

The impact of mobile phones on survey measurement error

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No. 2011-07
February 2011



INSTITUTE FOR SOCIAL
& ECONOMIC RESEARCH

Non-Technical Summary

Survey interviews are increasingly carried out on mobile phones. There are a number of reasons to think that the experience of being interviewed on a mobile phone may differ from that of being interviewed on a fixed line phone. We are interested in whether those differences in the experience make a difference to the data that are collected

In this paper, we present a theory of the ways in which mobile phone interviews and fixed phone interviews may differ and how these differences may affect survey measurement. We identify four key features that may vary between mobile and fixed phone interviews. These are line quality, the extent of multi-tasking amongst survey respondents, the extent to which survey respondents are distracted from the task of answering questions, and the extent to which other people are present and able to overhear what the survey respondent is saying.

We then evaluate the extent to which differences in these features affect survey measures by analysing data from a randomised experiment. In the experiment, a sample of people who had both mobile and fixed phones were randomly assigned to be interviewed either on their mobile phone or on their fixed phone.

Overall, we find only few and small differences in survey measures between the mobile phone interviews and the fixed phone interviews. The few differences that we find suggest that data quality may be higher with mobile phone interviews. This may be because survey respondents have greater control over whether other people are within earshot and whether others can listen in from another line. When other people can hear the responses being given – which may be more likely when responding on a fixed line – respondents may have a tendency to censor their responses to avoid socially undesirable answers.

The Impact of Mobile Phones on Survey Measurement Error

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Abstract: Mobile phone survey interviewing is becoming increasingly prevalent, so it is important to understand how it affects measurement error. We link cognitive response process theory (Tourangeau et al 2000) to theories of mode effects to build a comprehensive framework that identifies ways in which the different context of mobile interviews and differences inherent in the technology can influence survey responses. We evaluate elements of the framework using data from a randomised experiment in which respondents were assigned to be interviewed either by mobile or fixed phone and in which relevant measures of interview context were gathered. Our findings address causes of survey error resulting from mode of data collection, both in general and in the specific context of mobile phones. We also outline needed future research.

Keywords: interview context, satisficing, social desirability bias

JEL Codes: C81, C83

Acknowledgments: Design and data collection was supported by the European Social Survey - Gallup Europe programme of research into mixed mode data collection, funded by the European Union and Gallup Europe. The work of the authors was supported by the UK Longitudinal Studies Centre (ULSC) at the University of Essex, funded by the UK Economic and Social Research Council. We are grateful to Caroline Roberts for her considerable input into the design of the field study, to Annette Jäckle for inspiring the development of the theoretical framework presented in this article, and to Robert Manchin, Agnes Illyes and Gergely Hideg at Gallup Europe for overseeing data collection and data management.

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1. Introduction

The advent and rapid spread of mobile phones (cell phones) since the mid-1990s has introduced new challenges and opportunities for survey researchers. Increasingly, the mobile phone has become the communication medium of choice for many people in many situations. Consequently, more and more survey interviews are conducted via mobile phones (AAPOR Cell Phone Task Force, 2010). Surveys which sample from administrative lists that include phone numbers now find that many of those numbers are mobile numbers. Panel or follow-up surveys that collect phone numbers from initial respondents for the purposes of conducting future interviews by phone find that many respondents offer a mobile number, often preferring to offer this rather than a fixed-line number. And RDD and other telephone surveys are often now including mobile numbers in their sample, typically via a dual-frame approach (Brick et al, 2006) in order to increase population coverage. Throughout this article we use the term 'mobile phone interviews' to refer to situations in which a survey respondent is responding via his or her mobile phone to an interviewer-administered survey.

This article is about measurement error in mobile phone interviews. The rapid growth in mobile phone interviews makes it important that survey researchers understand the measurement issues associated with such interviews. There is reason to be concerned that measurement differences between mobile phones and fixed phones could exist, as factors that can affect measurement in other contexts, such as multi-tasking (Lavrakas et al., 2010) and distraction (Kellogg 2007, p.75, Schwarz et al., 1991, Hyman et al., 2009), certainly have potential to differ between mobile and fixed phone interviews. AAPOR Cell Phone Task Force (2010) state that "under certain circumstances, including when asking certain types of questions, concerns about cell phone data quality are not unfounded" and that "much more research is needed on cell phone survey data quality" (p.59). Moreover, the survey methods literature provides ample evidence of the presence of mode effects in other contexts, including between telephone interviews and other modes (see Bowling 2005, de Leeuw 2005). Mode effects research in other contexts has led to practical lessons for survey researchers on how to improve survey data quality and comparability (Dillman et al 2009, p.310-330). It is our hope that study of differences between mobile and fixed phone interviews may similarly lead to improved survey methods as a result of better understanding of differences in response processes.

This article makes a number of unique contributions. First, we develop a theoretical framework of differences between mobile and fixed phone interviews in factors that have potential to affect measurement. The framework identifies the mechanisms by which these factors exert influence and identifies potential relationships between them. The framework draws upon and integrates ideas from different disciplines and strands of research. An important aspect of the framework is that it aims to be comprehensive, in the sense that it addresses all possible differences between mobile and fixed phone interviews that could affect measurement. Instead of focussing on a single factor or theory, the framework considers all possible influences on measurement; influences can therefore be seen in context. An additional advantage of this broad perspective is that our framework helps to separate measurement error differences from other differences between mobile and fixed phone interviews that could easily be confounded. This should help researchers identify appropriate research designs to provide understanding of the component differences.

There are two benefits of the focus on *relative* measurement error. First, consideration of measurement error causes that differ between modes can help to identify important sources of overall measurement error, a topic of great importance to all survey researchers. Second, relative error is often of inherent interest, for example when prime analysis objectives involve comparisons between subgroups or over time. In such situations, researchers are particularly concerned with holding systematic errors as constant as possible between the groups being compared. For example, time trends estimated from any regular survey in which an increasing proportion of interviews are carried out on a mobile phone will be biased unless either, a) measurement error is independent of whether the interview is carried out on a fixed or mobile phone, or b) differences in measurement error can be controlled in analysis. This article is a first step towards providing researchers with the tools to achieve a) or b).

A further unique contribution of the article is the use of data from a randomised experiment that fully controls for coverage differences between fixed and mobile phones and minimises (though cannot eliminate completely) participation differences, while maintaining a realistic survey interview situation. The design provides a strong platform for the identification of genuine measurement differences. Additionally, the experiment involved the collection of a number of measures designed specifically to address aspects of our theoretical framework. After discussing our findings based on these experimental data we outline practical implications and suggestions for further research.

2. Background

A growing body of research addresses issues related to the use of mobile phones in survey interviewing (Steeh and Piekarski, 2008). A focus of much of this research is evaluation of the size and nature of the population that would be excluded from fixed-phone-only surveys, i.e. mobile-only households (Blumberg and Luke 2007, Blumberg and Frankel 2008, Kuusela et al 2008, Tucker et al 2007). Methods for sampling the mobile-only population, including dual-frame approaches, have received considerable attention (Brick et al, 2006; Tucker, Brick and Meekins, 2007; Tortora, Groves, and Peytcheva, 2008) as have issues of non-response and weighting (Brick et al, 2006; Kennedy, 2007). The acceptability to sample members of being interviewed on their mobile phone has also been studied, mainly with a focus on whether, and in what circumstances, it is possible to achieve good response rates (Bosnjak, Metzger, and Gräf, 2010; Fuchs, 2000; Lau, 2004; Vehovar et al, 2004). Other research has looked more generally at the feasibility and costs of interviewing on mobile phones (Brick et al., 2007) or at technical aspects such as recording and reporting the outcomes of call attempts (Callegaro et al, 2007). New possibilities for data collection provided by mobile technologies have also been investigated, including the use of SMS as a self-completion method (Couper, 2005; Steeh, Buskirk, and Callegaro, 2007). This body of research has provided considerable evidence on the implications of mobile phones for coverage, sampling, non-response, feasibility and costs. However, very little attention has been paid to possible effects on measurement, though Lavrakas et al (2007) speculate that response accuracy could be lower with mobile phone interviews, due to lack of privacy or multi-tasking.

2.1 Measurement Error and Mode Effects

Some consistent and convincing findings have emerged regarding differences in measurement between telephone interviews and other modes. Social desirability bias is found to be more prevalent in telephone interviewing than in self-completion modes (Kreuter, Presser, and Tourangeau, 2008; Tourangeau, Rips, and Rasinski, 2000; Tourangeau and Yan, 2007), but less prevalent in telephone interviewing than in face-to-face interviewing (Tourangeau and Smith, 1996), though several studies find no differences in this respect between telephone and face-to-face interviewing (e.g. Midanik and Greenfield, 2000; Nicolaas et al, 2000; see also Bowling, 2005). Recency effects – a tendency for respondents to choose later, and particularly the last, option from amongst multiple

response options - are often found in telephone interviews (McClendon, 1991), particularly when it is ensured that respondents listen to the complete list of options before responding (Holbrook et al, 2007). Furthermore, respondents are more likely to choose extreme response options when interviewed by telephone than when interviewed face-to-face (Groves and Kahn, 1979; Jordan, Marcus, and Reeder, 1980) or than when responding by self-completion (Tarnai and Dillman, 1992). Respondent satisficing (Krosnick, 1991) may be more common in telephone interviews than in either face-to-face interviews or self-completion modes. In the former case, this may be for a number of reasons, including the limited ability of the interviewer to react to non-verbal communication¹, the lack of visual stimulus for the respondent, the awkwardness associated with silent pauses on the telephone, poorer quality phone lines and the increased likelihood of respondent multi-tasking. In the latter case, the reasons are different: the presence of visual stimuli in self-completion mode may reduce cognitive burden, and time pressure is greater in phone interviews (Schwarz et al., 1991). On the other hand, the interviewer may be able to motivate and guide the respondent in a way not possible with self-completion instruments. Empirical evidence of these mode differences in satisficing is, however, inconsistent (Groves et al, 2009, 168-172). Additionally, context effects may be more limited in telephone interviews than in self-completion modes (Bishop, Hippler, Schwarz, and Strack, 1988) as the respondent is not able to know the nature of future questions before answering the current one.

Overall, the picture presented by research into mode effects is one of multiple ways in which measurement error may manifest itself differently with telephone interviewing than with other modes. Both the causes and the effects differ between the modes. However, differences between modes are unlikely to constitute the entirety of measurement error. There are common causes of measurement error that may apply more or less equally to all modes, including telephone interviewing. Indeed, much of the measurement error literature is silent about the mode(s) to which it refers (cf. Sudman and Bradburn, 1974; Tourangeau, Rips and Rasinski, 2000). It may well be that these common causes are amongst the most important contributors to measurement error in telephone interviews.

¹ Though it should be noted that non-verbal communication is not completely absent in telephone interviews: Conrad, Schrober and Dijkstra (2008) point out that timing cues, intonational cues and other discourse features can provide interviewers with additional information about the intentions or reactions of a respondent.

2.2 Measurement Differences between Mobile and Fixed Phones

A number of causes of survey measurement error are associated with factors that are suspected to differ between mobile and fixed phones, though evidence of systematic differences in these factors is scarce. Brick et al (2007) find that sample members are more likely to be away from their home when contacted by mobile phone, and Lavrakas et al. (2010) report that across a number of studies around one-third of respondents called on a mobile number are interviewed away from home. Schneiderat and Häder (2007) suggest that mobile phone respondents may be more likely to be in the presence of other people. Mobile phone respondents may also be more likely to multi-task during a survey interview (Schneiderat and Häder, 2007), though Pew Research Center (2006) find no difference between mobile and fixed phone interviews in this respect and AAPOR Cell Phone Task Force (2010, p.59) conclude “Much more research is needed [...] including more research into the possible effects of respondent multitasking while participating in a cell phone interview”. Line quality is believed likely to be lower on mobile phones and background noise may be more common (Lavrakas et al., 2010). Mobile phone respondents could be more likely to be distracted from the survey task, though Pew Research Center (2006) find no evidence of this. It has also been suggested that both cost and convenience considerations might cause mobile phone respondents to hurry through interviews paying the questions less attention than they might on a fixed line (AAPOR Cell Phone Task Force, 2010, Döring, 2009). However, there is very little empirical evidence of systematic difference between mobile and fixed phones in prevalence of distraction, multi-tasking, line quality or presence of others. We can conclude only, then, that potential exists for factors that influence measurement error to differ between mobile and fixed phones. The extent and nature of such differences in realistic survey situations remains to be established.

We do know that there are differences in the ways that people use mobile and fixed phones. It is well documented that most people think of a mobile phone as a personal device, unlike a fixed phone, which is typically shared by the members of a household (Döring 2009). This may result in different expectations regarding who can legitimately call on a mobile phone and what kind of conversations can take place. And there are known technological and contractual differences between mobile and fixed phones which could be relevant to the behaviour of survey respondents: mobile users can always see the phone number of a caller (unless explicitly withheld by the caller), whereas this is only possible

with some fixed phones; fixed phone users with multiple handsets may be wary of other people in the household 'listening in' from another handset, whereas this is not possible with a mobile phone; and the structure of user charges may differ; notably, in some circumstances mobile phone users – unlike fixed phone users – are charged for receiving, as well as for making, calls.

Even if some relevant factors differ between mobile and fixed phones, the question remains as to whether, and in what way, these differences lead to differences in measurement. It has been suggested that the increased likelihood of being in a non-private situation when interviewed on a mobile phone should lead to a greater propensity for social desirability bias in responses, but no evidence has been found of this tendency (Brick et al, 2007). Indeed, others have suggested that mobile phones offer a greater likelihood of the respondent being in a private situation, as they can choose where to answer the call, and where to go to continue the conversation once they have answered (Döring, 2009). It has also been suggested that satisficing will be more in evidence with mobile phone interviews, due to greater distraction, multi-tasking, and greater desire to finish the interview quickly (Lavrakas et al, 2007). Again, however, no evidence has been found of this (Dipko et al, 2005; Brick et al, 2007; Vicente, Reis, and Santos, 2009). Indeed, with respect to the possibility of measurement error differences between mobile and fixed phones, the AAPOR Cell Phone Task Force (2008) state that “currently available evidence ... is relatively sparse and mixed” (p.40) while AAPOR Cell Phone Task Force (2010) conclude that “most of the empirical evidence to date regarding cell phone respondents does not support the broad assumption of poorer data quality compared to what landline respondents provide. That is, there is no evidence to suggest that all or even most data gathered by cell phone are of poorer quality than their landline counterparts would be” (p.8), while also stating that “data quality remains an understudied area in the cell phone survey literature [...] Much more research is needed on cell phone survey data quality” (p.59). We would further note that the few studies that have attempted to compare measurement between mobile and fixed phones (Pew Research Center, 2006; Brick et al., 2007; Vicente, Reis, and Santos, 2009) have confounded the device effect with the population under study by comparing persons available to be contacted by mobile phone (and interviewed on mobile phone) with persons available to be contacted by fixed phone (and interviewed on fixed phone).

3. Theoretical Framework

In this section we develop a theoretical framework of the ways in which responding to survey interviews on a mobile phone may influence measurement error. Specifically, we do this by contrasting mobile phone interviews with fixed phone interviews, a mode with which survey researchers are already familiar. The aim is to provide means for identifying factors that could differentially affect measurement error and for understanding the mechanisms by which these factors influence measurement error. Survey measurement is a complex process with multiple dimensions. In consequence, we believe that multiple theories and approaches are needed in order to build a comprehensive picture of the influences. We draw upon ideas from a number of fields and research strands.

The cognitive model of response to survey questions proposed by Cannell, Miller and Oksenberg (1981) and refined by Tourangeau, Rips, and Rasinski (2000) highlights the components of the question-answering process that must be successfully negotiated. The model has been widely used by survey researchers to inform methodological research and is broadly accepted as an appropriate and useful representation of the answering process (Groves et al, 2009). In figure 1, we use the model as a starting point for identifying the potential effects on measurement error of mobile phone interviews. We have not joined the four steps in the model by arrows as we do not assume the process to be linear: some steps may be performed simultaneously and others iteratively. The point is simply that all four sets of tasks must be performed: to answer a question optimally a respondent should perceive the question (hear the words), comprehend the question (understand the words and their collective meaning), recall relevant information, evaluate the relevance of the information so as to construct an appropriate answer, and report to the interviewer the answer.

To the comprehension step we have explicitly added the task of perception. Perception is referred to in the survey literature in the context of self-completion questionnaires, where visual perception is important (Dillman, 2000, p.105) and involves locating each question and associated material such as routing and instructions and being able to read them. More generally, Tourangeau, Rips, and Rasinski (2000, p.9) refer to 'attending to the question.' In the telephone interview context it is auditory perception that is relevant. Survey researchers typically pay little attention to auditory perception, perhaps because it is assumed to be trivial. However, it should not be taken for granted in the case of mobile phone interviews. Respondents must be able to hear what the interviewer is saying and to recognise whether it

is a question, instructions, or something else. The need for perception is intimately bound up with the task of comprehension, so we consider perception and comprehension as a single step. We note that correct comprehension can often be achieved with incomplete perception, for example when certain syllables or sounds are omitted (Kellogg, 2007). In such cases, the listener may use 'top-down processing' (Jenkins and Dillman, 1995) to infer a detail (e.g. a specific word) from the context (the rest of the sentence or question)².

The second row of figure 1 sets out the necessary conditions for each of these stages to be completed successfully. To perceive the question, the respondent must be able to hear it. For the other four tasks, the respondent must devote sufficient *attention* to the task and make sufficient *cognitive effort*. Attention is the ability to focus on something specific while ignoring other stimuli (Kellogg, 2007). Humans have a limited capacity for attention, so researchers need respondents to pay sufficient attention to the question answering task (Tourangeau, Rips, and Rasinski, 2000, p.9). What qualifies as sufficient will of course vary between questions and between respondents. When attention is shared between multiple stimuli, the ability to deal appropriately with the stimuli to which only secondary attention is paid will be compromised. It should be noted, however, that some processes, such as walking, are largely controlled by automatic processing, requiring little or no conscious attention (Kellogg, 2007, p.76-80). Such stimuli requiring mainly automatic processing are less likely to distract attention than stimuli that require attentive processing. Cognitive effort indicates whether the respondent performs mental tasks sufficiently well to carry out each step in the answering task adequately (Cannell, Miller, and Oksenberg, 1981). Failure to do this may be referred to as *satisficing* (Krosnick, 1991). Note that we consider attention and effort to be distinct conditions, though they will tend to interact with each other. We consider it possible, for example, that a respondent may pay close attention to a task but not make sufficient effort to carry it out well. Additionally, we find it helpful to distinguish between them as rather different factors determine whether each of these conditions are met (see below). At the final step, once the respondent has identified the answer, he or she must be willing to report it to the interviewer. The respondent may instead prefer to conceal socially undesirable views and behaviours, a process which can lead to *social desirability bias* (DeMaio 1984). Other reasons for editing an answer prior to reporting it can be to avoid intrusive topics regardless of own views and behaviours (Schaeffer 2000), to avoid the risk of

² However, we suppose nevertheless that incomplete perception is more likely than complete perception to lead to either incorrect comprehension or lack of comprehension.

identity being revealed (Couper et al 2010) or because of a desire to appear consistent or to not offend the interviewer (Smith 1983).

Whether these necessary conditions are likely to be met is determined by factors which could differ either between mobile and fixed phone interviews (for the same respondents) or between different samples of respondents (regardless of mode of interview). These two sets of factors are identified in rows 3 and 4 respectively and are explained in the following paragraphs. Factors in row 3 (situational and context factors) can be interpreted as directly causing a mode effect on measurement error, while those in row 4 (respondent attributes) may indirectly cause mode differences in measurement error, via differences in coverage, preference or non-response.

Ability to hear the interviewer clearly is, we suggest, influenced by the inherent audibility of the sound being transmitted, the inherent ability of the respondent to hear clearly, and by intervening distraction such as other sounds or movement. The inherent audibility of the sound being transmitted is a factor that could differ between mobile and fixed phone interviews, due to differences in line quality. The quality of the line – referred to by Döring (2009) as tone quality – is generally believed to be better and more reliable with fixed phones (Döring, 2009), due to the reliance of mobile phone reception on network coverage and absence of signal interference. There may however be exceptions to this rule. The nature and extent of distraction could also differ between mobile and fixed phone interviews, being related to the location and circumstances of the respondent during the interview. Auditory distraction could reduce the respondent's ability to hear clearly the questions, response options and any other instructions. The inherent ability of the respondent to hear clearly is, however, determined by their aural health, which is independent of the device being used. This influential feature is therefore common to both mobile and fixed phone interviews, but it is a feature that could differ systematically between samples interviewed in each mode in a real survey situation, for example if older people were more likely to be interviewed on fixed phones (Link et al, 2007; Vicente, Reis, and Santos, 2009). This is therefore an example of a feature that is not affected by mode but could be confounded with mode in studies which compare different samples interviewed in different modes, due to differences in coverage or participation. The same is true of all the features in row 4 of figure 1.

A survey respondent may be less likely to devote sufficient attention to the question answering task if he or she is carrying out other tasks at the same time as responding to the survey interview (multi-tasking, figure 1) or is distracted by other things going on around them which may demand some of their visual or aural attention. Both of these factors have

the potential to differ on average between mobile and fixed phone interviews, so they appear in row 4. With regard to multi-tasking, mobile phones greatly increase the possibilities for the respondent to be actively engaged in other tasks at the same time as talking on the phone. This has the potential to reduce the attention paid by the respondent to the survey task, as the respondent may choose to devote attention elsewhere. (We note that the potential for multi-tasking also varies amongst fixed phones, depending on whether the handset is wired to the base unit or is wireless.) Multi-tasking is distinct from distraction as respondents are actively choosing how to divide their attention rather than simply being at risk of having some attention taken away. Distraction may be either auditory or visual. We posit that the restrictions imposed by fixed line technology on the physical location of the respondent during the interview will limit the likelihood and extent of either background noise or background activity causing a distraction to the respondent initially. However, we also note that mobile phones (and wireless fixed line phones) offer the respondent more scope to move away from distractions should they choose to do so. Thus, the likely direction of any difference in levels of distraction between mobile and fixed phone respondents is unknown *a priori*.

Krosnick (1991) proposed that the extent to which respondents make sufficient effort to answer survey questions accurately is determined by the interaction of three factors: the inherent difficulty of the task, the motivation of the respondent and the (cognitive) ability of the respondent. Task difficulty is an attribute of question content and design and can therefore be assumed to be invariant between modes, while motivation and ability are attributes of respondents.

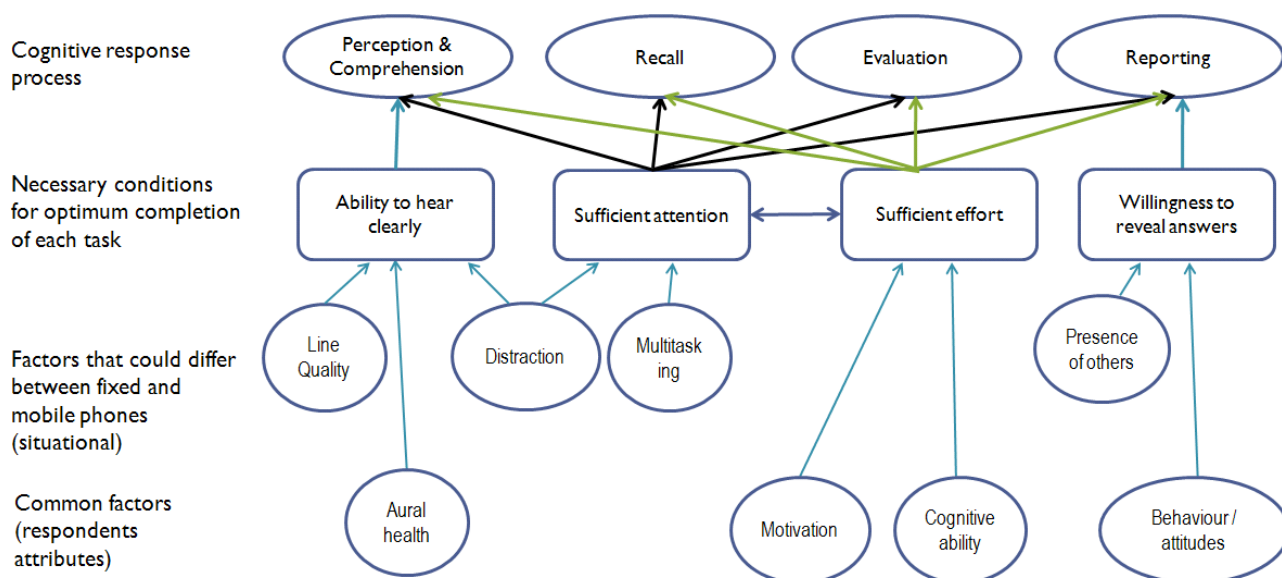
A respondent's willingness to reveal their answer to a question depends on the one hand on the nature of their true answer, which is a respondent attribute, and on the other hand on the potential that the survey situation provides for embarrassment, censure, disapproval or punishment (Tourangeau, Rips, and Rasinski, 2000, pp.279-288). The latter is influenced by whether or not other people are in the presence of the respondent, who those people are (particularly whether they are strangers or personal acquaintances), and the extent to which they are in the immediate proximity of the respondent (for example in a quiet room together) or merely in the background (for example passing in the street). According to Döring (2009), people within earshot of someone talking on a telephone will hear half the conversation and may engage in inferring the complete information (need-to-listen effect), a phenomenon of which the person talking on the phone may be aware. All three aspects described above of the presence of other people (whether, who and where) certainly have

potential to differ systematically between mobile and fixed phone interviews and are therefore included in row 3.

Our framework therefore identifies four sets of factors that could differ systematically between mobile and fixed phone interviews and could therefore introduce measurement error differences that can be attributed to the nature of the device on which the sample member is responding. These are the quality of the line, distraction, multi-tasking and the presence of others.

The final row of figure 1 identifies factors that are common to mobile and fixed phone interviews but can influence measurement error. These factors are characteristics of respondents so, conditional on a sample, they cannot differ between modes. It is however informative to include these factors in the framework as these are the means by which selection effects can introduce differences in measurement between modes. If mobile phone respondents differ systematically from fixed phone respondents to a particular survey in terms of one or more of these sets of attributes, this can cause an apparent mode effect, though the effect is in fact caused by selectivity (differential sample coverage/selection or differential non-response).

Figure 1. Potential measurement error differences between fixed and mobile phones



4. Data

To evaluate aspects of our theoretical framework, we use data from a randomised experiment. The experiment was carried out in Hungary in 2005 within the context of a programme of research into mixed mode data collection carried out jointly by the European Social Survey and Gallup-Europe. Our data come from the second phase of this research programme, which consisted of two experiments – one in Hungary and one in Portugal - in which samples were selected from frames that included names, addresses and phone numbers and were randomly allocated to receive either a face-to-face or telephone interview (Jäckle, Roberts, and Lynn, 2006). Within the Hungarian experiment, the subset of telephone respondents who had both a fixed line and a mobile were randomly allocated to be interviewed either via the fixed phone or via mobile. It is this subset that provides the data we use here.

4.1 Design of the Study

A systematic random sample of persons was selected from a sampling frame of persons residing in the Greater Budapest region. Sample members were randomly allocated to face-to-face and telephone samples. After removing a small number of non-working numbers, the telephone sample contained 2,748 persons. A total of 1,067 screen interviews were completed, representing a response rate to the screen (AAPOR RR1) of 38.8%. Of these 1,067 respondents, 724 reported that they had both a fixed and a mobile phone. These were randomly allocated to be interviewed either on their fixed phone or their mobile phone³. 342 interviews were achieved on fixed phones and 202 on mobile phones, representing a survey completion rate (AAPOR COOP1) of 75.1%, consisting of 94.5% amongst the fixed phone sample and 55.8% amongst the mobile phone sample. If the allocated device was the same as the device on which a respondent was initially contacted, the interviewer was permitted to proceed immediately with the interview. If the allocated device was of the other kind, the interviewer was instructed to call back on another day⁴. This was done in an attempt to maximise the realism of the interview situation, in the sense that people interviewed on their mobile phone should be located wherever they would happen to be located when contacted

³ The other 343 screen respondents reported having only a fixed phone and were interviewed on their fixed phone. This group is not of interest to our analysis.

⁴ The vast majority of phone numbers on the sampling frame were fixed phone numbers, so respondents allocated to a mobile phone interview were more likely than those allocated to a fixed phone interview to require a call back.

on their mobile⁵. Both screen and main interviews were carried out by Gallup Hungary interviewers calling from a call centre in Budapest.

4.2 Measures of Factors and Conditions Affecting Measurement Error

The questionnaire instrument contained 58 items⁶ plus six interviewer assessment items and took an average of 15 minutes 20 seconds to administer. The instrument included a number of items designed to collect information on factors that could affect measurement error (row 4 of figure 1) and on indicators of possible deviations from the necessary conditions for responses to be provided free of measurement error (row 3 of figure 1).

Regarding the factors that could affect measurement error, information on respondent location was obtained with the question, "Can I just check, are you at home at the moment or somewhere else?" If they responded "somewhere else", a follow-up question asked "Are you in someone else's home, at work, in a car, on a bus, train or tram, or somewhere else? Information on multi-tasking was obtained by first asking, "During the course of the interview were you doing anything else while we were talking?" If "yes" the respondent was asked "What were you doing?" Answers were recorded verbatim and coded later in the office, to the categories housework or cooking, watching TV, reading, using a computer, minding children, other. Interviewers were also asked to record whether the respondent appeared to be distracted in any way during the interview. We do not have a direct measure of the presence of others, but interviewers were asked to record whether they felt that anyone else had influenced the responses given by the respondent⁷.

Indicators of possible deviations from the necessary conditions for responses to be provided free of measurement error included respondent self-assessments of how uneasy they felt about answering survey questions on each of six topics. These were intended to provide indications of the potential for social desirability bias. Additionally, for each interview the interviewer was asked to assess how often the respondent had asked for clarification about questions, whether the respondent was reluctant to answer any questions,

⁵ Having made contact on a fixed phone number, phoning back immediately on a mobile number would have led to most mobile respondents being interviewed at home. We would note, however, that it was not possible to prevent interviewers from making more or less formal appointments to call back. We expect that it would have been natural for some respondents to have indicated their availability or preferences once the interviewer mentioned that they intended to call back.

⁶ Due to a small amount of routing, the mean number of items asked per respondent was 54.

⁷ We recognise that telephone interviewers will not always be able to identify whether the respondent is in the presence of other people but we think they will usually detect whether someone else is explicitly influencing the responses given. For that reason, we included this item which was originally developed as an interviewer observation item for face-to-face interviews.

whether the respondent tried to answer the questions to the best of his or her ability, and whether overall the respondent understood the questions. Full wordings for all questions are given in appendix A.

Additionally, to help identify the mechanisms by which mode effects operate, respondents answering on a fixed phone were asked whether their handset was wireless or was attached to the base unit by a wire.

4.3 Questionnaire Items

Aside from the items described above, which were included for methodological purposes, the interview consisted of 41 substantive items, all of which are items regularly asked on either the European Social Survey (34 items) or the Eurobarometer (7 items). The topics covered were television viewing behaviour, attitudes towards politics, trust in institutions, voting behaviour, attitudes to immigrants, attitudes towards gender roles and towards sexuality, religious attendance and socio-demographic measures (see appendix A).

5. Methods

We derive two sets of quality measures, which indicate the presence or absence of the necessary conditions for optimum completion of the response task (row 2 of figure 1). The first set indicates responses associated with satisficing (hereafter, 'satisficing indicators'), i.e. a failure of the respondent either to devote sufficient attention to the task or to make sufficient effort to fully complete the task. The second set indicates responses associated with social desirability bias (hereafter 'social desirability bias' indicators), i.e. unwillingness on the part of the respondent to reveal their true answer. We compare distributions of these indicators between the mobile and fixed phone respondents, with a particular focus on the mediating role of influential factors that could differ between modes (row 4 of figure 1). We attempt to control for possible selection differences between the treatment groups in influential common factors (row 5 of figure 1).

5.1 Indicators of Satisficing

We use seven different satisficing indicators:

- Don't knows: proportion of "don't know" responses amongst all questionnaire items;

- Agreeing: proportion of “agree” responses amongst six agree-disagree items (Q17a-Q18b);
- Extreme and middle: Proportion of extreme-point or middle-point answers (0, 5 or 10 on an 11-point scale)⁸ to 13 scale items (Q3, Q4, Q8a-Q8g, Q14-Q16, Q19);
- Recency: proportion of 13 items with fully-labelled response options to which the last option was chosen (Q5-Q7, Q11-Q13, Q17a-Q18b, Q20);
- Straight-lining: maximum number of consecutive same responses in each of four blocks of items with a common response scale (Q8a-Q8g, Q14-Q16, Q17a-Q17d, Q18a-Q18b)
- Rounding: binary indicator of whether the response to each of two questions about hours and minutes spent watching TV was a multiple of one hour (Q1, Q2);
- Interview length: length of interview in minutes and seconds.

The value of any of these indicators for a particular respondent does not indicate whether or not he or she has provided a sub-optimal response, but over the samples as a whole a greater tendency towards satisficing should produce higher means for each of the first six indicators and a lower mean for the seventh (interview length).

5.2 Indicators of Social Desirability

We use 25 indicators of socially desirable responses, based upon 23 questionnaire items. For each item believed to have social desirability connotations we construct a dichotomous indicator of the (more) socially undesirable response(s). The definitions of these indicators appear in appendix B. Additionally, we use the overall proportion of socially desirable responses across these 23 items and the proportion of don’t know or refusal responses to the household income item (Q29).

As with the satisficing indicators, these provide an indication of the relative prevalence of social desirability bias only at the aggregate level. A greater tendency towards social desirability bias should result in lower proportions for each of the 23 item indicators, lower means for the summary proportion and a higher proportion of don’t know or refusal on household income.

5.3 Measures of Factors Affecting Response Quality

⁸ This follows the approach of Kaminska, McCutcheon and Billiet (2010), who combine the middle-point indicator of satisficing used by Krosnick, Narayan and Smith (1996) with the extreme-point indicator used by Belli, Herzog and van Howeyk (1999).

We use three indicators of factors that may be associated with satisficing. The first is a measure of multitasking while responding to the survey (Q38 in appendix A). The other two are interviewer assessments of how frequently the respondent asked for clarification and how frequently the respondent understood the questions (interviewer Q1 and Q4 in appendix A).

We use eight indicators of factors supposed to affect the likelihood of social desirability bias. Six of these are self-reported measures of how uneasy the respondent feels about answering survey questions on specific topics (Q36 in appendix A). Additionally, we use interviewer assessments of the extent to which the respondent was reluctant to answer questions and of whether someone else present influenced the responses given (interviewer Q2 and Q5 in appendix A).

5.4 Comparison Methods

Though allocation to mobile or fixed phone interview was random, the possibility of compositional differences remains, due to differences in non-response bias between the two groups. We ran logistic regression models with treatment group as the dependent variable and the following as predictor variables: sex, age, level of education, income, employment status, manual *vs* nonmanual occupation, internet access, self-assessed interest in politics, and an urban *vs* suburban indicator. The only significant predictor ($P < 0.05$) was age, with younger people being under-represented amongst mobile phone respondents relative to fixed phone respondents. In consequence, age is included as a covariate in all subsequent analyses.

To assess hypotheses relating to social desirability bias, we additionally want to compare fixed phone respondents with a wired handset to those with a wireless handset, as some relevant features of the latter are similar to those of a mobile phone. However, the population of persons with a wired handset may well differ systematically in relevant ways from that of persons with a wireless handset, so structural differences should be controlled in analysis. We fitted a 3-group multinomial logistic regression model, with wired handsets as the reference category versus wireless handsets and mobile phones. Four predictors were found to be significant ($P < 0.05$) and were thus included in the final model: age, gender, internet access and urban *vs.* suburban. The odds of having a wireless handset rather than a wired handset were estimated to be 1.82 for respondents with access to the internet, 2.50 for those in suburban rather than urban districts of Budapest, 1.50 for men and 1.005 for each

extra year of age. These four variables were therefore included as covariates in all analyses involving comparison of all three groups (mobile, fixed wired, fixed wireless).

Comparisons between sample groups are based upon the significance of odds ratios from OLS regression, binomial or multinomial logistic regression models. All models were fitted in *Stata* 11.0.

6. Results

6.1 Factors Influencing Measurement Error

Some differences were found between mobile and fixed phone respondents in terms of the factors expected to influence response quality, but these were limited to the factors expected to influence the likelihood of satisficing. No differences were found between the two groups in the eight factors expected to influence the likelihood of social desirability bias.

Of the three factors associated with satisficing, the two interviewer-assessed measures did not differ significantly between the two groups, but multitasking was more prevalent amongst mobile phone respondents (odds ratio = 1.59; $P = 0.078$, multitasking defined as doing housework, cooking, minding children or 'other' activity while responding to the survey).

More differences were found when comparing the fixed wired and fixed wireless groups with the mobile group. Two of the eight social desirability factors exhibited significant differences. Fixed wireless respondents were less likely than the other two groups to report unease with answering questions about immigrants (odds ratio = 0.14; $P = 0.06$). And fixed wired respondents were less likely than the fixed wireless group to be evaluated by the interviewer as reluctant to answer the questions (odds ratio = 0.49; $P = 0.08$).

Regarding satisficing, the extent of multitasking differed significantly between the three groups, as for two groups (above). Specifically, mobile respondents are 1.60 times more likely to multitask than fixed wired respondents ($P = 0.09$).

6.2 Response Quality: Comparisons between Fixed and Mobile Phones

Only one of the indicators of satisficing differed significantly between the two treatment groups (table 1). Mean interview length was longer for mobile phone interviews (2 minutes 20 seconds longer; $P < 0.001$; overall mean interview length = 15 minutes 20 seconds), suggesting more satisficing in fixed phone interviews.

Table 1: Differences in indicators of satisficing between mobile and fixed phone interviews

Indicator	Mobile vs. Fixed			
	OLS Coef	SE	Significance	R ²
Don't know	0.004	0.004	ns	0.013
Agreeing	0.012	0.015	ns	0.006
Extreme or middle	-0.024	0.017	ns	0.035
Recency	-0.005	0.010	ns	0.001
Straight-lining (prop same in q-n 8)	-0.014	0.014	ns	0.002
Straight-lining (prop same in q-n 14)	0.012	0.021	ns	0.001
Straight-lining (prop same in q-n 17)	0.001	0.015	ns	0.001
Straight-lining (prop same in q-n 18)	-0.021	0.019	ns	0.020
Interview length (in seconds)	140.092	28.553	<0.001	0.112
				Pseudo
Indicator	Odds Ratio	SE	Significance	R ²
Rounding	1.352	0.273	ns	0.033

Where differences were significant, fixed phone respondents were more likely than mobile phone respondents to give answers that appeared to indicate social desirability bias (table 2). Differences were significant for three individual items: time spent watching TV (Q1, P=0.01), proportion of TV time spent on news programmes (Q2, P=0.04), attitude towards immigrants (Q16, P=0.05). The proportion of refusal or don't know answers to the income question was also higher amongst fixed phone respondents (p=0.05)⁹.

⁹ As none of the measured factors that could influence social desirability bias were found to differ between mobile and fixed-phone treatments, the models were not refitted with these controls as the controls would not be able to explain any of the differences in observed socially desirable responses.

Table 2: Differences in indicators of socially desirable responses between mobile and fixed phone interviews

Indicator	mobile vs. fixed			
	OLS Coef	SE	Significance	R ²
Overall proportion socially desirable (out of 23 q-ns)	-0.014	0.011	ns	0.003
Indicator	Odds Ratio	SE	Significance	Pseudo R ²
Hours watching TV (Q1) (<3.0 per day)	0.601	0.122	0.012	0.069
Proportion of TV time watching news (Q2) (> 0.25)	0.627	0.143	0.041	0.027
Trust in others (Q3)	0.883	0.179	ns	0.001
Life satisfaction (Q4)	1.044	0.272	ns	0.021
Interest in politics (Q5)	0.925	0.175	ns	0.048
Politics is complicated (Q6)	0.744	0.163	ns	0.004
Making up mind (Q7)	0.965	0.264	ns	0.002
Vote in general election (Q9)	0.820	0.228	ns	0.021
Same-race immigrants (Q11)	0.897	0.358	ns	0.002
Different-race immigrants (Q12)	0.904	0.281	ns	0.000
Immigrants from poorer countries (Q13)	1.377	0.337	ns	0.008
Immigration bad for economy (Q14)	0.954	0.197	ns	0.000
Immigration undermines culture (Q15)	0.826	0.216	ns	0.003
Immigration makes Hungary worse (Q16)	0.653	0.139	0.045	0.013
Women cut down on work (Q17a)	1.154	0.210	ns	0.001
Men need not be responsible (Q17b)	0.618	0.396	ns	0.018
Men have more right to a job (Q17c)	0.975	0.189	ns	0.019
Parents should split (Q17d)	0.782	0.147	ns	0.009
Gays should not live freely (Q18a)	1.032	0.216	ns	0.008
Law need not be obeyed (Q18b)	2.454	1.624	ns	0.077
Low religiosity (Q19)	0.986	0.180	ns	0.006
No religious attendance (Q20)	1.178	0.213	ns	0.002
Extreme income quintile (Q29-Q30)	1.039	0.255	ns	0.004
Income refusal and don't know's	0.644	0.147	0.054	0.020

Table 3: Differences in indicators of satisficing between mobile, fixed wireless and fixed wired phone interviews

Indicator	wireless vs. wired			mobile vs. wired			wireless vs. mobile			R ²
	OLS Coef	SE	Signifi- cance	OLS Coef	SE	Signifi- cance	OLS Coef	SE	Signifi- cance	
Don't know	0.004	0.006	ns	0.005	0.004	ns	-0.001	0.006	ns	0.026
Agreeing	0.014	0.023	ns	0.014	0.017	ns	0.001	0.024	ns	0.012
Extreme or middle	-0.016	0.025	ns	-0.028	0.018	ns	0.012	0.026	ns	0.068
Recency	-0.013	0.015	ns	-0.005	0.010	ns	-0.008	0.015	ns	0.007
Straight-lining (prop same in q-n 8)	-0.001	0.021	ns	-0.014	0.015	ns	0.013	0.021	ns	0.006
Straight-lining (prop same in q-n 14)	0.030	0.032	ns	0.015	0.023	ns	0.014	0.033	ns	0.004
Straight-lining (prop same in q-n 17)	0.000	0.023	ns	0.000	0.016	ns	0.000	0.023	ns	0.014
Straight-lining (prop same in q-n 18)	-0.007	0.029	ns	-0.017	0.020	ns	0.010	0.029	ns	0.039
Interview length (in seconds)	10.646	43.144	ns	140.279	30.87	<0.001	-129.632	44.524	0.004	0.121

Indicator	wireless vs. wired			mobile vs. wired			wireless vs. mobile			Pseudo R ²
	Odds ratio	SE	Significance	Odds ratio	SE	Significance	Odds ratio	SE	Significance	
Rounding	1.132	0.355	ns	1.481	0.325	0.074	0.765	0.243	ns	0.044

6.3 Response Quality: Comparisons between Fixed-Wired, Fixed-Wireless and Mobile Phones

Two of the seven satisficing indicators exhibited a significant difference between the groups¹⁰ (table 3). The proportion of respondents providing rounded answers was higher amongst mobile respondents than amongst wired respondents (31% mobile, 26% wired, $P = 0.07$). Also, mobile respondents had a mean interview length 2 minutes 20 seconds longer than fixed wired respondents ($P < 0.001$) and 2 minutes 10 seconds longer than fixed wireless respondents ($P = 0.004$). As with the two group comparisons, these results did not alter when the significant factor expected to be associated with satisficing, multitasking, was added to the model.

Significant differences were found for seven of the item indicators of social desirability (table 4). Amongst these items there was one (time spent watching TV) for which the proportion of socially desirable answers was higher relative to mobile respondents amongst both fixed line groups, and one (politics being complicated) for which the proportion was higher relative to mobile respondents only amongst fixed wired respondents. For one item (immigrants make Hungary a worse place to live) two pairwise differences were significant, with the proportion of socially desirable responses being higher amongst fixed wireless respondents than amongst fixed wired respondents or mobile respondents. For one item (immigration should be allowed from poorer countries), socially desirable responses were more prevalent amongst wireless and mobile respondents than amongst wired respondents, while for one item (income) the proportion was higher amongst wired than amongst wireless respondents. The proportion of refusals or don't knows to the income question was higher amongst wired respondents than amongst wireless or mobile respondents. In addition the overall proportion of socially desirable answers was 2.5% higher amongst wired respondents than amongst mobile respondents (marginal significance of $P = 0.12$).

Thus, in summary there were four items for which mobile respondents exhibited less social desirability bias than fixed wired respondents. For three of these, there was no significant difference between mobile and fixed wireless respondents, There was one additional item for which mobile respondents exhibited less social desirability bias than fixed wireless respondents and one to which fixed wireless respondents exhibited less social

¹⁰ Though the overall agreeing indicator did not differ between the groups, for two of the six items contributing to the indicator the proportion agreeing was higher amongst one of the two fixed-line groups than amongst mobile respondents.

Table 4: Differences in indicators of socially desirable responses between mobile, fixed wireless and fixed wired phone interviews

Indicator (Continuous)	wireless vs. wired			mobile vs. wired			wireless vs. mobile			R ²
	OLS Coef	SE	P-value	OLS Coef	SE	P-value	OLS Coef	SE	P-value	
Overall socially desirable (prop: #of soc des out of 23 q-ns)	0.009	0.016	ns	-0.016	0.011	ns	0.025	0.016	ns	0.070
Indicator (Dichotomous)	Odds ratio	SE	P-value	Odds ratio	SE	P-value	Odds ratio	SE	P-value	Pseudo R ²
Hours watching TV (Q1) (> 3.0 per day)	0.534	0.168	0.046	0.460	0.105	0.001	1.161	0.364	ns	0.105
Proportion of TV time watching news (Q2) - < 0.25	0.633	0.228	ns	0.550	0.142	0.020	1.151	0.405	ns	0.042
Trust in others (Q3)	1.675	0.572	ns	1.045	0.227	ns	1.604	0.562	ns	0.025
Life satisfaction (Q4)	0.839	0.319	ns	0.951	0.265	ns	0.882	0.347	ns	0.023
Interest in politics (Q5)	1.546	0.481	ns	0.940	0.195	ns	1.644	0.523	ns	0.086
Politics is complicated (Q6)	0.634	0.213	ns	0.616	0.149	0.045	1.029	0.345	ns	0.024
Making up mind (Q7)	1.203	0.544	ns	0.960	0.284	ns	1.253	0.581	ns	0.047
Vote in general election (Q9)	0.708	0.304	ns	0.795	0.248	ns	0.890	0.383	ns	0.076
Same-race immigrants (Q11) ^^^	-	-	-	-	-	-	-	-	-	-
Different-race immigrants (Q12)	1.856	1.045	ns	0.982	0.318	ns	1.889	1.082	ns	0.012
Immigrants from poorer countries (Q13)	2.211	0.908	0.053	1.541	0.393	0.090	1.434	0.617	ns	0.025
Immigration bad for economy (Q14)	1.491	0.512	ns	0.981	0.216	ns	1.520	0.535	ns	0.024
Immigration undermines culture (Q15)	0.925	0.378	ns	0.789	0.221	ns	1.171	0.485	ns	0.020
Immigration makes Hungary worse (Q16)	2.099	0.864	0.072	0.707	0.161	ns	2.970	1.233	0.009	0.045
Women cut down on work (Q17a)	1.239	0.343	ns	1.225	0.240	ns	1.011	0.289	ns	0.012
Men need not be responsible (Q17b)	0.335	0.345	ns	0.318	0.269	ns	1.055	0.914	ns	0.066

Men have more right to a job (Q17c)	0.980	0.292	ns	0.897	0.188	ns	1.092	0.334	ns	0.037
Parents should split (Q17d)	0.942	0.264	ns	0.755	0.154	ns	1.247	0.364	ns	0.027
Gays should not live freely (Q18a)	0.900	0.283	ns	1.077	0.246	ns	0.836	0.273	ns	0.019
Law need not be obeyed (Q18b)	2.701	2.950	ns	2.372	1.646	ns	1.138	1.347	ns	0.125
Low religiosity (Q19)	0.963	0.268	ns	0.929	0.184	ns	1.037	0.296	ns	0.023
No religious attendance (Q20)	1.270	0.350	ns	1.210	0.235	ns	1.049	0.298	ns	0.003
Extreme income quintile (Q29-Q30)	0.501	0.169	0.040	0.867	0.233	ns	0.578	0.199	ns	0.023
Income refusal and don't know's	0.405	0.153	0.017	0.509	0.125	0.006	0.796	0.317	ns	0.047

^^^ note: for Q11 these comparisons are not possible because there are no wireless fixed-line respondents who provided a socially undesirable response

desirability bias than fixed wired respondents. However, one item (immigration from poorer countries) showed effects in the opposite direction, with fixed wired respondents showing less social desirability bias than either other group.

The models for each of the seven social desirability indicators exhibiting significant differences were then re-run adding the social desirability factors found to differ between the three groups as additional covariates (results not shown). These factors were interviewer assessed reluctance (all models) and unease with answering questions about immigrants (models for the four items on attitudes to immigrants). None of the results changed substantially. Thus, these factors appear to explain little of the differences in response distributions between the groups.

7. Discussion

First and foremost, our findings suggest that measurement error differences between interviews carried out on a mobile phone and those carried out on a fixed phone are small. The majority of our tests did not find significant differences in indicators of satisficing or in indicators of social desirability bias. Many important characteristics of the interview setting are common between these modes, so it is perhaps not surprising if measurement characteristics are similar. Researchers may be reassured by this result. In terms of measurement, at least, challenges in combining these two modes may be marginal rather than major.

Of the differences that we found, most were in the direction of indicating less social desirability bias with mobile phone interviews. We also found suggestive evidence that the extent of social desirability bias with wireless fixed phones may be intermediary between that with mobile phones and wired fixed phones. This could indicate that the effect is due to the greater freedom of mobile phone respondents to choose where to answer survey questions. It is at least plausible to imagine that, a) respondents may often choose to move out of earshot of other people in order to answer survey questions, and b) they are most likely to be able to do this if speaking on a mobile phone, less likely to be able to do it on a wireless fixed phone (as they must remain within range of the base unit), and least likely to be able to do it on a wired fixed phone.

We found no compelling evidence of greater satisficing in mobile phone interviews. The only finding in support of such a hypothesis was a greater tendency to provide rounded answers in mobile interviews. We found that mobile interviews were slightly longer than fixed phone interviews on average, a finding consistent with less satisficing in mobile phone interviews, but which could also have alternative explanations. One alternative explanation relates to the discussion of social desirability in the previous paragraph. If mobile phone respondents are more likely to move to a quieter or more private place, either at the start of the interview or part way through, this move could be associated with a pause in the interview, which increases interview length.

We have a number of suggestions for future research. First, to realistically assess differences between mobile and fixed phone interviews in terms of the context-specific factors identified in our framework (distraction, multi-tasking, line quality and the presence of others) it is necessary that calls made to respondents on each kind of device should be made using the same kind of calling patterns (in terms of days of the week, hours of the day, intervals between call attempts, and so on) as would be used on a real survey. To fully achieve this, a sampling frame is needed that contains both a fixed phone number and a mobile phone number for each person who has both types of phone. With such a set-up, the need is avoided to make initial contact with some respondents in a mode other than the one in which the interview is to be carried out. Consequently this removes the risk that the time and location of interviews is influenced by the initial contact in a different mode.

Better measures of the context-specific factors could be developed. In particular, we recognise that the measures of distraction and of the presence of others used in this study are limited. Future studies should seek better ways to measure these, for example through direct questions about who else was within earshot. We additionally note that distraction is potentially item-specific. Research would benefit from being able to identify the point(s) in the interview at which distraction(s) occurred.

Further research could usefully seek to identify the reasons for mobile phone interviews lasting longer. Related to this, it would be helpful to identify the extent to which respondents in each mode move to a different location in order to answer the survey questions, their reasons for doing so (audibility, privacy), and whether this

extends the interview length. Indeed, one could experiment with suggesting to respondents that they might like to move location.

All the factors that potentially influence measurement error (multitasking, distraction, presence of others, line quality) may interact with relevant respondent attributes. Consequently, in a survey context where some respondents are interviewed by mobile phone and some by fixed phone – but the allocation is not random – the mode effect on measurement (row 4 of figure 1) will be conditional on the selection into mode (row 5 of figure 1). An understanding of these interactions is necessary in order to be able to predict net effects on survey error. To investigate these issues, future methodological studies will need to include good measures of the relevant respondent attributes (ability, interest, etc).

Finally, we note that findings regarding the issues discussed in this paper could be culturally-specific. This suggests a need for replication and comparison of research cross-culturally and cross-nationally.

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Appendix A: Question Wording

ESS-Gallup mixed mode methodology experiment – Phase 2, Telephone questionnaire, Hungary

1. On an average weekday, how much time, in total, do you spend watching television?
[INTERVIEWER WRITE IN HOURS AND MINUTES]
2. How much of this [response from 1] is spent watching **news** or programmes about **politics and current affairs**? [INTERVIEWER WRITE IN HOURS AND MINUTES]
3. Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people? Please use a scale from 0 to 10, where 0 means you can't be too careful and 10 means that most people can be trusted. Pick a number from 0 to 10.
4. All things considered, how satisfied are you with your life as a whole nowadays? Please use a scale from 0 to 10, where 0 means extremely dissatisfied and 10 means extremely satisfied. Pick a number from 0 to 10.
5. How interested would you say you are in politics – are you very interested, quite interested, hardly interested, or not at all interested?
6. How often does politics seem so complicated that you can't really understand what is going on? Would you say never, seldom, occasionally, regularly, or frequently?
7. How easy or difficult do you find it to make your mind up about political issues? Do you find it very difficult, difficult, neither difficult nor easy, easy, or very easy?
8. How much do you personally trust each of the following institutions? Please use a scale from 0 to 10, where 0 means you do not trust an institution at all, and 10 means you have complete trust.
Firstly...**READ OUT**
 - a ...Hungary's parliament?
 - b ...the legal system?
 - c ...the police?
 - d ...politicians?
 - e ... political parties?
 - f ...the European Parliament?
 - g ...the United Nations?
9. Some people don't vote nowadays for one reason or another. Did you vote in the last Hungarian national election in April 2002? [Yes; No; Not eligible to vote]

IF YES AT Q9

10. Which party did you vote for in that election in April 2002? [Centrum Párt, Fidesz - MPP - MDF, FKGP, MIÉP, MSZP, Munkáspárt, SZDSZ, Other]

ASK ALL

Now some questions about people from other countries coming to live in Hungary.

11. To what extent do you think Hungary should allow people of the same race or ethnic group as most Hungarian people to come and live here? Do you think Hungary should allow many to come and live here, allow some, allow a few, or, allow none?
12. How about people of a different race or ethnic group from most Hungarian people? Do you think Hungary should allow many to come and live here, allow some, allow a few, or, allow none?
13. How about people from poorer countries outside Europe? Do you think Hungary should allow many to come and live here, allow some, allow a few, or, allow none?
14. Would you say it is generally bad or good for Hungary's economy that people come to live here from other countries? Please use a scale from 0 to 10, where 0 means it is bad for the economy and 10 means it is good for the economy. Pick a number from 0 to 10.
15. And would you say that Hungary's cultural life is generally undermined or enriched by people coming to live here from other countries? Use a scale from 0 to 10, where 0 means that Hungary's cultural life is undermined and 10 means Hungary's cultural life is enriched. Pick a number from 0 to 10.
16. Is Hungary made a worse or a better place to live by people coming to live here from other countries? Again, use a scale from 0 to 10, where 0 means Hungary would be made a worse place to live and 10 means Hungary would be a better place to live. Pick a number from 0 to 10.
17. I am now going to read out some statements about men and women and their place in the family. Please tell me how much you agree or disagree with each one.
 - a. Firstly: "A woman should be prepared to cut down on her paid work for the sake of her family." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
 - b. Secondly: "Men should take as much responsibility as women for the home and children." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
 - c. Thirdly: "When jobs are scarce, men should have more right to a job than women." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
 - d. Finally: "When there are children in the home, parents should stay together even if they don't get along." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
18. I'm now going to read out two more statements. Please say to what extent you agree or disagree with each one.
 - a. Firstly: "Gay men and lesbians should be free to live their own life as they wish." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
 - b. Secondly: "Whatever the circumstances, the law should always be obeyed." Do you agree strongly, agree, neither agree nor disagree, disagree, or, disagree strongly?
19. Regardless of whether you belong to a particular religion, how religious would you say you are? Please use a scale from 0 to 10, where 0 means you are not at all religious and 10 means you are very religious. Pick a number from 0 to 10.

20. Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays? Is it at least once a week, at least once a month, less often than that, or never?
21. How would you describe the area where you live? Is it a big city, the suburbs or outskirts of a big city, a town or small city, a country village, or a farm or home in the countryside?
22. What is the highest level of education you have achieved? Is it... **READ OUT**

....nem járt iskolába,	01
1-4 osztály elemi/általános iskola vagy azzal egyenértékű,	02
5-7 osztály általános iskola vagy azzal egyenértékű,	03
befejezett általános iskola vagy azzal egyenértékű,	04
szakmunkásképző, szakiskola,	05
befejezetlen középiskola,	06
érettségi, befejezett középiskola vagy azzal egyenértékű,	07
érettségire épülő felsőfokra nem akkreditált szakképzés,	
középfokú technikum,	08
felsőfokra akkreditált szakképzés, felsőfokú technikum,	09
befejezetlen felsőfokú tanintézet (főiskola vagy egyetem),	10
főiskolai diploma,	11
egyetemi diploma,	12
posztgraduális végzettség,	13
felsőfokú végzettség, tudományos fokozattal?	14
Other (WRITE IN):	15

23. Can I just check, did you do any paid work (of an hour or more) in the last seven days? [Yes; No]

IF NO AT Q.23

24. Have you ever had a paid job? [Yes; No]

INTERVIEWER: If respondent currently in work (Yes at 23), ask 25 about current job; if not in paid work but had a job in the past (Yes at 24), ask 25 about last job. [If never had paid job, skip to Q.28]

25. a. What kind of work do/did you do? Is/was it non-manual, or manual?

IF NON-MANUAL AT Q.25a

- b. And how would you describe your job? Is/was it... **READ OUT**

INTERVIEWER: USE EXAMPLES GIVEN IF RESPONDENT ASKS FOR CLARIFICATION

...senior professional,	1
(e.g. accountant, solicitor, medical practitioner, scientist, civil/mechanical engineer)	
other professional,	2

(e.g. teacher, nurse, physiotherapist, social worker, welfare officer, artist, musician, police officer [sergeant or above], software designer)

senior manager or administrator, 3
(usually responsible for planning, organising and co-ordinating work and for finance, such as finance manager, chief executive)

Middle or junior manager or administrator, 4
(e.g. office manager, retail manager, bank manager, restaurant manager, warehouse manager, publican)

or, other clerical? 5
(e.g. secretary, personal assistant, clerical worker, office clerk, call centre agent, nursing auxiliary, nursery nurse)

IF MANUAL AT Q.25a

c. And how would you describe your job? Is/was it...READ OUT

INTERVIEWER: USE EXAMPLES GIVEN IF RESPONDENT ASKS FOR CLARIFICATION

...a technical or craft occupation, 1
(e.g. motor mechanic, fitter, inspector, plumber, printer, tool maker, electrician, gardener, train driver)

An intermediate manual or service occupation, 2
(e.g. postal worker, machine operative, security guard, caretaker, farm worker, catering assistant, receptionist, sales assistant)

Or a routine manual or service occupation?, 3
(HGV driver, van driver, cleaner, porter, packer, sewing machinist, messenger, labourer, waiter/waitress, bar staff)

ASK ALL

26. What is/ was the name or title of your main job? **WRITE IN**

27. In your main job, what kind of work do/did you do most of the time? **WRITE IN**

28. When thinking about your household's **net** income, do you think in terms of your weekly income, your monthly income, or your annual income?

29. **INTERVIEWER REFER TO APPROPRIATE SECTION OF INCOME TABLE BELOW**

People's income comes from lots of different sources, such as wages or salaries, pensions, social benefits, savings, investments and so on. If you add up your household's total **net** income from **all** sources, is it...READ OUT FIGURES FROM APPROPRIATE COLUMN.

INTERVIEWER: PROBE FOR ESTIMATE IF EXACT FIGURE UNKNOWN.

[example for monthly income]

- ... less than €500 per month, 1
- between €500 and €2000 per month, 2
- between €2000 and €5000 per month, 3
- or, more than €5000 per month? 4

BAND	WEEKLY (IF 1 AT Q28)	MONTHLY (IF 2 AT Q28)	ANNUAL (IF 3 AT Q28)
1	up to €120	up to €500	up to €6000
2	up to €460	up to €2000	up to €24000
3	up to €1150	up to €5000	up to €60000
4	more than €1150	more than €5000	more than €60000

30. IF ANSWER GIVEN AT Q29

INTERVIEWER: REFER TO TABLE BELOW AND GIVE BREAK-DOWN FIGURES FOR BAND GIVEN AT Q29.

You have said your **net** household income is [*refer to figure given at Q29*] is that [e.g.] €500 to €1000 per month,

€1000 to €1500 per month, or €1500 to €2000 per month?

3

ND	proximate net WEEKLY income	proximate net MONTHLY income	proximate net ANNUAL income
	less than €40	less than €150	less than €1800
	€40 to under €70	€150 to under €300	€1800 to under €3600
	€70 to under €120	€300 to under €500	€3600 to under €6000
	€120 to under €230	€500 to under €1000	€6000 to under €12000
	€230 to under €350	€1000 to under €1500	€12000 to under €18000
	€350 to under €460	€1500 to under €2000	€18000 to under €24000
	€460 to under €580	€2000 to under €2500	€24000 to under €30000
	€580 to under €690	€2500 to under €3000	€30000 to under €36000
	€690 to under €1150	€3000 to under €5000	€36000 to under €60000
	€1150 to under €1730	€5000 to under €7500	€60000 to under €90000
	€1730 to under €2310	€7500 to under €10000	€90000 to under €120000
	€2310 or more	€10000 or more	€120000 or more

31. **INTERVIEWER CODE SEX OF RESPONDENT** [male; female]
32. In which year were you born? [**INTERVIEWER WRITE IN YEAR**]
33. Can I just check, do you have a mobile telephone? [Yes; No]
34. Do you have access to the Internet at home or at work? [Yes, at home; Yes, at work; Yes, both at home and work; No]
35. If you were asked to do a survey at home that would take about an hour, how would you choose to answer the questions? Would it be face-to-face interview, telephone interview, filling in a paper questionnaire, filling in a questionnaire on the web, or some other way? (**WRITE IN**)
36. Some people feel a bit uneasy about some questions in surveys. I'll mention several types of question. Please tell me for each one whether or not you felt uneasy about answering them. [Yes; No]
- Questions about your income
 - Questions about people from other countries coming to live in this country
 - Questions about politics in general
 - Questions about voting
 - Questions about religion
 - Questions about men and women's place in the home
37. Can I just check, what kind of telephone are you using to talk to me? Is it a fixed-line telephone with a wire attaching the handset to the base, a fixed-line telephone with mobile handset, a mobile (cellular) phone, or something else?
38. Many people find they are able to do other things while talking on the telephone, for example housework, cooking, watching television, reading, using a computer or minding children. During the course of the interview, were you doing anything else while we were talking? (**IF YES:** What were you doing?) [**INTERVIEWER CODE:** No; Housework / cooking; Watching TV; Reading / Using a computer; Minding children; Other]
39. Can I just check, are you at home at the moment or somewhere else? (**IF SOMEWHERE ELSE:** Where?) [**INTERVIEWER CODE:** At home; At work/ office; In a restaurant / bar; On a bus / train / tram; In a public place; Other]
40. Now we have finished the interview, I just want to ask you about the length of the interview. Would you have been willing to continue much longer, a bit longer, or not at all?

QUESTIONS FOR INTERVIEWERS (COMPLETED AT THE END OF THE INTERVIEW)

1. Did the respondent ask for clarification on any questions? [Never; Almost never; Now and then; Often; Very often]
2. Did you feel the respondent was reluctant to answer any questions? [Never; Almost never; Now and then; Often; Very often]

3. Did you feel that the respondent tried to answer the questions to the best of his or her ability? [Never; Almost never; Now and then; Often; Very often]
4. Overall, did you feel the respondent understood the questions? [Never; Almost never; Now and then; Often; Very often]
5. Did anyone else present influence the responses given? [Yes; No]
6. Did the respondent appear to be distracted in any way during the interview? [Yes; No; Maybe]

Appendix B: Definitions of Indicators of Social Undesirability

High hours watching TV per weekday: Q1 = 3.0 or more

Low proportion of current affairs viewing: $Q2/Q1 < 0.25$

Low trust in others: $Q3 < 4$

Low life satisfaction: $Q4 < 4$

Uninterested in politics: Q5 "hardly interested" or "not at all interested"

Politics is complicated: Q6 "regularly" or "frequently"

Making mind up about political issues: Q7 "difficult" or "very difficult"

Did not vote in general election: Q9 "no"

Allow no same-race immigrants: Q11 "none"

Allow no different-race immigrants: Q12 "none"

Allow no immigrants from poorer countries: Q13 "none"

Immigration bad for economy: $Q14 < 4$

Immigration undermines cultural life: $Q15 < 4$

Immigration makes Hungary a worse place: $Q16 < 4$

Women should be prepared to cut down on paid work: Q17a "agree" or "agree strongly"

Men need not take responsibility for home and children: Q17b "disagree" or "disagree strongly"

Men have more right to a job than women: Q17c "agree" or "agree strongly"

Parents need not stay together if they don't get along: Q17d "disagree" or "disagree strongly"

Gays should not be free to live as they wish: Q18a "disagree" or "disagree strongly"

The law need not always be obeyed: Q18b "disagree" or "disagree strongly"

Low religiosity: $Q19 < 4$

Never attends religious services: Q20 "never"

Top or bottom income quintiles: Income (Q29, Q30) $< 75,000$ or $> 340,000$ Forint