetical academic study of determinants of knowledge based on our regression models, with just one exception, a study would result in basically the same conclusions regarding the effects of the independent variables. The only exception is an effect of Internet news consumption, which are significant in telephone samples but not in web samples. The conclusion here might be that use of web surveys to analyze relationships between variables in the general population seem to be unproblematic but that the researcher should be careful if she or he wants to analyze variables that are related to Internet use because respondents in web samples seem to be much heavier Internet users.[15]

Comparing Norwegian and U.S. results, we have seen that web–telephone differences are generally larger in the United States than in Norway. Rather obviously, there are several possible explanations for these country-level differences such as demographic, social, and cultural differences between Norway and the United States. However, we are inclined to believe that better Internet coverage in Norway is an important part of the explanation of seemingly better web survey estimates in Norway. The Internet coverage rate in Norway was quite probably over 90% at the time of our survey, while coverage in the United States was somewhat lower (recall that Internet penetration rates were 72.3% in the United States in June 2008 and about 87.7% in Norway in August 2007). One should also notice that the ranking of countries in terms of political sophistication remains the same, regardless of which survey procedure is used. Norwegians exhibit higher levels of political knowledge than Americans in both telephone and web surveys and estimated differences in knowledge levels between the countries are very similar, disregarding the type of the survey (see Table 3). Web and telephone surveys seem, therefore, to produce similar results in comparative studies, although one should bear in mind that we base this conclusion on the comparison of only two countries.

To summarize, as of early 2009, web surveys do not seem to be much worse instruments for measuring knowledge than telephone surveys, at least in the two countries with high Internet penetration rate and well-established survey research agencies. A researcher choosing between telephone and web surveys should consider the type of research questions, desired precision levels, and cost constraints. If one is mainly interested in the relationship between variables, and does not use variables directly related to Internet use, a web survey seems to be a viable alternative for political knowledge type questions. If the researcher's main interest is in absolute levels of knowledge, choosing an optimal type of survey is more complicated. Web surveys seem to produce slightly upward biased estimates, but one can get larger web samples for the same amount of the money and thus more precise estimates. The decision thus has to be made according to researchers' willingness to accept systematic measurement error (more pronounced in web surveys) and random measurement error (more pronounced in telephone surveys, given same price as web surveys). Regarding future research, it would be of interest to analyze results from more than two countries to see whether our assumption of higher Internet penetration rate leading to much smaller web–telephone differences is correct. If this is so, we might expect a rapid increase in the quality of web surveys due to a quick increase in Internet coverage of general populations cross-nationally.

## Notes

1. Although the representativeness problems are probably the most important ones, it also has to be borne in mind that web surveying is a relatively novel surveying technique and that there is an ongoing research into practical details of conducting the surveys (cf. Healey, 2007).
2. A 2006 special issue of *Public Opinion Quarterly* (vol. 70, no.5) was devoted to nonresponse bias in household surveys.
3. Sources: International Telecommunication Union for Norwegian data and Nielsen/NetRatings for the U.S. data. By March 2008, the Internet Penetration Rate was already above 90% in the Netherlands and was also probably above 90% in Norway at the time when we conducted our surveys in January 2009.
4. Results of Holland and Christian (2009) indicate that the new opportunities provided by web surveys might be used to improve the quality of open-ended questions but that the nonresponse remains a serious problem.
5. An additional problem is related to an ambiguity regarding what is to be counted as a "don't know" answer for an open-ended question. Mondak (2001, p. 229) provides an example where respondents are asked to identify positions held by William Rehnquist (the Chief Justice of the Supreme Court). In the authors' example, a response: "King of Canada," that is obviously not a serious attempt to answer the question is coded as "Incorrect answer," not as "Don't know," This implies that the author is coding answers to open-ended questions as DK only if "Don't know" is explicitly mentioned or if no answer is provided.
6. In addition to Norway and the United States, web surveys were conducted in Sweden, the Netherlands, Belgium (Flanders), and the United Kingdom. The web survey in the United States was conducted by

Polimetrix, whereas the survey in Norway was conducted by Zapera (a member of YouGov Group covering Northern Europe and Baltic states).

7. Respondents who joined the panel as a response to advertising have self-selected themselves and that might be a source of systematic differences between web and telephone samples.
8. In an analysis of data from two countries like the one we conduct, there are obviously differences between the countries with regard to relevant background variables. One such variable—respondent's race—might be of relevance in the United States, but it is not relevant in Norway. We have not focused on race in our analyses, but simple checks of relevant racial information available in our U.S. web survey data indicate that race in itself is not of great importance with regard to knowledge questions.
9. One should also notice that we are discussing the levels of statistical significance in six comparisons and the multiple comparison problem is therefore present. However, if we use the (overly conservative) Bonferroni correction as a strict test of statistical significance, the difference should be considered statistically significant if its $p$ value is lower than .0084. This would not change the results in Table 2, while only one difference would be considered statistically significant in Table 1.
10. All percentages are calculated from Table 3. For example, the weighted − unweighted difference in American web sample is $50.72 - 49.35 = 1.37$; that is, about one percentage point.
11. In the web survey in Norway, mean value of *Age* actually increases after weighting, indicating that younger respondents are overrepresented in the unweighted sample. This is probably caused by more widespread use of the Internet among younger strata of the population and therefore resulting in a larger probability that younger individuals would participate in a web survey.
12. See values of standardised coefficients in Tables 5 and 6. As one can see, effects of education are considerably stronger than the effects of age, with a single exception of the Norwegian telephone survey.
13. Methodological note: We are using a discrete variable (knowledge index with seven possible values) as a dependent variable in ordinary least squares (OLS) regression. Strictly speaking, OLS regression analysis presupposes a continuous dependent variable. Nevertheless, the use of OLS regression can be justified, if the dependent variable is assumed to represent an underlying continuous variable, has at least five possible values, its sample distribution is not too skewed, and the sample size is large (DeMaris, 2004, p. 307). Because all of these conditions are fulfilled in our case, we proceed with the use of OLS regression.
14. The observed web–telephone knowledge differences might also be partly a result of differences in presentation mode. Even with the 30 s time limit, web survey respondents are probably advantaged since they can see all of the response alternatives on the screen while telephone survey respondents have to remember the response alternatives and then select the one they believe to be correct.
15. In other words, regression models based on web and on telephone data seem to have same general structure. Nevertheless, one should keep in mind that web surveys seem to consistently overestimate levels of knowledge in the population.

# Appendix A

## *Excerpt from English version of survey questionnaire (identical questions for both telephone and web surveys)*

"Now, a few questions about events and persons that have been mentioned in news recently."

Rotate answer alternatives for all questions

B1: Who is Nicolas Sarkozy?
<1> President of France
<2> Prime Minister of Canada

<3> President of the European Commission
<4> Secretary-General of the United Nations
<99> Can't say

B2: Who is Robert Mugabe?
<1> President of Zimbabwe
<2> Rebel leader in Congo
<3> President of South Africa
<4> Nigerian presidential candidate
<99> Can't say

B3: Who is Hamid Karzai?
<1> President of Afghanistan
<2> Iraqi Prime Minister
<3> Libyan Revolutionary Leader
<4> Suspected Al-Qaeda leader
<99> Can't say

B4: What is OPEC?
<1> Organization of oil-exporting countries
<2> Energy cooperation treaty between Japan and China
<3> Economic organization of countries in Asia
<4> Treaty on climate change prevention
<99> Can't say

B5: What is Hang Seng?
<1> Stock market index in Hong Kong
<2> Korean shipping company
<3> Large investment bank in China
<4> Business district in Tokyo
<99> Can't say

B6: What is Hamas?
<1> Palestinian political party and paramilitary organization
<2> Lebanese political and paramilitary organization
<3> Province in Iraq
<4> Secret intelligence service of Israel
<99> Can't say

# Appendix B

**Table B1.** Proportions of Correct Answers in Text and Picture Question Formats (Percentage, Web Surveys, Weighted Data)

| | Picture | Text | Picture–Text Difference | *p* Value |
|---|---|---|---|---|
| Norway | | | | |
| Item 1 (Sarkozy) | 74.0 | 73.3 | 0.7 | .886 |
| Item 2 (Mugabe) | 63.4 | 64.0 | −0.6 | .843 |
| Item 3 (Karzai) | 48.7 | 32.0 | 16.7 | .000 |
| United States | | | | |
| Item 1 (Sarkozy) | 48.4 | 48.4 | 0.0 | 1.000 |
| Item 2 (Mugabe) | 24.9 | 35.4 | −10.5 | .000 |

*(continued)*

**Table B1 (continued)**

| | Picture | Text | Picture–Text Difference | *p* Value |
|---|---|---|---|---|
| Item 3 (Karzai) | 43.0 | 37.0 | 6.0 | .061 |

*Note. p* values based on Fisher's exact test (H0: $p_{pic.} = p_{text}$). Norway: $N_{pic.} = 470$; $N_{text} = 530$. United States: $N_{pic.} = 493$; $N_{text} = 507$ (real sample sizes in both Norway and United States).

**Table B2.** Mean Values of Media Exposure Measures (Weighted Data)

| | Norway | | United States | |
|---|---|---|---|---|
| | Telephone | Web | Telephone | Web |
| TV news | 4.29 | 4.10 | 3.88 | 3.85 |
| Newspapers | 4.02 | 3.67 | 2.75 | 2.66 |
| Radio news | 3.61 | 3.39 | 2.98 | 3.12 |
| Internet news | 3.13 | 4.30 | 2.67 | 3.81 |

*Note*. Range all variables: 1–5. Higher values mean more consumption.

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## Bios

**Zan Strabac** is Postdoctoral research fellow at Department of Sociology and Political Science at Norwegian University of Science and Technology. His main areas of research are quantitative methods, sociology of migration and ethnic relations, peace studies and media studies. He is currently working on a postdoctoral project on the media's influence on public perception of political reality. [email: zan.strabac@svt.ntnu.no]

**Toril Aalberg** is an Associate Professor of Media Sociology at the Norwegian University of Science and Technology (NTNU). She graduated as a Dr. Polit. in Political Science (2001) with emphasis on comparative public opinion studies. Her previous work includes comparative studies of public opinion on income inequalities and distributive justice as well as studies on political communication. Fields of interests are the relationship between media and politics, election campaigns, how media affects public opinion and the role of stereotypes. Aalberg has published extensively in both Norwegian and International books and journals. [email: toril.aalberg@svt.ntnu.no]