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Methodology

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This paper aims to identify the interviewer characteristics that influence survey cooperation. A multilevel cross-classified logistic model with random interviewer effects is used to account for clustering of households within interviewers due to unmeasured interviewer attributes, and for the cross-classification of interviewers within areas. We find that interviewer confidence and attitudes play an important role in explaining between-interviewer variation in refusal rates. We also find evidence of interaction effects between the interviewer and householder, for example with respect to gender and educational level, supporting the notion of similarity of interviewers and respondents generating higher cooperation. The results are discussed with respect to potential implications for survey practice and design.

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Abstract

Interviewers play a crucial role in gaining cooperation from a sample unit. This paper aims to identify the interviewer characteristics that influence survey cooperation. Of principal interest to survey practitioners are interviewer attributes associated with higher cooperation rates, particularly among sample members whose characteristics are traditionally associated with a lower probability of response. Our data source is unusually rich, in that it contains extensive information on interviewers including their attitudes and behaviors which is linked to detailed information on both responding and nonresponding sample units. An important value of the data is that they permit examining a host of as yet unanswered questions about whether some interviewer attributes stimulate cooperation among some respondents but not others. In short, we investigate if some sample units react favorably to certain interviewer characteristics. A multilevel cross-classified logistic model with random interviewer effects is used to account for clustering of households within interviewers due to unmeasured interviewer attributes, and for the cross-classification of interviewers within areas. The model allows for statistical interactions between interviewer and household characteristics.

We find that interviewer confidence and attitudes towards persuading reluctant respondents play an important role in explaining between-interviewer variation in refusal rates. We also find evidence of interaction effects between the interviewer and householder, for example with respect to gender and educational level, supporting the

notion of similarity of interviewers and respondents generating higher cooperation. The results are discussed with respect to potential implications for survey practice and design.

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Introduction

As survey response rates continue to decline, efforts to understand how they affect the quality of survey estimates abound (Keeter et al., 2000; Groves and Peytcheva, 2008). One challenge is clear - the field must first understand the mechanisms that affect the decision to participate in a survey, and then learn how those mechanisms relate to the survey variables we wish to measure. However, efforts to understand survey participatory decisions have been plagued by inadequate data resources informative about nonrespondents.

In face-to-face and telephone surveys one of the survey participatory mechanisms under partial control of the researcher is the interviewer. Survey methodology has long recognized the essential role of the interviewer in the quality of survey estimates (e.g. Feldman, et al. 1951-52; Hanson and Marks, 1958). The interviewer in telephone and face-to-face surveys is the key agent of the researcher: interviewers define the purposes of the survey to the sample persons, provide them with a key rationale for participating in the survey, address any concerns and find convenient times for the respondent to be interviewed.

The interviewer activities are crucial determinants of the coverage error, sampling bias, nonresponse error and measurement error of the resulting survey estimates. For that reason, survey methodology has studied observable attributes of interviewers that affect the measurement properties of survey responses. This research has shown that when observable characteristics of interviewers are thematically linked to the constructs of the measurement, measurement error variance associated with interviewers can be induced (e.g. for gender-induced effects see Kane and Macauley, 1993; Flores-Macias and Lawson, 2008). In statistical terms, these effects might be viewed as fixed-effects; that is, they are conceptualized as systematic influences that are repetitive over realizations of the survey. For example, in some sense, female interviewers would be

expected to generate different responses than male interviewers on gender-sensitive items. Another literature on interviewer effects examines variation without explicitly identifying its source. "Interviewer variance" (due to unobserved characteristics) is the variability in survey estimates expected to arise when survey estimates vary depending on which interviewers conduct the data collection. Such interviewer variance is a source of instability in estimates, additional to that of sampling variance. Interviewer variance has been shown to have magnitudes that rival sampling variance in some studies (Bailey, Moore and Bailar, 1978) and there is some evidence of larger interviewer variance as a function of interviewer training and experience (Freeman and Butler, 1976; Fowler and Mangione, 1990).

While the above literature is large, it focuses on *measurement* error properties of survey data and how interviewers affect them. In contrast, there is relatively little literature on how interviewers affect survey nonresponse. Interviewers with more experience and interviewers who report more confidence about their performance prior to the survey tend to have higher cooperation rates (Groves and Fultz, 1985; Hansen, 2007; Groves and Couper, 1998). There is also some evidence of higher cooperation when attributes of interviewers and respondents are matched (Moorman et al., 1999). However, many of the prior studies have the weakness of being post-hoc analyses, fraught with nonobservation of those who are not interviewed. They often have only limited information available on interviewers, are only based on a small number of interviewers and analyze effects in only one survey with a specific design and survey topic, which make general conclusions more difficult (e.g. O'Muircheartaigh and Campanelli, 1999; Pickery et al., 2001).

This paper addresses a unique match of survey data with census data. A key strength of this study is the rich information available on the interviewers and both the responding and nonresponding sample units. The interviewer information includes

details about demographic characteristics, workload and experience, attitudes to interviewing and interviewing strategies and behaviors. The interviewer data are linked to detailed person-level and household-level information, as well as information about each call made to the household. This unique type of data permits the investigation of interaction effects between characteristics of sampled units and those of interviewers which for many other studies has not been possible so far due to data limitations (Groves and Couper, 1998; O'Muircheartaigh and Campanelli, 1999; Pickery and Loosveldt, 2002, 2004). This study also takes account of several surveys simultaneously.

This paper asks the following questions:

1. What are the attributes of interviewers that affect response rates?

2. Are different interviewer attributes important for the participation of different sample units?

3. Do interviewer-level influences on cooperation depend on survey designs?

To address these questions we use multilevel cross-classified models with random interviewer effects to account for individual interviewer characteristics, the clustering of households within interviewers and the cross-classification of interviewers within areas. The models allow for statistical interactions between interviewer and household characteristics.

The structure of the remainder of the paper is as follows. First, the study design and data available are described. Then, the analysis method and the results are discussed. The final section makes some concluding remarks and discusses the implications of the findings for survey practice.

Study Design and Data

This study benefits from detailed information about interviewers obtained via a survey of face-to-face interviewers employed by the UK Office for National Statistics (ONS) in

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2001 (Interviewer Attitude Survey, IAS). The timing of the survey was chosen to coincide with the 2001 UK Census. The design of the survey and the questionnaire were conceptually based on earlier work by Groves and Couper (1998) and Hox and De Leeuw (2002). The survey provided information on socio-demographic characteristics, interviewer experience, work background, workload planning and organization, interviewing strategies, doorstep approaches, behaviors and attitudes, including attitudes and feelings towards refusal, persuasion of reluctant respondents, gaining cooperation, working at different times and days of the week and travel preferences. In total, the questionnaire included about 170 items. The questionnaire was filled in by the interviewers using a Computer Assisted Self-Interviewing instrument (CASI). Participation in the survey was voluntary and interviewers who participated in the survey were paid one hour for their time. The survey was not anonymous because identifying information was needed to link the resulting data to other data sources. Nevertheless, interviewers were reassured that the results would only be used for research purposes. Two reminders were sent to interviewers that did not return the questionnaire. In total about 84% of interviewers replied to the survey. More information about the IAS survey can be found in Freeth et al. (2002).

The main advantage of this study is that these interviewer data have been linked to other sources of information, including the response outcomes of six major household surveys. In an elaborate design that required years to complete, detailed information about both responding and nonresponding households has been obtained from the UK 2001 Census for each person in the sample housing units. These data provide socio-economic and demographic characteristics of the individuals living in the sampled households, as well as a wide range of household characteristics. In addition, for every call to the household the interviewer recorded any observations made via an interviewer observation (IO) questionnaire, referred to as field-process or paradata

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(Couper, 1998). These observations include basic information about the household, characteristics of the accommodation, household composition, the quality of housing and observations about the neighborhood, such as presence of children, gender and age of the householder talked to at each contact, presence of physical impediments and if the interviewer feels safe in the area after dark. (The IO information also includes records about time and day of the call. However, these data will not be considered in this paper.) Area-level data from aggregated census data were also linked. The area data include variables such as population density, the percentage of the population living in houses, flats and communal establishments, the percentage belonging to a certain age, ethnic or economic activity group or religion, and unemployment rate. The linkage was carried out and checked by ONS. Although the data have been expensive to collect they only recently became available for research purposes and further analysis. More detailed information about the study rationale, the data collected and the linkage of the different data sources can be found in Durrant and Steele (2009) and White et al. (2006).

The six cross-sectional household surveys included in the study cover a wide range of topics and vary in their design and requirements. The six surveys are: the Expenditure and Food Survey (EFS), the Family Resources Survey (FRS), the General Household Survey (GHS), the Omnibus Survey (OMN), the National Travel Survey (NTS) and the Labour Force Survey (LFS). The survey topics range from expenditure to travel habits. Two of the surveys (EFS and NTS) require keeping a diary and have long questionnaires, with a high demand on the survey participant. Two surveys (OMN and LFS) have short questionnaires and ask general questions about accommodation, employment, income, education and health. The surveys also vary in their length of data collection period, interviewer workload and the interviewer training that each interviewer receives prior to the survey. An overview of the differences in the design of the six surveys that may affect cooperation is given in Table 1.

The outcome of the six surveys, and the dependent variable in our analysis, is defined as an indicator of refusal versus cooperation, conditional on the interviewer having made contact with the household. Household cooperation is defined as obtaining an interview from *at least one* member of the household, including both full (i.e. *all* household members respond) and partial cooperation (i.e. *at least one* but not all respond). Five of the six surveys require that all persons 16 years and older take part in the survey; in the Omnibus survey only one person from each household is selected for interview. (For analysis purposes, we regard this as a special case of full response.) There is substantial variation in refusal rates across surveys from just over 30% for the EFS to about 14% for the LFS (see Table 1), which may be explained by the differences in survey topics, interview length, length of data collection period, and additional requirements such as a diary.

The analysis sample includes all households selected for interview and successfully contacted in one of the six surveys during May-June 2001, the months immediately following the 2001 census. Certain cases have been deleted from the analysis as described in detail in Durrant and Steele (2009), such as non-eligible persons, vacant homes and re-issues (i.e. cases where there was a change in interviewer after the first interviewer had been unsuccessful in gaining cooperation from a household), resulting in a dataset of 17701 contacted households, 564 interviewers and 392 areas. The exact wording of the questions and the percentage distribution within categories of the variables included in the final multilevel model of Sections 3 and 4 are given in Tables 1 and 2 of the online Appendix.

When analyzing interaction effects between the householder and the interviewer ideally one would like to investigate the characteristics of the person at the doorstep. This, however, is difficult since usually this person cannot be identified in the data

available. Here, we use information obtained from interviewer observation data on gender and approximate age of the person that the interviewer talked to at first contact. Also, to be able to use variables measured at the individual level in our models on household-level nonresponse, we define some variables for the household reference person (HRP) to represent the household as a whole (for further justification see Durrant and Steele, 2009).

The interpretation of interviewer effects may be complicated by their confounding with area effects. In clustered survey designs an interviewer is normally assigned to a primary sampling unit (PSU) and their workload consists of all sampled households in that PSU. Occasionally an interpenetrated design is employed, where interviewers are allocated at random to households, enabling - at least to some extent - a separation of interviewer and PSU effects (O'Muircheartaigh and Campanelli, 1999; Schnell and Kreuter, 2005). More often, however, no such design is employed. Area effects are then usually ignored in the analysis or area information is not available (e.g. Pickery and Loosveldt, 2004). Due to the high costs involved, the surveys included in the Census Link Study also did not employ interpenetrated sampling designs. Consequently, it is not possible to fully separate interviewer from PSU effects. However, a complete confounding of area and interviewer effects was avoided: most interviewers work on several surveys and some mobile interviewers exist, leading to interviewers working across PSUs; we also allow for area effects in our models where areas are defined at the local authority district level, a geographical area slightly larger than a PSU. As a result, interviewers and areas are cross-classified, i.e. an interviewer may work in several areas and an area may be covered by several interviewers. We do not claim to be able to disentangle area and interviewer effects precisely. We argue that the interviewer characteristics of primary interest, such as attitudes and behaviors, are unlikely to be correlated with area characteristics such as population density. Under this assumption, a

significant effect of an interviewer-level variable may be interpreted as an interviewer rather than an area effect.

Analysis Methods

We use a multilevel cross-classified logistic model to explore the effects on the probability of refusal of interviewer characteristics and interviewer-household interactions. A multilevel model allows for the correlation in nonresponse probabilities for households allocated to the same interviewer. Using standard regression analysis, which does not account for such clustering, results in underestimation of standard errors, which in turn leads to overstatement of the statistical significance of effects. The downward bias in standard errors is especially severe for coefficients of higher-level variables, interviewer characteristics in the present case. A cross-classified model accommodates the effect of more than one type of nesting which occurs at the *same* level (here interviewers and areas), allowing for the cross-classification of areas and interviewers (see Goldstein, 2003). Other authors have used similar multilevel models for the analysis of interviewer effects on nonresponse (Pickery et al., 2001; Hox, 1994; O'Muircheartaigh and Campanelli, 1999).

We denote by $y_{i(jk)}$ the outcome for household i contacted by interviewer j in area k, where the cross-classification of interviewers and areas is indicated by placing their indices in parentheses. The dependent variable is coded as

$$y_{i(jk)} = \begin{cases} 0 & \text{cooperation} \\ 1 & \text{refusal.} \end{cases}$$

Denoting the probability of refusal by $\pi_{i(jk)} = \Pr(y_{i(jk)} = 1)$, and taking cooperation as the reference category, the multilevel cross-classified logistic model for refusal can be written as

$$\log\left(\frac{\pi_{i(jk)}}{1 - \pi_{i(jk)}}\right) = \boldsymbol{\beta}^T \boldsymbol{x}_{i(jk)} + u_j + v_k, \tag{1}$$

where $\boldsymbol{x}_{i(jk)}$ is a vector of household, interviewer and area-level covariates and

interactions, $\boldsymbol{\beta}$ is a vector of coefficients and u_j and v_k are random effects,

representing unobserved interviewer and area effects respectively. The random effects

are assumed to follow normal distributions, i.e. $u_j \sim N(0, \sigma_u^2)$ and $v_k \sim N(0, \sigma_v^2)$. The

variance parameters σ_u^2 and σ_v^2 are respectively the residual between-interviewer and

between-area variances in the log-odds of refusal versus cooperation. Variables that were

not statistically significant at the 10% level, and that did not interact significantly with

other variables, were removed from the model. Due to the large number of available

predictors and possible interaction terms we restricted our analysis to terms of scientific

interest as informed by the theoretical substantive framework. The models were

estimated using Markov chain Monte Carlo (MCMC) methods in MLwiN (Rasbash et al.

2008b; Browne, 2008) with non-informative priors. The parameter estimates and

standard errors are the means and standard deviations of 80,000 chains, after a burn-in

of 5000 (Browne, 2008). To aid interpretation we calculated predicted probabilities, using

a simulation approach to average over the interviewer and area random effect

distributions (see Rasbash et al., 2008a).

Results

Between-Interviewer Variance in Survey Participation

Table 2 summarizes estimates of the interviewer and area random effect variances from

alternative specifications of the multilevel logistic models for refusal. All models include

dummy variables for survey to account for design differences among the six surveys. The

table also shows the DIC (deviance information criterion) diagnostic which can be used

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for model comparison, with a smaller DIC indicating a better fit (Spiegelhalter et al. 2002).

[Table 2 about here]

Comparing Model 0, including only survey effects and no interviewer or area random effects, with the same model including either interviewer (Model 1a) or area (Model 1b) random effects, we see that the DIC is reduced by 121 and 67 respectively, suggesting between-interviewer and to a lesser extent between-area variation in cooperation rates. For both models the interviewer and area variances are significant with the area variance just over half the size of the interviewer variance. We then fitted a cross-classified model that accounts for interviewer and area effects simultaneously (Model 2), reducing the DIC by 7 in comparison to the model with only interviewer effects (Model 1a). The interviewer variance is still highly significant and about three times larger than the area variance, which is only marginally significant. Including household-level characteristics (Model 3) reduces the DIC by a further 415 (=18338-18753) and halves the area variation which is no longer significant, suggesting that household characteristics explain most of the area variation, as would be expected (O'Muircheartaigh and Campanelli, 1999; Schnell and Kreuter, 2005). The interviewer variation appears almost unaffected by the addition of household-level variables. Including interviewer-level variables, their interactions with household characteristics and their interactions with the survey indicators in Model 4 explains about half of the interviewer variation. Nevertheless, there remains a small amount of unexplained significant interviewer variation. This compares to findings in O'Muircheartaigh and Campanelli (1999) who found interviewer effects were no longer significant once the effects of interviewer-level variables were controlled. The area variance is unaffected by the introduction of the interviewer-level variables, suggesting that we are indeed explaining interviewer variation rather than area variation with the interviewer-level

characteristics. The final model (Model 5) also accounts for area variables, which have virtually no effect on either the interviewer-level variance or the DIC diagnostic and reduce the area variability by only a small amount. The interpretation of the final model (Model 5) is discussed in the following sections.

What are the Attributes of Interviewers that Affect Response Rates?

There are three streams of research that have focused on the mechanisms underlying interviewer effects on response rates. The earliest (Durbin and Stuart, 1951) observed that more experienced interviewers, probably through skill acquisition and demonstration over time, achieved higher response rates. The second, compatible with the first, observed that independent of experience, perceived confidence in one's abilities allowed interviewers to perform better (Groves and Couper, 1998). Finally, several works suggest that high-response rate interviewers are focused on respondent concerns (Morton-Williams, 1993) and tailor their introductory behaviour to individual respondents (Groves and Couper, 1998). The weakness of the past research, however, is that it generally failed to statistically control for attributes of the sample households affecting response propensies, risking confounding between interviewer and householder effects. Our data allow us to explore simultaneously each of these three streams of research and to control for household and area characteristics. We describe the findings of the final model (Model 5), presented in Tables 3 and 4.

[Tables 3 and 4 about here]

The influence of the household-level variables in Model 5, while focused on the interviewer, can be briefly summarized as follows (see Durrant and Steele, 2009): refusal is higher for a household in London and urban areas, which did not move during the last year, has no car, is occupied by a single person, had a household reference person of

lower education, is self-employed and regards his/her health as not good. On the other hand, refusals are lower in households with children and with caregivers. We also found interviewer observation variables to be significant and two were included in the final model: the refusal probability is higher if the house is in a worse condition than others in the area and if the householder at first contact is male. After controlling for household characteristics, only one area-level variable remained significant - the percentage of the population between 0 and 4 years old.We now turn to the interpretation of the three sets of interviewer influences: interviewer experience, confidence in abilities and interviewer behavior.

Interviewer experience and pay grade

A common finding in the past literature is that refusal rates decrease with increasing length of interviewer experience (Groves and Couper, 1998; Pickery and Loosveldt, 2002; Hox and De Leeuw, 2002). Some of these studies used interviewer corps with relatively few long-tenured interviewers. A potential limitation of research on interviewers is the problem of self-selection. We may expect better interviewers to stay in their job for longer and worse performing interviewers to change to a different job sooner. We are therefore limited in the interpretation of causal effects of, for example, length of interviewer experience, and only an experimental design may be able to disentangle such effects.

When experience is the only interviewer-level variable in our model, we also found it to predict lower refusal rates for more experienced interviewers. However, after controlling for the effect of pay grade, a different relationship between experience and the refusal rate emerges. With that statistical control, interviewers who have been in the job for 9 years or more seem to perform significantly less well than those with less experience. There is also an indication that the probability of refusal declines after 1-2

years experience (although effect is not significant). This curvilinear relationship between performance and length of experience has been hypothesized in the literature but has not before been supported by empirical evidence (Groves and Couper, 1998, p. 203). We interpret this as a potential disentangling of two underlying processes: most interviewers receive jumps in pay grade as they gain experience and measuring only the effects of experience confounds these two processes. Skill level, as reflected in pay grade, appears to be the real underlying mechanism driving response rates, not the simple length of time employed.

We also find that, after controlling for pay grade and length of years experience, interviewers who have worked 5 or more hours per day in the previous year have lower refusal rates than those who did not work or worked fewer hours per day last year, also supporting a potential role of interviewer experience. It is the common practice of survey organizations to provide larger workloads to higher-performing interviewers, and thus this finding may be endogenous to refusal rates.

Interviewer confidence and attitudes

The second set of prior research examined whether confidence, attitudes and expectations of interviewers affect the propensity to respond. Prior work on interviewer attitudes has been limited to bivariate or interviewer-level analyses, usually with the interviewer-level response rate as the dependent variable (e.g. Groves and Couper, 1998; Hox and De Leeuw, 2002). In our analysis of household-level response, we find important effects of interviewer attitudes on cooperation rates. In particular, we find a strongly significant effect of the confidence of the interviewer and the attitude towards persuasion of reluctant respondents, both measured independently of the survey in question. Interviewers who report more confidence in their ability to persuade reluctant respondents, who believe they can persuade when others cannot and who disagree with

the statement 'no matter what I do some respondents will never agree to participate' show a lower probability of refusal. Interviewers who agree they should persuade reluctant respondents also have a lower refusal rate than interviewers that disagree with this statement. We found some indication that if interviewers believe that refusal is due to something they did, the refusal rate is higher. This finding may also indicate that interviewers who are less confident about their behavior may be less successful - although this variable was not significant in the final model. These findings on confidence show the important role of positive expectation (see Groves and Couper, 1998). It may indicate that interviewers who believe in themselves and their techniques may be able to persuade larger proportions of the sample. The results also stress the importance of being willing and able to persuade reluctant respondents, with interviewers that feel they can and should persuade being more successful. (We also find a survey-specific effect on confidence of interviewers which is discussed in the later section on survey designs.)

Interviewers who report that a refusal affects their behavior have on average lower refusal rates. Rather than interpreting this as an effect of confidence, it may be the case that these interviewers take the experience of a refusal as an opportunity to change their behavior and to adapt to new demands, leading to an improved performance. This may indicate an ability to tailor and to adjust the interviewer's technique to the sample unit. Interviewers were asked whether they supported 'sending a different interviewer if the respondent refused.' Those who support that policy tended to have lower refusal rates. This may indicate that interviewers who do not wish interference from other interviewers and who are possibly less open-minded towards another person's technique and skills are more likely to experience higher refusal rates.

The attitude of the interviewer to travelling longer distances, to staying overnight and to work evenings and weekends regularly, were all significant in initial modeling but

not in the final model after controlling for other interviewer-level variables. We may conclude that more persistent interviewers, interviewers that believe in themselves, that are confident and feel able to persuade reluctant respondent may be more successful at gaining cooperation.

Interviewer behaviors, strategies and approaches at the doorstep

Our measures of interviewer behaviors are self-reports from the questionnaire, administered independent of their working on the survey in question, asking interviewers about what they *generally* do, rather than being recorded at the contact level. It is clear from the literature on interviewer tailoring that such measures may not fully reflect the tendency for successful interviewers to vary their behaviors both across and within contacts with respondents (Morton-Williams, 1993). Thus, we focused particularly on variables that may indicate the ability and willingness of the interviewer to tailor their approach to each household they visit and on variables representing the interviewer's doorstep approach. The following variables were used as indicators of tailoring ability: ability to deal with everybody in the same manner, use of the same or different introduction for each household, giving compliments to respondents about their house, the belief that respondents need a unique approach, and the interviewer's belief that they can change their approach, use a wide variety of approaches, or rather find it difficult to modify their approach from situation to situation. Variables related to interviewing techniques at the doorstep include: waiting to explain the survey, saying that the topic should interest and that the interviewer is not a salesperson, indicating that most people enjoy the interview, that the survey is a chance to express views, and explaining methods how sample members were selected. Although we found significant effects of some of these variables, most lost significance when other interviewer-level variables were added to the model or had non-interpretable main effects on refusal. For example, interviewers

who alter their introduction to fit each household they visit, who compliment the householder or who do not think that they can deal with everybody in the same manner seem to have lower refusal rates, when variables were entered each on their own. After controlling for other interviewer-level variables, however, all of these variables were non-significant.

Groves and Couper (1998) argue that main effects of interviewer behavior on survey cooperation may be unlikely because it is not whether certain strategies are adopted *in general* that is important, but whether strategies are *tailored* towards a sample unit. We believe that progress on identifying the specific behavioral mechanisms requires measurement at the conversational level (see Sturgis and Campanelli, 1998; van der Vaart et al. 2005). Also, rather than focusing on main effects of variables that may be interpreted as indications of tailoring it may be more important to investigate statistical interactions between interviewer and household characteristics. Given these results in Model 5, we note that the measured effects of interviewer experience and attitudes may be confounded with real unmeasured behavioral differences related to experience and attitudes. In contrast to past work, however, they do control for household-level attributes.

Are different interviewer attributes important for the participation of different sample persons?

An important value of the data is that they permit examining a host of as yet unanswered questions about whether some interviewer behaviors and attributes stimulate cooperation among some respondents but not others. In short, do some sample units react favorably to interviewer approaches that others would reject? Most of the past literature on this stems from one premise: interviewers and respondents sharing attributes might tend to produce higher response rates. Due to data limitations, there

has been little exploration of the statistical interactions between interviewers and householders in previous research on nonresponse (Groves and Couper, 1998; O'Muircheartaigh and Campanelli, 1999; Pickery and Loosveldt, 2002, 2004). One of the advantages of the Census Link Study is that its rich information on interviewers, linked to individual and household characteristics, permits such an analysis.

Socio-Demographic Interviewer Characteristics

We first test whether homogeneity between sample members and interviewers may result in higher probability of cooperation. The presence of such interactions may suggest ways of tailoring interviewing strategies for particular types of respondents. Information on such interactions may be used to match interviewers to sample units.

We find an interaction effect (significant at the 10% level) between the gender of the person at first contact and that of the interviewer. Female householders are more likely to respond than men if the interviewer is also female, while interviewer gender has no effect among male sample units (Table 4). We also found an effect (significant at the 5% level) in the same direction between gender of the HRP and that of the interviewer (effect was not additionally included in the model). These findings may be explained by a potential fear of crime of a woman towards a male stranger. It could also be explained by the *theory of liking* (Groves et al., 1992), which hypothesizes that people are favorably inclined towards those individuals who they like or have something in common with, such as similar characteristics or attitudes.

We found no significant interaction effect between age of the interviewer and age of the householder at first contact (using estimated age group of the householder obtained from interviewer observations). It should be noted that it is more difficult to estimate an approximate age group for the person at first contact than it is to record

gender, resulting in a higher proportion of 'age not known'. This measurement problem may be one reason for not finding a significant age interaction effect.

We also investigated interaction effects based on educational level. Since we do not have information on the education available for the person at the doorstep we use the variable education of the HRP who is representative for the household as a whole. We can see that the refusal rate is significantly lower in the case when both the householder and the interviewer have no or only a low educational attainment as well as when both have a college degree (Table 4). The refusal rate is higher for the case when the interviewer has a low educational level but the householder has a college degree. The probability is even higher if the interviewer has a college degree but the householder does not, and is highest for the case where the interviewer has only a low or no educational attainment and the householder has a professional degree of some form. This effect indicates that sample members may be favorably inclined towards those who they have something in common with and are somewhat like themselves, which may support the theory of liking. In short, the interaction effects found provide evidence for the notion of similarity of interviewers and respondents generating higher cooperation. This may support the practical decision of many survey managers to match interviewers with sample households if possible.

Influence of interviewer characteristics and self-awareness on persuading difficult households

The survey community has found (and our model supports), that certain types of households are more difficult to persuade, such as single-person households, households without children, households with unemployed persons. It is of interest to investigate the characteristics of interviewers that are more successful in persuading such difficult cases. In particular, we tested if level of confidence and experience of the interviewer had different effects on securing cooperation of more difficult households. The interviewer

questionnaire also asked if the interviewer believed certain types of persons were more difficult to persuade to participate in surveys. We thus could also investigate the effect of self-awareness of the interviewer.

We found some support for these hypotheses. Interviewers who report they are more confident in persuading reluctant respondents are more likely to be successful in persuading households without children for example, a group of households that generally is more difficult to persuade (Table 4; significant at 10% level). We also found some effects of self-awareness of the interviewer; for example if the interviewer reported finding it difficult to persuade households with children and if the household has dependent children the refusal rate was indeed higher (effect not included in the final model). In this case the interaction effect confirmed the self-awareness of the interviewer's difficulty in persuading a certain type of household. The findings may have implications for survey practice. It may be possible, for example after the first contact to the household, to allocate certain interviewers to more difficult cases, for example when re-issuing the case to a different interviewer, as part of responsive designs or a follow-up study.

Do Interviewer-Level Influences on Cooperation Depend on Survey Designs?

There is some evidence from studies of interviewer variance in responses, that interviewer effects arise most prominently when the challenge of the job becomes difficult (Mangione et al. 1992). The data set is uniquely well-suited to examining whether the strong correlates of high interviewer response rates are active for all six surveys. The hypothesis that would arise directly from the research literature is that survey designs that make less burdensome requests of respondents do not require the skills of the best interviewers. Indeed, it is common for interviewer managers to start off a new hire on "easy" cases or surveys when possible.

We considered a number of interactions of interviewer characteristics with the survey indicators. In particular we tested for survey-specific effects of a) socio-demographic characteristics of interviewers, such as age and gender; b) interviewer strategies and techniques, including style of doorstep approach such as use of the same or different introduction for each household, the ability to deal with everybody in the same manner, and what the interviewer says or does at the doorstep; and c) interviewer experience, interviewer education, experience of working for another survey organization and having another employment. In particular, effects c) were considered to explore the hypothesis that the level of experience and interviewer education are of greater importance in more complex surveys, such as those with a long questionnaire and a diary.

We found a survey-specific effect of how confident interviewers feel they are in persuading reluctant respondents (Table 4). For surveys that are more complex, i.e. have a more demanding survey topic, have a longer interview or require a diary, the level of confidence of the interviewer is important. Interviewers that feel more confident do significantly better than less confident interviewers in more complex surveys, such as the EFS with a long questionnaire, questions about income and expenditure and a two-week diary. For a less demanding survey, such as the LFS with only a short interview, the level of confidence does not lead to significant differences in the response propensities between more and less confident interviewers.

There are potentially important practical implications of this finding. It supports assertions that some survey protocols do not demand as much training on respondent recruitment issues as others and implies that allocation of experienced staff can be made more effectively.

Summary and Discussion

This paper has found empirical support for several key mechanisms through which interviewers affect survey response rates:

a) We identified significant effects of pay grade and interviewer experience. While more senior interviewers tend to achieve higher response rates, their skills recognized through promotion to higher pay grades seem to be more critical in understanding the effect; controlling on pay grade we actually find a decline in performance after 9 years in the job.

b) We found pervasive effects of interviewer confidence and attitudes; if interviewers express confidence in their abilities, they achieve higher response rates; interviewers with a positive attitude towards persuasion or those who agree they should persuade reluctant respondents tend to have lower refusal rates. In short, confident, engaged interviewers seem to perform better.

c) Like other studies, we find little predictive power from reports *at the interviewer-level* of interviewer behavior and interviewer ability to adapt to different situations; we view this as support for the notion that behavioral impacts on response rates depend on specific features of interactions with respondents (Maynard and Schaeffer, 1997).

d) Our unique data allowed the investigation of interaction effects between interviewers and householders. We found some evidence for the hypothesis that interviewers and respondents sharing attributes may tend to produce higher response rates. In particular, we found that female householders seem to be more cooperative with female interviewers than with male interviewers and that when interviewer and householder share educational backgrounds, higher response propensities exist.

e) We also investigated the influence of certain interviewer attributes on persuading more difficult cases. We found that confident interviewers did better than those with less confidence among households without children, a group commonly producing

lower response rates; similarly the more confident interviewers did better on the more difficult surveys. Both of these findings are consistent with the notion that, when the interviewing job gets difficult, the more confidence the interviewer has, the better the performance.

Although the illumination of these findings required complicated statistical modeling, there are practical implications for the field, for example regarding interviewer training and allocation of interviewers to sample units. Simply using the most experienced interviewers as a tool to maximize response rates may be myopic; it would be better to examine historical performance of interviewers (in these data measured by pay grade), since some long-term interviewers may perform less well than those with less experience.

The importance of confidence and a positive attitude towards persuasion may have implications for interviewer training. How interviewers assess their own abilities seems to make a difference, confidence and related attitudinal states measured independently of the survey performance seems to predict that performance. Interviewer training that contributes to such self-image as well as strategies for enhancing interviewer confidence and a positive expectation therefore merit consideration.

Our findings on interviewer-respondent interaction effects, such as on gender and education, suggests the matching of interviewer characteristics to different subgroups of the population, which may be of particular relevance for the design of interviewer call-backs, re-issues and follow-ups, for example in responsive survey designs. More confident interviewers seem to be most valuable on the most difficult surveys with simpler surveys showing a smaller effect of interviewer differences. Interviewer supervisors may have known or suspected some of the above, but our findings suggest that they may have more widespread applicability.

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Figures and Tables

Table 1: Summary of main survey characteristics for the six surveys. (adapted from Durrant and Steele, 2009).

Survey Design Characteristic	EFS	FRS	GHS	OMN	NTS	LFS
Length of data collection period	1 month +1 week	1 month	1 month	3 weeks	2.5 to 6.5 weeks	7+7+2 days (spread over 13 week period)
Interviewer workload in number of addresses	18	24	23	30	23	20
Type of additional interviewer training given (in addition to standard training)	1 day	1 day	briefing	postal	1.5 days	4 days (interviewers work only on this survey)
Purpose leaflet available	Yes: in the field	Yes: in the field	Yes: in the field	Yes	Yes: postal (London only)	Yes: postal
Respondent incentives	Stamps; £10/£5 for diary	Stamps	None	Stamps	Pen and fridge magnet	None
Respondent rules	All house-holders aged 16+	All house-holders aged 16+	All house-holders aged 18+	One house-holder aged 16+	All house-holders aged 16+	All house-holders aged 16+
Proxy response allowed	Yes	Yes	Yes	No	Yes	Yes
Average length of interview (in mins)	70	80	70	26	60	30 (for wave 1)
Diary required (in addition to questionnaire)	Yes: 2 weeks	No	No	No	Yes: 1 week	No

The surveys collect information based on the household as a whole and on the individuals within the households.

Information collected by survey:
EFS: Core topics include: household expenditure, rent and mortgage payments, taxes, benefits, detailed information about the income of each household member, and trends in nutrition.
FRS: Aims to provide information on living standards, people's relationship and interaction with the social security system. The questionnaire seeks information on income and benefits, tenure and housing costs, assets and savings, occupation and employment, health and ability to work, pensions and insurance, childcare and caregivers.
GHS: Core topics include: accommodation, consumer durables, housing tenure, migration, employment, pensions, education, health, smoking, drinking, family formation, and income.
NTS: Aims to provide a comprehensive picture of personal travel behaviour. Questions include ethnic group, place of work, reliability and frequency of local services such as buses and trains, use of vehicles, long distance journeys and travel outside of Great Britain.
OMN: Multi-purpose survey which aims to obtain information about the general population or about particular groups. The questionnaire is in two parts, including first a set of core classificatory questions and then a series of unrelated modules on varying topics at the request of customers. Core questions include information on demographic details, economic status, job details, employment status, full- or part-time working, tenure, and ethnic origin.
LFS: Aims to provide information about the UK labour market and unemployment. The survey seeks information on respondent's personal circumstances, their labour market status and income.

Table 2: Estimates (with 95% credible intervals) of the interviewer and area random effect variances from alternative specifications of the multilevel cross-classified logistic models for refusal. †

	Interviewer variance	SE	Area variance	SE	DIC
Model 0 (variable survey; hh level only)	--	--	--	--	18863
Model 1a (Model 0 with interv. Var)	0.094 (0.064; 0.129)	(0.017)	--	--	18742
Model 1b (Model 0 with area effects)	--	--	0.055 (0.032; 0.083)	(0.013)	18796
Model 2 (Model 1a with area var; cross-classified)	0.077 (0.047; 0.112)	(0.017)	0.026 (0.007; 0.052)	(0.011)	18735
Model 3 (Model 2 + household variables)	0.081 (0.049; 0.118)	(0.018)	0.013 (0.001; 0.037)	(0.010)	18338
Model 4 (Model 3 +interviewer variables)	0.040 (0.012; 0.070)	(0.015)	0.012 (0.001; 0.033)	(0.009)	18321
Model 5 (Model 4+area variables)	0.039 (0.015;0.069)	(0.014)	0.010 (0.001; 0.032)	(0.008)	18319

† The values in each cell are the point estimate (the means of 80,000 MCMC samples, with burn-in of 5,000) and the corresponding 95% interval estimate (the 2.5% and 97.5% points of the distribution). Standard errors (SE) are calculated as the standard deviations of the estimates from the MCMC samples.

Table 3: Estimated coefficients (and standard errors in parentheses) of multilevel cross-classified logistic model (Model 5).

Variable (0 = Reference category)	Categories	$\hat{\beta}$ $(ste(\hat{\beta}))$
Constant		0.06916 (0.180)
Household-Level Variables		
Survey indicator † (0 EFS)	1 FRS	-0.385 (0.074)**
	2 GHS	-0.636 (0.069)**
	3 OMN	-0.445 (0.069)**
	4 NTS	-0.470 (0.071)**
	5 LFS	-1.256 (0.083)**
Educational attainment (HRP) † (0 No educational attainment)	1 O/A levels, GCSEs (UK school degrees)	-0.229 (0.070)**
	2 First/Higher/College degree	-0.550 (0.089)**
	3 Other professional degree/ educational attainment	-0.283 (0.126)**
Household has no dependent children (0 household has dependent children)	1 no dependent children	0.242 (0.050)**
London indicator (0 not London)	1 London	0.185 (0.077)**
Rural indicator (0 Urban)	1 Rural	-0.188 (0.069)**
Economic Activity (HRP) (0 Employed)	1 Self employed	0.279 (0.066)**
	2 Unemployed	0.135 (0.124)
	3 Retired	-0.162 (0.061)**
	4 Looking after family	-0.097 (0.129)
	5 Other (incl. student, permanently sick etc)	-0.014 (0.086)
Perception on health (HRP) (0 Good)	1 Fairly good	0.130 (0.045)**
	2 Not good	0.126 (0.064)**
Caregiver in household (0 No)	1 Yes	-0.152 (0.051)**
Household type (0 Single household)	1 Couple household	0.069 (0.048)
	2 Multiple household	0.234 (0.069)**
Car Ownership (0 One car or more)	1 No car	0.117 (0.051)**
Household moved during last year (0 No)	1 Yes	-0.155 (0.077)**
Interviewer Observations		
Gender of householder at first contact † (0 Male)	1 Female	-0.021 (0.050)
House in a better or worse condition than others in area (0 Better)	1 Worse	0.433 (0.090)**
	2 About the same	0.101 (0.063)
Area-Level Variables		
Percentage of population between 0 and 4 years (centred)	(continuous variable)	0.076 (0.037)*

Interviewer-level variables (IAS)		
Interviewer gender † (0 Male)	1 Female	-0.037 (0.066)
Interviewer educational attainment † (0 Degree or postgraduate, College degree)	1 Academic attainment below College degree (O/A levels, GCSEs) 2 Lower, no, other educational attainment	-0.057 (0.072) -0.488 (0.206)**
Pay grade (0 Interviewer)	1 advanced interviewer and merit 1 and 2 2 merit 3 and field manager	-0.117 (0.070) -0.382 (0.094)**
Years of experience (0 Less than 1 year)	1 1 to 2 years 2 3 to 8 years 3 9 years or more	-0.021 (0.073) 0.060 (0.090) 0.267 (0.114)**
Daily hours previous year weekdays (1 5 and more hours)	1 0-4 hours	0.118 (0.062)*
Should persuade most reluctant respondent (0 strongly agree, agree)	1 neither agree nor disagree 2 disagree, strongly disagree	-0.155 (0.082)* 0.106 (0.065)*
Can persuade when others can't (0 disagree, strongly disagree)	1 neither agree nor disagree 2 strongly agree, agree	-0.105 (0.049)** -0.300 (0.096)**
Can convince reluctant respondents † (0 Less confident)	1 More confident	-0.648 (0.204)**
Refusal affects how behave (0 Rarely, never)	1 always, frequently, sometimes	-0.135 (0.054)**
No matter what I do, some respondents will never agree to participate (0 strongly agree, agree)	1 strongly disagree, disagree, neither agree nor disagree,	-0.212 (0.109)**
If respondent refused because too busy it is better to send a different interviewer † (0 strongly agree, agree)	1 strongly disagree, disagree, neither agree nor disagree	0.154 (0.078)**

Continued…

Interactions between interviewer and household characteristics		
Interviewer gender * Gender of householder at first contact (0 Male and 0 Male)	1*1 Female – Female	-0.125 (0.076)*
Educational attainment (HRP)* Interviewer educational attainment (0 No educational attainment and 0 Degree or postgraduate, College degree)	1*1 O/A levels, GCSEs – Academic attainment below College degree	0.051 (0.093)
	2*1 First/Higher/College degree – Academic attainment below College degree	0.084 (0.121)
	3*1 Other professional degree/ educational attainment – Academic attainment below College degree	0.045 (0.169)
	1*2 O/A levels, GCSEs – Lower or no educational attainment	0.121 (0.266)
	2*2 First/Higher/College degree – Lower or no educational attainment	0.627 (0.317)**
	3*2 Other professional degree/ educational attainment – Lower or no educational attainment	1.213 (0.451)**
Can convince reluctant respondents * household has no dependent children (0 Less confident and 0 household has dependent children)	1 More confident - no dependent children	0.198 (0.112)*
Survey-Specific effects		
Survey indicator * Interviewer can convince reluctant respondents (0 EFS and 0 Less confident)	1*1 FRS –more confident	0.290 (0.243)
	2*1 GHS-more confident	0.196 (0.228)
	3*1 OMN-more confident	0.295 (0.224)
	4*1 NTS-more confident	0.405 (0.233)*
	5*1 LFS-more confident	0.549 (0.222)**

The estimated coefficients and their standard errors are the means and standard deviations of parameter values across 80,000 Markov chain Monte Carlo samples, after the burn-in of 5000 and starting values from second order PQL estimation. The missing value categories have been suppressed to save space.

* significant at the 10% level
** significant at the 5% level
† interaction between interviewer characteristic and either survey or household characteristics
HRP information based on household reference person

Table 4: Predicted probabilities of refusal (in %) based on selected two-way interactions.†

Interaction between survey and interviewer attitude		EFS	FRS	GHS	OMN	NTS	LFS
Can convince reluctant respondent	Less confident	42.2	25.8	20.5	22.0	20.9	12.1
	More confident	30.7	22.0	16.4	19.3	19.6	11.7

Interaction between gender of the interviewer and householder at first contact		Interviewer Gender		
		Male	Female	
Gender of householder at first contact	Male	23.9	23.0	
	Female	23.5	20.8	

Interaction between education of interviewer and HRP		Education of Interviewer		
		Degree or postgraduate (University degree)	Academic attainment below University degree, O/A levels, GCSEs (school degrees in UK system)	Lower educational attainment, no attainment, other educational attainment
Education of HRP	No educational attainment	26.8	25.7	17.9
	Academic attainment below College degree, O/A levels, GCSEs (school degrees in UK system)	22.7	22.5	16.4
	First/Higher/ College degree	17.5	18.1	20.4
	Other professional degree, other educational attainment (e.g. City and Guilds)	21.6	21.5	36.2

Interaction between interviewer can convince reluctant respondents and household without dependent children		Interviewer can convince reluctant respondents		
		Less confident	More confident	
Dependent Children	Household without dependent children	19.1	13.1	
	Household with dependent children	15.6	8.9	

† Predicted probabilities are calculated by varying the values of the two interacting variables, holding all other covariates at their sample mean value. In the case of a categorical variable, the dummy variable associated with a particular category takes on the value of the sample proportion in that category instead of the usual 0 or 1 value.