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How and why does the mode of data collection affect consent to data linkage?

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We use experimental mixed-mode data from a probability survey in Great Britain to examine why respondents are less likely to consent to data linkage in online than face-to-face interviews. We find that the 30 percentage point difference in consent rates is a causal effect of the mode on willingness to consent; it is not due to selection of different types of respondents into web and face-to-face interviews. We find that respondents are less likely to understand the data linkage request, less likely to process the consent request thoroughly, and more likely to be concerned about privacy and data security when answering online rather than in a face-to-face interview. Using digital audio-recordings of the face-to-face interviews, we find that verbal behaviours of interviewers do not explain the mode effects: respondents only rarely ask questions or express concern, and interviewers only rarely offer additional information about the data linkage. We also examine which devices respondents used to complete the web survey and find that these do not explain the mode effects either. Finally, we test the effects of simplifying the consent request, by reducing the reading difficulty: while the easier wording increases understanding of the request, it does not increase consent in either mode. We conclude with a discussion of potential mechanisms that are consistent with our results and would require further testing.

Keywords: mixed modes; mode effect; consent wording; privacy concerns; data security concerns

1 Introduction

Linking data from administrative records to survey data is an increasingly attractive option, for a number of reasons. First, the number and scope of administrative records available in digital format are growing. Second, the rising cost of surveys and declining response rates to surveys are leading researchers to look for other sources to supplement or replace survey data. Third, the increasing demand for more—and more timely—data places increasing demands on respondents, again leading to a need for alternative data sources. Finally, process-generated administrative data can provide more detailed and accurate data than respondents' self-reports. The various ways in which administrative data can be used, whether to replace or enhance surveys, are detailed elsewhere (e.g. Benzeval et al., 2020; Calderwood & Lessof, 2009; Gates, 2011; National Academies of Sciences, Medicine, et al., 2017). The linking of survey and administrative data is not without challenges (Benzeval et al., 2020). A principal challenge faced by non-government survey organisations is the requirement to obtain informed consent from respondents to link their survey data to administrative records.

The rising costs of survey data collection that are leading researchers to look for alternative data sources are also leading to increased use of mixed-mode data collection. Many large longitudinal and cross-sectional surveys are integrating the web survey mode into their data collection protocol (Couper & McGonagle, 2019).

In this paper we examine why respondents are less likely

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to consent to data linkage in a web survey than a face-to-face interview—and what can be done to reduce this gap. We use experimental data to examine potential mechanisms. The findings have implications for how to design and implement consent questions.

Several studies have consistently found that consent to administrative record linkage is lower on the web than in an in-person interview (see the review of challenges in obtaining consent to data linkage in mixed mode surveys by Jäckle, Gaia, & Benzeval, 2017). Jäckle, Beninger, Burton, and Couper (2021) reported a consent rate of 67% for those interviewed face-to-face, compared with 48% for those who responded by web in Wave 9 of the *Understanding Society* Innovation Panel. These differences persisted when looking at assigned mode or using covariate adjustment or instrumental variable analysis to account for selection into mode. Sakshaug, Hülle, Schmucker, and Liebig (2017) reported a "strikingly lower" linkage consent rate (54%) in the self-administered mode (mail/web) than in the interviewer-administered mode (face-to-face; 94%) in a study with random assignment to mode in Germany. Thornby, Calderwood, Kotecha, Beninger, and Gaia (2018) also found differences in consent rates by mode, ranging from 89% for face-to-face, 90% for telephone, and 69% for web, in the Next Steps Age 25 Survey which employed a sequential mixed-mode design. Sample members were invited to complete online, with non-respondents then allocated first to telephone interviews, and then to face-to-face interviews. These results suggest that the increased use of the web in mixed-mode surveys raises significant challenges for administrative record linkage consent.

Given the rising use of the web for data collection and increased demand for administrative record linkages, there is a pressing need to understand the reasons behind these observed mode differences, and to find ways to increase rates of consent, especially on the web. However, maximizing consent rates is not the only goal. It is important to understand how informed respondents are about their decision to consent or not. There is relatively little research on this topic (for exceptions, see Das & Couper, 2014; Edwards & Biddle, 2021; Thornby et al., 2018). The goal is therefore not only to maximize consent, but to maximize *informed* consent to administrative record linkage.

This paper uses experimental data from the *Understanding Society* Innovation Panel to examine why consent rates are so much lower in online than face-to-face surveys and what can be done to increase informed consent in online surveys. As a starting point we examine the effect of mode on consent rates (replicating previous findings), as well as the effect on understanding the consent request and confidence in the consent decision. Our analysis of mode effects on consent understanding and confidence are, to the best of our knowledge, novel. We then examine potential mechanisms that could explain why mode affects consent outcomes: the influence of mode on respondents' attitudes towards privacy and data security; the influence of mode on the cognitive process by which respondents decide whether to consent; whether the device respondents use to complete the web survey plays a role; and interviewer behaviours in administering consent questions. Finally, we examine what can be done to reduce mode differences and increase informed consent in online surveys, by experimentally testing different approaches to wording the consent question. We conclude with a discussion of practical implications for survey design and further avenues for research.

2 Background and research questions

The conceptual framework that we use to examine how respondents decide whether to consent to data linkage, and why this decision process might be influenced by the mode of data collection, is largely based on qualitative in-depth interviews that explored how respondents make the decision whether to consent to data linkage and which factors influence their decision (Beninger, Digby, & MacGregor, 2017). In interpreting the findings from the qualitative interviews and developing our framework, we drew on the survey methods literature examining consistency of consent decisions over time (Jäckle et al., 2021; Mostafa & Wiggins, 2018; Weir, Faul, & Ofstedal, 2014); the cognitive model of how respondents answer survey questions (Cannell, Miller, & Oksenberg, 1981; Tourangeau, Rips, & Rasinski, 2000); the literature on rational versus heuristic decision making (Kahneman, 2011; Petty & Cacioppo, 1986); and the literature in psychology on real-life decision making (Galotti, 2007).

We describe and test our framework in detail in Burton, Couper, Crossley, Jäckle, and Walzenbach (2021) and summarize the key findings here. The outcomes we examine are whether the respondent consented to the data linkage, how well they understood the linkage request, and how confident they were about their decision (Figure 1). We found that respondents varied in how they process the consent decision (Burton et al., 2021): across five surveys about a third of respondents said they made the decision by thinking about what would happen if they said 'yes', a third said they based their decision on gut-feeling, and a third based it on what they usually say when asked for personal information (habit). That is, only about a third of respondents made a reflective decision, two-thirds made more instinctive decisions. These self-reports were corroborated by markers of the decision process: those reporting more reflective decision processes took longer to answer the consent question, were more likely to read additional information materials, self-reported higher levels of effort, and scored higher on questions testing their knowledge of data linkage. The decision processes also differed in the amount and nature of information that respondents drew on in making the decision: those making reflec-

tive decisions were more likely to consider what information the government has about them, how much they trust the organisations involved in the linkage, and the benefits to society; they also took a larger number of factors into account in making their decision. Which decision process a respondent used depended to some extent on the respondent's characteristics: for example, respondents with higher education levels were more likely to make a decision based on considering the consequences of consenting, older respondents were more likely to base their decision on trust in the organisations involved. Which decision process a respondent used however also seemed to depend on situational factors: when respondents were asked the same consent question again a year later, nearly half of respondents used a different decision process than they had the first time they were asked. Crucially, we found that the decision process was related to the consent outcomes: respondents making reflective decisions were more likely to consent and had a better understanding of the linkage process. As illustrated in Figure 1, this correlation between the decision process and consent outcomes is however not necessarily causal, the factors that affect the decision process might also have direct effects on the consent outcomes.

Why then is it that respondents are less likely to consent to data linkage in a web survey than with a face-to-face interviewer? Our overarching hypothesis is that differences between modes of data collection—such as whether an interviewer is involved and present, the speed at which respondents answer the survey questions, and the technology used to administer the questionnaire—can alter factors that influence how the respondent processes the consent decision and thereby lead to differences in consent outcomes.

First, if an interviewer is involved, they can offer additional explanations beyond what is scripted in the question text and supporting information materials. In the qualitative interviews some participants said the possibility of clarifications and reassurance made it more likely that they would consent in a face-to-face interview than online (Beninger et al., 2017, p. 13). The interviewer can explain the linkage process, emphasize confidentiality and data security, and answer other questions that the respondent might have. That is, the interviewer presence allows the question-answer process to be interactive: the interviewer can tailor additional information to what the respondent wants to know, or volunteer additional information that they judge necessary. In a web survey additional information can easily be provided, but it is provided for everyone rather than being tailored to the respondent's reaction, and might appear as extra burden for the respondent.

Second, if an interviewer is present, how the interview unfolds is influenced by social norms. In the qualitative interviews some participants cited social pressures to conform as a reason why they might be more likely to give consent in a face-to-face interview than online (Beninger et al., 2017, p. 13-14). This is consistent with previous studies showing that respondents give more socially desirable answers to questions administered by interviewers than they do in self-completion surveys, where social pressures do not exist (Tourangeau & Yan, 2007).

Third, respondents tend to complete surveys more quickly online than with a face-to-face interviewer. This was echoed by some participants in the qualitative interviews (Beninger et al., 2017, p. 13). As a result, online respondents might be less likely to read additional supporting information and less likely to make reflective decisions, than face-to-face respondents.

Fourth, in a face-to-face interview respondents can see where their survey responses are going: into the interviewer's laptop. In online surveys they complete the questionnaire in a browser, seemingly sharing their personal information online. In the qualitative interviews, participants noted that the technology used to administer the questionnaire affected how concerned they were about the security of their data (Beninger et al., 2017, p. 13). Online respondents might therefore have more concerns about the security of their data than face-to-face respondents.

Fifth, for respondents completing the survey online, the type of device they use to complete the survey might also affect how they process the consent question and the concerns they have about data security. The smaller screen size of smartphones might make it more difficult for respondents to read and answer consent questions and associated information materials. If respondents are completing the survey on a mobile device in a public space, possibly using public Wi-Fi networks, they might also be more concerned about the security of their data.

Depending on which mechanisms explain differences in consent rates, the question then is what can be done? How can the survey and questionnaire be designed to reduce differences between modes in consent rates?

In the following sections we use data from an experimental mixed-mode survey to examine the following research questions:

RQ1 To what extent does the survey mode affect consent outcomes, including consent rates, understanding of the consent request and confidence in the consent decision?

RQ2 Which mechanisms lead to differences in consent outcomes between modes? Does the mode affect respondent attitudes about data privacy and security? Does it affect the consent decision process? Does the type of device web respondents use to complete the survey affect respondent attitudes or the response process? Do interviewer behaviours encourage consent?[1]

[1]We are unfortunately not able to examine social desirability

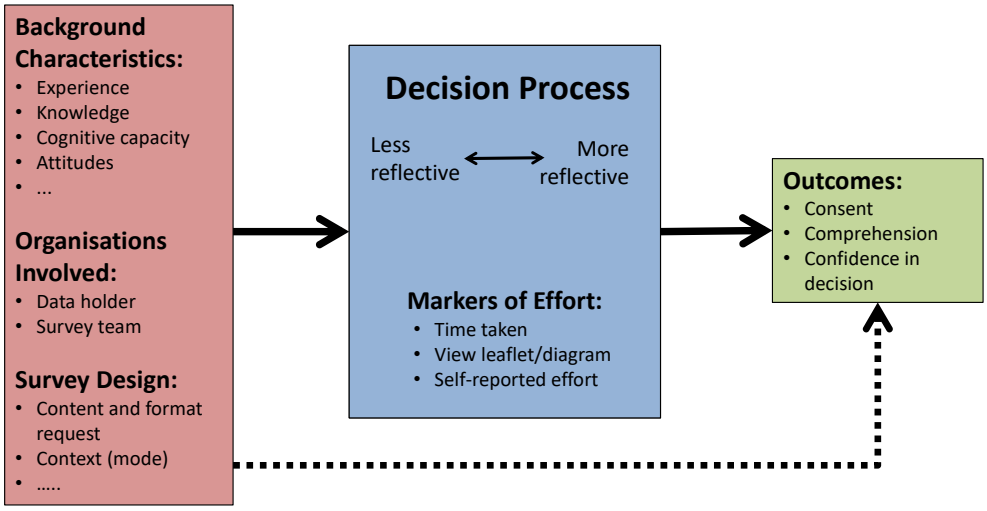

Figure 1. Conceptual framework (Burton, Couper, Crossley, Jäckle, & Walzenbach, 2021, Fig. 1)

RQ3 Does simplifying readability of the consent question reduce differences between modes in consent outcomes?

3 Data: The *Understanding Society* Innovation Panel

3.1 The survey and experiments

The Innovation Panel (IP) is part of *Understanding Society*: the UK Household Longitudinal Study. It is a platform for methodological testing and experimentation and its design mirrors that of the main study. The sample is a clustered stratified sample of addresses in Great Britain. Interviews are sought annually, with all household members aged 16 and older. The IP started in 2008 with a sample of 1,500 respondent households. Refreshment samples of about 500 respondent households were added in Waves 4, 7, 10, and 11. The data used in this paper are from Wave 11, which was fielded in May to October 2018 by Kantar Public and NatCen Social Research (University of Essex, Institute for Social and Economic Research, 2021b).

We use two experiments fielded in Wave 11. The first is a randomised allocation of households to mode of data collection. The second is a randomised allocation of individuals to different wording of a consent request, asking for permission to link the respondent's survey data to administrative data held by HM Revenue and Customs (HMRC), the UK tax authority.

The mode of data collection experiment was introduced in Wave 5. It is a sequential mixed mode design with random allocation to the mode sequence. The same questionnaires are used for all respondents, with mode-specific adaptations where necessary (unified mode design, Dillman, 2007). Two-thirds of households were invited to complete the annual interview online (web-first group). Non-respondents were then followed up by face-to-face interviews. The remaining third of households were allocated to face-to-face interviews (FTF-first group). The Wave 7 and Wave 10 refreshment samples were initially allocated to face-to-face interviews. From their third wave onwards, two-thirds were randomly assigned to web-first and one-third to FTF-first. The Wave 11 refreshment sample was the first refreshment sample in which there was a web-first component at the initial wave: a random one-third of households were issued web-first, with the remaining two-thirds issued FTF-first. Across waves, households remained in the randomised groups to which they were initially allocated. From Wave 8 onwards, however, households with very low predicted probability of completing the survey online were moved to the FTF-first group. Across waves the mode protocols changed somewhat, so that by Wave 11 non-respondents in the face-to-face group were followed up with invitations to complete the survey online and non-respondents in both groups were followed up by telephone interviews in the final stages of fieldwork.

The Wave 11 household response rate for the continuing samples was 73%, with 80% of individuals in responding households giving full interviews (University of Essex, Institute for Social and Economic Research, 2021a). The response rates were similar between the two randomised mode treatment groups: for example, in the original sample 80% of households allocated to FTF-first (and 81% of individuals in those households) responded, compared to 78% of house-

bias in face-to-face interviews with the data at hand.

holds allocated to web-first (and 83% of individuals in those households). For documentation of the IP survey design and implementation see University of Essex, Institute for Social and Economic Research (2021a).

The consent question wording experiment was designed to vary the difficulty of the request. Half of the respondents were allocated to the 'standard' question wording, which had been used previously in the main *Understanding Society* survey. The other half were allocated to an 'easy' version, where the text was rewritten to reduce reading difficulty and to provide all essential information about the linkage in the question text rather than an additional information leaflet. The wording of both consent questions is documented in Appendix A. The simplification was based on findings from qualitative in-depth interviews about wording that hampered respondents' understanding of the consent request (Beninger et al., 2017) and on criteria used for reading level statistics. The revisions included eliminating passive sentences, reducing the length of sentences, and splitting sentences into paragraphs to ensure that interviewers pause between sentences and web respondents could skim the beginning of each sentence and still understand the gist. The easier version was however not shorter than the standard version. We assessed reading difficulty using the Flesch-Kincaid Grade level scores (which rates reading difficulty on a U.S. school grade level) implemented in MS Word. The revisions reduced the reading level from 14.3 to 8.8, meaning that a ninth grader (aged 14-15) would be able to understand the easy question wording. The randomisation for this experiment occurred within the survey, such that the allocation to question wording was crossed with the mode in which respondents completed the survey.

The analyses in this paper exclude proxy respondents ($n = 94$), telephone respondents ($n = 1$), and respondents in households with low predicted probability of completing the survey online ($n = 90$), as they were not randomly assigned to mode of interview. The analyses further exclude respondents for whom the consent question is missing ($n = 1$) and face-to-face respondents who did not answer the self-completion section of the survey, which contained a module of follow-up questions pertaining to the consent wording experiment ($n = 196$). The resulting analysis sample consists of 2,608 respondents.

Table 1 documents the treatment groups by actual mode of interview. The randomised allocation to survey mode is strongly associated with the actual mode of interview. Among respondents allocated to the FTF-first treatment, most completed the survey with an interviewer (94%). In contrast, among those allocated to web-first, 78% completed the survey online. The question wording groups are of similar size within and across modes of interview.

Both randomisations—to survey mode and consent question wording—are balanced in terms of gender, age, education, whether in work, household composition, and housing tenure: χ^2 tests for differences in respondent characteristics between treatment groups are not significant at the 10% level.

The variables used are from the individual Innovation Panel interviews. The face-to-face version included a 10-minute self-completion module administered as Computer Assisted Self-Interview (CASI). In the online survey this module was integrated seamlessly with the other modules. The order of modules and wording of questions was the same in both modes.

Item non-response rates for all variables were low, at most 3% unless stated otherwise below. Missing observations have therefore been set to modal values, so that all analyses are based on the full analysis sample of 2,608 respondents, except the analyses of question timings and objective understanding, for which missing observations were not recoded. Appendix Table B1 documents the distributions of all variables by mode of interview. All variables with four-category ordinal response scales have been recoded into binary indicators, by combining the first two and the last two categories respectively. All other variables were recoded as documented below. The wording of all questions is documented in Appendix A.

3.2 Consent outcomes

Respondents were asked for *consent* to link tax records held by HM Revenue and Customs (HMRC) to the survey data. Don't know and refusals are treated as non-consent and included in the analyses (2% of responses, no significant difference between face-to-face and web respondents). The consent question was followed by a question to assess *subjective understanding* of the consent request: respondents were asked how well they thought they understood what would happen with their data. As an *objective* measure of *understanding*, respondents were asked a series of eight true/false statements about data linkage, that were based on a similar test of understanding by Das and Couper (2014). Objective understanding is measured as the number of correct answers. 4% of web and 3% of face-to-face respondents answered some but not all eight test questions. In these cases we assume that nonresponses indicate an inability to answer the question, and so don't know and refusal answers are coded as incorrect. In contrast, the test score is set to missing for respondents who did not answer *any* of the eight test questions (11% of web and 1% of face-to-face respondents). These two steps result in $n = 2,448$ respondents with valid test scores. Our baseline analysis thus assumes that partial nonresponse reflects a lack of knowledge. It also assumes that full nonresponse is unrelated to objective understanding, conditional on mode. In Appendix C we explore the sensitivity of our results for objective understanding to these assumptions, using "Lee Bounds" for bounding treatment effects with nonrandom sample election (Lee, 2009; Tauchmann, 2014). We

Table 1
Randomised treatment allocations, by mode of interview

	Actual mode of interview				Total
	FTF		Web		
Treatment allocations	N	%	N	%	
Randomised survey mode					
FTF-first	965	94	67	6	1,032
Web-first	351	22	1,225	78	1,576
Consent question wording					
Standard	677	51	653	49	1,330
Easy	639	50	639	50	1,278
Total	1,316	50	1,292	50	2,608

interpret the results of this sensitivity analysis as showing that even if item nonresponse is nonrandom, the data strongly suggest a negative effect of web mode on objective knowledge.

Respondents were also asked how *confident* they were about the decision they had made. For face-to-face respondents these follow-up questions were asked in CASI, to avoid any differences between modes in responses due to social desirability bias with the interviewers.

3.3 Respondent attitudes

In an earlier module, prior to the consent question, respondents were asked how worried they are about their personal *privacy*. They were also asked about *data security*: how concerned they are about whether different private and public organisations that have personal information about us keep this information confidential. Following the consent question, respondents were asked how *sensitive* they thought the data that HM Revenue and Customs have about them are and how much they *trust* different organisations, including "Understanding Society interviewers and the company they work for", "The University of Essex (managers of the *Understanding Society* survey)", and "HM Revenue and Customs".

3.4 Consent decision process

Respondents were asked how they had made the *decision* whether or not to say "yes" or "no" in response to the question about data linkage. The response options were "I thought about what would happen if I said 'yes' or 'no'", "Instinct or gut feeling", "I said what I usually say when I'm asked for information that is very personal", and "Something else". This variable was recoded into mutually exclusive categories, and labelled "considered consequences" if the respondent selected only the first response category, "gut feeling" if they selected only the second, "habit" if they selected only the third, and "something else or combinations" if they selected the last category, more than one, or if they answered don't know or refused to all (item non-response=3%). *Response times* for the consent question are derived from paradata. The response times are missing for 1% of respondents. In addition, the response times of outliers, that is, the 1% of observations with the longest response times, have been set to missing. Whether the respondent *read the information leaflet* about data linkage is derived in two different ways. For face-to-face respondents this is derived from an interviewer observation asking whether the respondent read the leaflet. For web respondents this is derived from response phase paradata capturing mouse clicks (McClain et al., 2019). The indicator is coded as 1 for face-to-face respondents who appeared to read all of the leaflet and for web respondents who clicked on the link to the leaflet, and 0 otherwise. Whether the respondent *looked at the diagram* describing data linkage is derived in the same way. For face-to-face respondents this is again derived from an interviewer observation on whether the interviewer showed the diagram. For web respondents this is again derived from paradata. The indicator is coded as 1 if the interviewer talked through all of the diagram or the respondent clicked on the link to the diagram, and 0 otherwise. Finally, respondents were asked whether the *amount of information* provided about data linkage was too much, too little, or about right.

4 Methods

All tables are based on the analysis sample of 2,608 respondents, except the analyses of question timings (based on 2,595 respondents with valid timings data) and the analyses of objective understanding of the linkage request (based on 2,448 respondents with valid test scores).

Due to the IP sample design, respondents are clustered in households and Primary Sample Units (PSUs). While accounting for clustering in PSUs changes some of the estimated standard errors and p-values, it does not change the significance levels of results. We therefore report the results without accounting for clustering.

4.1 Analyses of the experiment with data collection modes

Although respondents were randomly allocated to mode treatment groups (FTF-first or web-first), the actual mode of interview is not randomised due to non-compliance of respondents with the mode initially allocated. We therefore examine the effects of the data collection mode in three ways: using the actual mode of interview (as-treated analysis), using the randomised allocation to mode (intention-to-treat analysis), and using the randomised allocation to mode as an instrument for the actual mode of interview (instrumental variable analysis). In the as-treated analysis, any differences between modes can be due to both the effect of mode on responses and the selection of different types of respondents into modes. The intention-to treat analysis removes any effect of selection, but under-estimates the mode effect since part of the web-first sample completed the survey with an interviewer. The instrumental variable (IV) analysis rescales the intention-to-treat estimates, adjusting them for the proportion of respondents who complied with their assigned survey mode. That is, the IV analysis provides causal estimates of the effects of mode for compliers (local average treatment effect). The as-treated and intention-to-treat analyses are based on cross-tables of the variables of interest by actual mode or allocation to mode. For categorical variables the significance tests are based on χ^2 tests of the independence of distributions between actual modes or randomised allocations to mode. For continuous variables (objective understanding scores and response times), the significance tests are based on tests of means or two-sample Wilcoxon rank-sum (Mann-Whitney) tests. The IV analyses (Greenland, 2000) are reported in the relevant sections of the text rather than in tables. When testing the effect of mode on response times, we use the log of time due to its skewed distribution. We interpret $\left(\exp^{\beta_{\text{web}}} - 1\right) \cdot 100$ as the percentage change in response times if respondents complete the survey online rather than with an interviewer. To test whether the consent question wording alters the effect of mode on consent, we estimate IV regressions of the consent outcomes on mode allocation, question difficulty, and the interaction between the two.

4.2 Behaviour coding of audio-recordings

To examine what interviewers and respondents do when administering consent questions, we used digital audio-recordings of the Wave 11 face-to-face interviews. At the start of the interviews, respondents were asked for permission "*to record some parts of this interview to help us improve the questions we ask in future surveys*". If permission was given, the audio-recording was set to automatically turn on at the start of the consent question and off at the start of the following question. Interviewers were alerted to the recording by a signal on their laptop, which switched itself on and off with the recording. Overall, 86% of respondents gave permission and the rate was slightly higher among respondents allocated to the easy consent wording (88%) than among those allocated to the standard wording (84%, $p = 0.05$). However not all recordings were transmitted to the fieldwork agency, some recordings were not audible, and sometimes the consent question was missing in the recording. There is however no difference between those asked the easy and the standard consent questions in the proportion of missing recordings ($\chi^2 p > 0.05$). The analysis of interviewer and respondent behaviours is based on the 780 respondents interviewed face-to-face with codable audio-recordings (see Appendix Table B2).

Using the digital audio-recordings, we coded whether or not interviewers did the following:

- read the question as scripted or omitted parts of the question,
- handed over the information leaflet explaining data linkage,
- handed over or explained the diagram visualising the data linkage process,
- provided any additional information about the linkage,
- emphasised confidentiality, or
- gave an adequate response to concerns and questions raised by the respondent.

For the respondents, we coded whether they:

- interrupted the interviewer and therefore did not hear the entire question text, or
- expressed uncertainty, concern, or asked a question.

5 Results

5.1 RQ1: To what extent does the mode of interview affect consent outcomes, including consent rates, understanding of the consent request and confidence in the consent decision?

As in previous studies, web respondents were less likely to consent (42%) than face-to-face respondents (73%), a difference of 31 percentage points ($p < 0.001$, Table 2). The intention-to-treat analysis (i.e. by randomised mode allocation), suggests that only part of this difference between modes was due to different types of respondents selecting into web and face-to-face interviews: the difference between mode allocation groups remained large at 22 percentage points ($p < 0.001$). Scaling the intention-to-treat estimate up to estimate the effect of mode for compliers suggests that the consent rate would in fact be 30 percentage points lower than if respondents completed the survey with an interviewer (IV regression, S.E. = 2.6, $p < 0.001$). This estimate is close to the difference by mode of interview (31 percentage points), suggesting that differences in consent rates are almost entirely due to the mode affecting people's willingness

to consent—and not due to selection of different types of people into web and face-to-face interviews.

Web respondents had lower levels of self-reported understanding of the consent request (Table 2). Among face-to-face respondents, 66% said they completely or mostly understood, compared to only 43% of web respondents, a difference of 23 percentage points ($p < 0.001$). The intention-to-treat analysis again suggests that the difference was only partly due to selection into mode: the difference remained high, at 15 percentage points ($p < 0.001$). The IV estimate suggests that completing the survey online instead of face-to-face reduced the percentage of respondents who felt they completely or mostly understood the consent request by 22 percentage points ($p < 0.001$). This estimate is again close to the difference between modes of interview (22 percentage points), suggesting that it is almost entirely an effect of the mode. Since the questions about understanding were asked in the self-completion section of the questionnaire, the higher rates of self-reported subjective understanding cannot be explained by social desirability bias, which might lead face-to-face respondents to over-report how well they understood.

Examining objective understanding paints a similar picture: web respondents answered on average 4.6 of the test items correctly, face-to-face respondents 4.8 items ($p < 0.001$). The IV estimate suggests that completing the survey online instead of face-to-face reduced the mean number of correct answers by 0.39 (S.E. = 0.094, $p < 0.001$). This estimate is slightly larger than the difference in scores observed by mode of interview, again suggesting that the difference is due to the effect of mode on responses and not due to selection into mode. The estimate is similar if all observations with any missing responses to the test questions are dropped ($\beta = 0.35$, S.E. = 0.092, $p < 0.001$). In Appendix C we show that nonparametric bounds on the mode effect that make minimal assumptions about the nonresponses indicate a negative effect of mode.[2]

Although consent rates and understanding of the consent request were lower in web than face-to-face interviews, there was no difference between modes in how confident respondents were about their consent decision. Across modes, nearly three-quarters of respondents said they were confident or very confident in their decision.

5.2 RQ2: Which mechanisms lead to differences in consent outcomes between modes?

In this section we explore several of the possible mechanisms discussed earlier for the observed mode differences.

Effect of mode on respondent attitudes. Table 3 examines one of the mechanisms through which the mode of data collection might affect consent outcomes: by influencing attitudes that are relevant for the consent decision.

The results show that web respondents reported higher levels of concern about privacy and data security than face-to-face respondents: 71% of web and 63% of face-to-face respondents said they were very or somewhat worried about privacy; 83% of web and 78% of face-to-face respondents said they were very or somewhat concerned about data security (both $p < 0.001$). As in the analyses of consent outcomes, these differences remain significant in the intention-to-treat analyses. This suggests that those completing the survey online are not different in their privacy concerns (selection bias), but rather that the act of completing the survey online is associated with greater concern. The IV regressions similarly suggests a difference of 8 percentage points between modes in the percentage of respondents who are very or somewhat worried about privacy (S.E. = 2.6, $p = 0.002$) and a difference of 5 percentage points (S.E. = 2.2, $p = 0.018$) in the percentage of respondents who are very or somewhat concerned about data security.

The mode of data collection did not influence respondents' perceptions of how sensitive HMRC data are or their trust in the organisations involved in the data linkage. In both modes just under 70% of respondents said the data HMRC hold about them were sensitive, or highly sensitive ($p > 0.1$). There was a small difference in whether respondents said they trusted the survey organisation somewhat or a lot (face-to-face 85% and web 81%, $p = 0.009$). However this difference was not significant in the intention-to-treat analysis or the IV regression. In both modes, around 80% of respondents said they trusted the university responsible for the survey somewhat or a lot and 75% said they trusted HMRC somewhat or a lot ($p > 0.1$ for both).

Effect of mode on the consent decision process . Table 4 examines another mechanism through which the mode of data collection might affect consent outcomes: by influencing how respondents process the consent decision. Web respondents were less likely than face-to-face respondents to report thinking about what would happen if they said yes to the consent request (26% compared to 35%, $p < 0.001$). The intention-to-treat analysis shows a similar difference as does the IV regression, according to which systematic processing of the consent request was 8 percentage points less likely if compliers completed the survey online instead of with an interviewer (S.E. = 2.6, $p = 0.003$). Web respondents were instead more likely to make a habit-based decision about consent (34% compared to 22%). There was little difference in whether respondents based their decision on gut feeling or reported other or multiple decision processes.

Table 5 examines indicators of how much effort respondents put into answering the consent question. Web respondents answered the consent question more quickly than face-to-face respondents: the median response times were 29 seconds versus 87 seconds, a difference of 58 seconds. Since

[2] Both the lower and upper bound of the mode effect are negative, but the confidence interval for the upper bound does not exclude zero. See Appendix C for further details.

Table 2
Consent outcomes by survey mode

	Actual mode				Randomised mode			
	FTF	Web	Diff.	P-value	FTF-first	Web-first	Diff.	P-value
Consent (%)	73	42	−31	< 0.001	71	49	−22	< 0.001
Completely/mostly understand (%)	66	43	−23	< 0.001	64	49	−15	< 0.001
Mean number of correct answers	4.8	4.6	−0.2	< 0.001	4.9	4.6	−0.3	< 0.001
(Very) confident in consent decision (%)	73	72	−1	0.415	74	71	−3	0.160

P-values from χ^2 tests for differences in percentages and tests of means for number of correct answers.

Table 3
Respondent attitudes by survey mode (in %)

	Actual mode				Randomised mode			
	FTF	Web	Diff.	P-value	FTF-first	Web-first	Diff.	P-value
Very/somewhat worried about privacy	63	71	8	< 0.001	63	69	6	0.003
Very/somewhat concerned about data security	78	83	5	0.001	78	82	4	0.018
HMRC data are (highly) sensitive	67	70	2	0.231	69	68	0	0.913
Trusts the survey somewhat/a lot	85	81	−4	0.009	84	82	−2	0.123
Trust the university somewhat/a lot	81	78	−3	0.099	81	79	−2	0.192
Trusts HMRC somewhat/a lot	77	75	−2	0.297	77	75	−2	0.208

P-values from χ^2 tests.

response times are skewed we examine differences in means by regressing the log response time on the mode of interview. This suggests that web respondents took on average 60% ($b = -0.924$, S.E. = 0.031, $p < 0.000$) less time to answer the consent question than face-to-face respondents. Regressing log response time on the mode allocation for the intention-to-treat analysis suggests a shortening of 47% ($b = -0.633$, S.E. = 0.034, $p < 0.000$); the IV regression suggests a shortening of 59% ($b = -0.890$, S.E. = 0.044, $p < 0.001$). Restricting the analysis to respondents who neither read the leaflet nor the diagram suggests that this difference is not because web respondents were less likely to read additional materials (average response times: −55%, $b = -0.799$, S.E. = 0.049, $p < 0.001$). This reflects the fact that surveys are generally completed more quickly online than face-to-face, either because web respondents read more quickly than interviewers or because interviewers take time to hear and enter the answer.

The interviewer observations indicate that 40% of face-to-face respondents read the information leaflet fully. A further 34% skimmed the leaflet. In contrast, only 8% of web respondents clicked on the link to the information leaflet and we do not know whether or not they actually read it. According to the interviewers, they explained the diagram illustrating data linkage to 17% of respondents. In contrast only 3% of web respondents clicked on the link to the diagram. Whether or not face-to-face respondents saw the diagram might depend on how comfortable their interviewer felt in explaining it. Nonetheless, these results indicate that web respondents make very little use of additional information that is provided as part of a consent question. This conclusion is also reflected in the fact that web respondents were more likely than face-to-face respondents (16% vs. 8%, $p < 0.001$) to say that the amount of information provided about the data linkage was too much.

Effect of the device used to complete the web survey . The differences in reported concerns between face-to-face and web respondents, and the differences in how respondents process the consent request, might be due to the device used to complete the interview rather than the mode of data collection.

Of the 1,292 web respondents, 57% completed the survey on a PC, including laptops and netbooks, 20% completed it on a tablet, and 23% completed it on a smartphone. We test whether consent outcomes, respondent attitudes, and consent decision processes are associated with the device used to complete the web survey. Since the three groups of web respondents differ in their socio-demographic composition (see Appendix Table B3), we estimate a separate model for each dependent variable, regressed on dummy indicators for completing the survey on a tablet or a smartphone (with PC as the reference category) and controls for gender, age, education, whether in work, region of residence, housing tenure, and household size. We use logit models for all dependent variables except objective understanding of the consent request (measured by the number of correct answers to the knowledge test questions) and log time taken to answer the consent question, for which we use OLS regression (Table

Table 4
Consent decision process by survey mode

	Actual mode				Randomised mode			
	FTF	Web	Diff.	P-value	FTF-first	Web-first	Diff.	P-value
Considered consequences (%)	35	26	−9	-	34	29	−5	-
Gut feeling (%)	26	22	−4	-	25	23	−2	-
Habit (%)	22	34	12	-	23	31	8	-
Something else/combination (%)	17	17	0	-	17	17	0	-
χ^2 tests of the 4x2 tables				<0.001				<0.001

Table 5
Indicators of consent decision processing effort by survey mode

	Actual mode				Randomised mode			
	FTF	Web	Diff.	P-value	FTF-first	Web-first	Diff.	P-value
Time (median seconds)	87	29	−58	< 0.001	83	37	−46	< 0.001
Read/clicked on leaflet (%)	40	8	−32	< 0.001	38	16	−22	< 0.001
Discussed/clicked on diagram (%)	17	3	−14	< 0.001	16	7	−9	< 0.001
Amount of information too much (%)	8	16	8	< 0.001	9	14	5	< 0.001

P-values from two-sample Wilcoxon rank-sum (Mann-Whitney) test for difference in median response times and χ^2 tests for differences in percentages.

Table 6
Outcomes by device used to complete the web survey (web respondents only)

	Tablet[a]			Smartphone[a]			
	AME[c]	SE	P-value	AME[c]	SE	P-value	P-value[e]
Consent	−0.023	0.036	0.534	0.024	0.037	0.526	0.306
Completely/mostly understand	−0.006	0.037	0.873	−0.070	0.037	0.057	0.154
Number of correct answers[d]	−0.337	0.128	0.008	−0.169	0.128	0.186	0.280
(Very) confident in consent decision	0.032	0.033	0.330	−0.023	0.034	0.493	0.175
Very/somewhat worried about privacy	0.033	0.033	0.317	0.004	0.033	0.911	0.466
Very/somewhat concerned about data security	−0.016	0.029	0.573	−0.025	0.027	0.353	0.789
HMRC data are (highly) sensitive	−0.041	0.035	0.233	0.045	0.033	0.173	0.038
Trusts the survey somewhat/a lot	−0.018	0.029	0.539	−0.048	0.030	0.111	0.422
Trust the university somewhat/a lot	0.025	0.030	0.407	−0.020	0.031	0.504	0.223
Trusts HMRC somewhat/a lot	0.012	0.031	0.713	−0.054	0.033	0.110	0.104
Decision process: considered consequences	−0.013	0.033	0.695	−0.050	0.032	0.119	0.352
Decision process: gut feeling	0.050	0.032	0.112	0.062	0.032	0.049	0.763
Log time to answer consent question[d]	−0.109	0.059	0.064	0.321	0.059	0.000	0.000
Clicked on leaflet	−0.015	0.019	0.432	−0.021	0.021	0.311	0.806
Clicked on diagram	−0.009	0.013	0.516	−0.015	0.013	0.261	0.690
Amount of information too much	0.045	0.028	0.109	0.095	0.029	0.001	0.176

[a] Reference category: PC/laptop/netbook [b] Wald test of equality of coefficients of Tablet vs. Smartphone
[c] Average marginal effects estimated from separate models for the dependent variable in each row, regressed on the device used to complete the web survey, age, gender, education, whether in work, region of residence, and housing tenure.
[d] Estimates from OLS regressions, all others from logit models.

6). Compared to respondents who completed the web survey on a PC, those who completed on a smartphone were 7 percentage points less likely to say they completely or mostly understood the linkage request ($p = 0.057$), 6 percentage points more likely to say they based their consent decision on gut feeling ($p = 0.049$), 10 percentage points more likely to say that too much information was presented about the data linkage ($p = 0.001$), and on average took 38% longer to answer the consent question. Those who completed on a tablet on average answered 0.34 fewer of the objective understanding questions correctly than those who completed on a PC ($p = 0.008$). There were however no differences between smartphone and PC users in objective understanding of the consent request, and no differences between either smartphone or tablet users and PC users in the probability of consent, confidence in the consent decision, concerns about data privacy or data security, how sensitive they thought the data HMRC hold about them are, trust in the survey, the university and in HMRC, whether they used a systematic decision process, and whether they clicked on the leaflet or clicked on the diagram. That is, for most of the consent outcomes, respondent attitudes and consent decision characteristics examined in this paper, the device respondents used to complete the web survey had little or no effect. This suggests that the device used by web respondents to complete the survey was less important than the mode of interview in determining consent. Note that we did not measure where the respondent completed the survey and whether they were in a public space using a public Wi-Fi network.

Interviewer behaviours encouraging consent . Analyses of the audio-recordings of face-to-face interviews show that few respondents made use of the opportunity to ask the interviewer questions (Table 7): only 16% asked a question and 5% expressed concern or uncertainty. Respondents were equally likely to ask questions or express concern if the wording of the consent question was easy rather than standard. That is, even though respondents understood the consent request less well, when asked the standard wording rather than the easy wording, they did not make use of the opportunity to ask the interviewer for clarifications.

Similarly, interviewers rarely volunteered additional information to explain the data linkage request or offer reassurance: they emphasized confidentiality in only 4% of cases. They were however significantly more likely to provide additional unsolicited information with the standard consent question wording (17% of cases) than with the easy wording (11%, $p = 0.010$).

The audio-recordings support the interviewer observations recorded in the survey, about whether respondents read the information leaflet. In 72% of audio-recordings the interviewer can be heard handing over the information leaflet when administering the consent question. The consent question included the sentence *"Please read this leaflet and look at this diagram. . . "*, so it is unlikely that interviewers handed the materials over without saying anything or did so earlier in the interview. According to the interviewer observations (see Table 5 and corresponding text above), 40% of respondents fully read the leaflet and 34% skimmed it. The interviewer observations, however, over-state whether the interviewer explained the diagram to the respondent: according to the interviewer reports they did so in 17% of cases (Table 5), however this behaviour was only audible in 4% of cases with codable audio-recordings (Table 7). This suggests some level of interviewer social desirability in reporting that they complied with instructions. Even so, the verbal behavior of the interviewer (either in volunteering additional information, in offering reassurances to the respondent, or in responding to questions about the request) do not seem to be an explanation for the observed mode differences in consent rates.

5.3 RQ3: Does simplifying readability of the consent question reduce differences between modes in consent rates?

Since web respondents have lower understanding of the consent request than face-to-face respondents, it is possible that simplifying the wording of the consent request could reduce the gaps in understanding, and possibly also in consent, between modes. Table 8 therefore examines whether the easier question wording reduced the effect that the mode of data collection had on consent outcomes. The table shows the coefficients, standard errors, and p-values of IV regression estimates from four separate models: consent, subjective understanding, objective understanding, and confidence in the consent decision. Each of these outcomes is regressed on the actual mode of interview, question wording difficulty, and their interaction. The mode of interview and the interaction are instrumented using the randomised allocation to mode of interview.

The results show that the easy question wording increased subjective and objective understanding, but had no main effect on consent or confidence in the consent decision. The question wording difficulty did not moderate the effect of mode on consent, subjective understanding or confidence in the consent decision: none of the interactions between question wording and mode of interview are significant at the 10% level. Overall, the interview mode affected consent outcomes, regardless of how the consent request was worded.

6 Summary and conclusion

In this paper we use experimental mixed-mode data to examine why respondents are less likely to consent to data linkage, when they are asked in an online survey than in a face-to-face interview. We find that the 30 percentage point difference in consent rates is almost entirely due to the mode affecting people's willingness to consent—and not due to selection of different types of people into web and face-to-face

Table 7
Occurrence of interviewer and respondent behaviours in % (face-to-face interviews, N=780)

		Consent treatment group		
	Overall	Standard	Easy	P-value
Interviewer handed leaflet over	72	70	73	0.511
Interviewer handed diagram over	12	11	12	0.599
Interviewer explained diagram	4	4	5	0.826
Interviewer provided additional info/elaboration	14	17	11	0.010
Interviewer emphasized confidentiality	4	4	4	0.752
Interviewer answered adequately to respondents question or concern	14	13	14	0.692
Respondent asked question	16	16	17	0.700
Respondent expressed concern or uncertainty	5	4	6	0.240

Table 8
Consent outcomes, interaction of question wording and survey mode

	Consent			Subjective understanding			Objective understanding			Confidence in decision		
	b	S.E.	p	b	S.E.	p	b	S.E.	p	b	S.E.	p
Easy wording	0.02	0.03	0.53	0.08	0.03	0.02	0.57	0.11	< 0.00	0.02	0.03	0.45
Web	−0.32	0.04	< 0.00	−0.18	0.04	< 0.00	−0.27	0.13	0.04	−0.03	0.04	0.36
Easy·Web	0.03	0.05	0.56	−0.09	0.06	0.12	−0.24	0.19	0.19	−0.01	0.05	0.90
Constant	0.72	0.02	< 0.00	0.62	0.02	< 0.00	4.63	0.08	< 0.00	0.73	0.02	< 0.00
R-squared	0.10			0.05			0.02			0.00		

IV regressions. Instrumented: Easy·Web, Web. Instruments: Easy·Web-first, Web-first.

interviews. This finding is consistent with results from the main *Understanding Society* panel study reported in Jäckle et al. (2021). In addition, we find that respondents understand the linkage request less well when they answer the consent question online; confidence in the consent decision is however not affected by the survey mode.

Examining different potential mechanisms that could explain why the mode affects willingness to consent, we find that respondents are more concerned about privacy and the security of their data when completing the survey online. Respondents also process the consent request less thoroughly when answering online: they are less likely to consider the consequences of giving consent and more likely to make a habit-based decision; they are less likely to read additional information materials about the linkage; and they answer the question more quickly online than with a face-to-face interviewer. These results confirm insights from the qualitative interviews that informed the research design for this study. However, we also find evidence that the difference between modes in understanding the linkage request does not explain the difference in consent rates: simplifying the readability of the consent request increases understanding but does not increase consent.

We find that the devices used to complete the web survey, whether PCs, tablets or smartphones, do not drive the mode effects. We also find that interviewers' verbal behaviours, identified from audio-recordings of face-to-face interviews, do not explain the mode effects: respondents rarely ask questions and interviewers rarely offer additional information or explanations. Finally, we find that easier wording of the consent request does not reduce the gap in consent rates between modes.

The finding that web respondents only rarely click on links to additional information embedded in the consent question is consistent with findings in the survey methods literature on web survey design. Among our web respondents only 8% clicked on the link to the leaflet explaining the linkage, 4% clicked on the link to the diagram. Janson (2013) found that fewer than 2% of respondents clicked on embedded links for help in a web survey; Conrad, Couper, Tourangeau, and Peytchev (2006) similarly found that respondents were unlikely to click on definitions and clarifications provided for questions in a web survey.

A potential limitation of our research design is that the experiment was implemented in a longitudinal survey. It is possible that the length of time respondents have been in the panel and the history of modes in which they have completed the survey in the past might affect consent rates. The analyses presented here, however, rely on the randomised assignment to modes, which was done independently for the original sample and each of the refreshment samples. Differential attrition or length of time in the panel might affect overall

consent rates, but are unlikely to affect differences between modes. Although overall rates of consent may be lower in a cross-sectional study, there is no reason to expect the mode differences we observe to disappear.

Our results are consistent with other findings in the survey methods literature about the importance of situational factors in determining consent. When data from multiple consent questions asked within one interview are used to jointly model probabilities of consent, the unobservables are correlated across models (Jenkins, Cappellari, Lynn, Jäckle, & Sala, 2006; Mostafa, 2016). This suggests that respondents have a latent willingness to consent—or not consent. However, when examining multiple consents collected in different interviews of a panel study, there is little evidence of a latent willingness to consent over time (Mostafa & Wiggins, 2018). This suggests that situational factors influence the consent decision. Within one interview the situational factors are likely to be consistent across different consent requests, leading to a seeming latent willingness to consent. In different interviews of a panel study the situational factors could be different at each interview. This interpretation is consistent with the observation that when non-consenters in a panel study are asked the same linkage request again in a later interview, half of respondents then do consent (Jäckle et al., 2021; Weir et al., 2014). This also suggests that the consent decision is not fixed, but can be influenced by situational factors.

The findings on decision processes and consent outcomes in face-to-face and web surveys point to some situational factors that might influence the consent decision. However, our findings are consistent with several competing hypotheses. Further experimental research is needed to disentangle these and identify which of the situational factors are most important. Such analyses would form the basis for thinking about practical implications of what can be done to increase informed consent in online surveys. Our results are consistent with social norms influencing the consent decision: if an interviewer is present, respondents seem to find it more difficult to decline the consent request than when they are answering the question on their own. Our results are also consistent with respondents valuing the possibility of asking the interviewer questions about the data linkage: even if audio-recordings of interviews suggest that they rarely take up this option, they might see the offer as part of the exchange. Our results are also consistent with the data collection technology priming respondents to be more or less concerned about the security of their data: respondents answering the survey online might feel unsure about where on the web their data are going, while face-to-face respondents feel that their data are handled in a secure environment.

In addition to these practical implications, our results point to new hypotheses about features of the linkage request that could potentially increase informed consent. These hypotheses remain to be tested: in web surveys, highlighting the security of data transfers and that neither the survey nor the linked data are stored anywhere in the web might increase consent; emphasising social desirability of giving consent might increase consent in web surveys.

A key conclusion from our research is that survey respondents process the request for data linkage consent in different ways. Acknowledging this, and tailoring the information provided to the needs of respondents may help increase informed consent. Simply providing more information on the linkage process—a common strategy employed by survey organisations and often advocated by ethics review boards—does not achieve the desired outcome. Another key conclusion is that it is worth reducing the reading difficulty of consent requests. Even though simplifying the question does not increase consent, it increases *informed* consent and possibly reduces interviewer effects: respondents have better understanding of the request and interviewers are less likely to volunteer unsolicited additional information.

A key challenge is maintaining high rates of consent and minimising non-consent bias (differences between consenters and non-consenters) as surveys transition from fully interviewer-administered modes to sequential mixed-mode designs involving web-first data collection. A lot of research has already gone into mitigating the effects of the mode transition on survey response rates and data quality. Similar effort is needed to realise the promise of combining survey and administrative data based on the informed consent of survey participants. An important first step is understanding the reasons behind the observed mode differences. This paper represents an important step in that work, but more remains to be done.

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Appendix A
Survey questions used for analyses

Note: The full Innovation Panel wave 11 questionnaire is available at: https://www.understandingsociety.ac.uk/documentation/innovation-panel/questionnaires

Respondent background characteristics

Privacy concerns. In general, how worried are you about your personal privacy?

1. Very worried
2. Somewhat worried
3. Not very worried
4. Not worried at all

Data security concerns. Different private and public organizations have personal information about us. How concerned are you about whether or not they keep this information confidential?

1. Very concerned
2. Somewhat concerned
3. Not very concerned
4. Not concerned at all

Sensitivity of HMRC data. How sensitive do you think the data that HM Revenue and Customs have about you are?

1. Highly sensitive
2. Sensitive
3. Somewhat sensitive
4. Not sensitive
5. They do not have any data about me

Trust in organisations. How much do you trust each of the following to keep the data they collect confidential, that is not share them with other parties or lose them?

Scripting notes: Arrange in table with questions listed vertically as rows and response options listed horizontally as column headings.

Questions:

- *Understanding Society* interviewers and the company they work for
- The University of Essex (managers of the *Understanding Society* survey)
- HM Revenue and Customs
- National Health Service
- Department for Work and Pensions
- Banks
- Online retailers
- Social media platforms

Response options:

1. Do not trust at all
2. Trust a little
3. Trust somewhat
4. Trust a lot

Consent questions

Note: The leaflet and diagrams referred to in the consent questions are archived with the fieldwork documents for the Innovation Panel wave 11. See the "Interviewer materials" available at https://www.understandingsociety.ac.uk/documentation/innovation-panel/fieldwork-documents. The diagrams are under the headings "Data Linkage Flowchart Version A (standard)" and "Data Linkage Flowchart Version B (new)". The leaflet is under the heading "IP11 Information on adding economic records v3".

Standard consent question wording. We would like to add records held by HM Revenue and Customs, or HMRC, containing information on your employment and self-employment history, your income, National Insurance contributions and tax credits. All information will be used for research purposes only by academic or policy researchers under restricted access arrangements which make sure that the information is used responsibly and safely.

Please read this **leaflet** and look at this **diagram** <Version B> explaining how we would like to attach your HMRC records to the answers you have given in this study.

Do you give permission for us to pass your name, address, sex and date of birth to HMRC for this purpose?

1. I have read the leaflet and am happy to give consent
2. I do not want to give consent

Easy consent question wording. We would like to add records held by HM Revenue and Customs, or HMRC, to the answers you have given in this study. If you agree:

- We will send HMRC your name, address, sex and date of birth so that they can identify the records they have about you. The HMRC records contain information about your current and previous employment, your income, National Insurance contributions and tax credits.
- We will not send HMRC the answers you have given in this study.
- HMRC will send us your records. These will contain an anonymous identification number but not your name, address, sex or date of birth.
- We will add the HMRC records to the answers you have given in this study.
- We will make the combined anonymous data available for academic and policy research purposes only.
- Access to the data will be restricted and controlled, to make sure that researchers use the information responsibly and safely.
- This will not affect the way that you deal with the HMRC in any way.

Please read this **leaflet** and look at this **diagram** <Version A> for further information.

Do you give permission for us to pass your name, address, sex and date of birth to HMRC for this purpose?

1. Yes
2. No

Follow-up questions about consent decision process

Subjective understanding of consent request. How well do you think you understand what would happen with your data, if you allowed us to link it to records held by HM Revenue and Customs?

1. I do not understand at all
2. I understand somewhat
3. I mostly understand
4. I completely understand

Confidence in linkage consent decision. We are interested in how people decide whether or not to give us permission to add data held by HM Revenue and Customs to the answers they have given in this study.

How confident are you about the decision you made?

1. Very confident in my decision
2. Confident in my decision
3. Somewhat confident in my decision
4. Not confident in my decision

Whether too much information provided. Was the amount of information presented on data linking too much, too little, or about right?

1. Too much information presented
2. Too little information presented
3. Amount of information was about right

Consent decision process. How did you decide whether to say "yes" or "no" in response to the question about data linkage?

Please select all of the answers that apply to you.

1. I thought about what would happen if I said "yes" or "no"
2. Instinct or gut feeling
3. I said what I usually say when I'm asked for information that is very personal
4. Something else (please specify)

Objective understanding of data linkage. To help us understand whether the explanation we gave you about linking HMRC data and your answers to this study was clear or unclear, here are a few statements about how the linkage is done. Please specify whether you think each of the statements is true or false.

Answer categories: True/false for each row

- Every researcher can access the combined data via the Internet (false)
- HM Revenue and Customs will combine the information they have with your answers to this study (false)
- Researchers using the data will only have access to anonymous data (true)
- The combined data can be used by HM Revenue and Customs to check that you have been paying your taxes (false)
- HM Revenue and Customs will send us the information they have about you (true)
- Your name, address, sex, and date of birth will be saved with the linked data (false)
- We will send your name, address, sex, and date of birth to HM Revenue and Customs (true)
- HM Revenue and Customs will send us future data about you, unless you object in writing (true)

Whether read the information leaflet about data linkage (face-to-face respondents only). Interviewer observation: Did the respondent read the information leaflet about data linkage?

1. Yes, appeared to read all of the leaflet
2. Yes, appeared to skim the leaflet
3. No, did not read the leaflet
4. Did not have a leaflet

Whether looked at the diagram describing data linkage (face-to-face respondents only). Interviewer observation: Did you use the data linkage flowchart?

1. Yes, talked through all of the flowchart
2. Yes, talked through part of the flowchart
3. No, I did not show respondent the flowchart
4. Did not have the flowchart

Consent to audio-recording of interview (Innovation Panel face-to-face respondents)

We'd like to record some parts of this interview to help us improve the questions we ask in future surveys. Is that alright with you?

1. Yes, did not query it or ask questions
2. Yes, but first queried it or asked questions
3. No, having first queried it or asked questions
4. No, did not query it or ask questions

Appendix B
Tables

Table B1
Summary statistics

	Actual mode of interview			
	FTF		Web	
	N	Col %	N	Col %
Gender				
Female	579	44.0	588	45.5
Male	737	56.0	704	54.5
Age				
16-40	414	31.5	427	33.0
41-59	443	33.7	475	36.8
60+	456	34.7	390	30.2
Education				
Degree or equivalent	499	37.9	515	39.9
A/AS level	171	13.0	186	14.4
GCSE or lower	646	49.1	591	45.7
Consent to HMRC data linkage				
No	358	27.2	749	58.0
Yes	958	72.8	543	42.0
Subjective understanding of consent request				
I do not understand at all	118	9.0	262	20.3
I understand somewhat	333	25.3	468	36.2
I mostly understand	473	35.9	347	26.9
I completely understand	392	29.8	215	16.6
No. correct answers to knowledge Qs				
0	4	0.3	15	1.3
1	23	1.8	26	2.3
2	62	4.8	60	5.2
3	150	11.6	169	14.7
4	308	23.7	304	26.4
5	287	22.1	226	19.7
6	260	20.0	193	16.8
7	162	12.5	126	11.0
8	42	3.2	31	2.7
Confidence in consent decision				
Very confident in my decision	372	28.3	354	27.4
Confident in my decision	589	44.8	571	44.2
Somewhat confident in my decision	313	23.8	316	24.5
Not confident in my decision	42	3.2	51	3.9

Continues on next page

Continued from last page

	Actual mode of interview			
	FTF		Web	
	N	Col %	N	Col %
Concerns about privacy				
Very worried	188	14.3	157	12.2
Somewhat worried	639	48.6	761	58.9
Not very worried	395	30.0	356	27.6
Not worried at all	94	7.1	18	1.4
Concerns about data security				
Very concerned	367	27.9	338	26.2
Somewhat concerned	660	50.2	736	57.0
Not very concerned	239	18.2	205	15.9
Not concerned at all	50	3.8	13	1.0
How sensitive are the data to be linked				
Highly sensitive	412	31.3	416	32.2
Sensitive	475	36.1	483	37.4
Somewhat sensitive	278	21.1	276	21.4
Not sensitive	140	10.6	107	8.3
They do not have any data about me	11	0.8	10	0.8
Trust in the survey agency (and interviewers)				
Do not trust at all	46	3.5	48	3.7
Trust a little	154	11.7	198	15.3
Trust somewhat	639	48.6	667	51.6
Trust a lot	477	36.2	379	29.3
Trust in the University (survey sponsor)/ Universities in UK				
Do not trust at all	59	4.5	63	4.9
Trust a little	192	14.6	217	16.8
Trust somewhat	695	52.8	692	53.6
Trust a lot	370	28.1	320	24.8
Trust in HMRC				
Do not trust at all	80	6.1	95	7.4
Trust a little	228	17.3	230	17.8
Trust somewhat	568	43.2	615	47.6
Trust a lot	440	33.4	352	27.2
Consent decision process				
Considered consequences	465	35.3	342	26.5
Gut feeling	337	25.6	286	22.1
Habit	289	22.0	440	34.1
Something else	98	7.4	72	5.6
Multiple responses	127	9.7	152	11.8
Whether read/clicked on leaflet				
No	788	59.9	1,184	91.6
Yes	528	40.1	108	8.4
Whether discussed/clicked on diagram				
No	1,089	82.8	1,247	96.5
Yes	227	17.2	45	3.5
Amount of information presented on data linking				
Too much	111	8.4	203	15.7
Too little	76	5.8	138	10.7
About right	1,129	85.8	951	73.6
Response times (seconds)	min	max	median	mean
FTF respondents	4	273	87	95
Web respondents	3	262	29	43

Table B2
Whether codable audio-recording available, by consent treatment group

	Consent to record			Codable audio-recording		
	N	%	Total	N	%	Total
Standard wording	696	84.3	826	393	56.5	696
Easy wording	675	87.7	770	387	57.3	675
Total	1,371	85.9	1,596	780	56.9	1,371

Table B3
Sample composition of web respondents by device used to complete the survey (Column %)

	Device used to complete web survey			
	PC/laptop/netbook	Tablet	Smartphone	P-value
Male	51.2	42.0	34.7	
Female	48.8	58.0	65.3	<.001
Age 16-29	16.9	7.5	33.7	
Age 30-39	10.4	6.3	23.8	
Age 40-49	14.7	18.8	16.8	
Age 50-59	22.2	29.0	16.2	
Age 60-69	20.3	23.5	4.3	
Age 70+	15.5	14.9	5.3	<.001
Degree or equivalent	42.4	39.6	34.0	
A/AS level	15.4	11.8	14.2	
GCSE or lower	42.2	48.6	51.8	.034
Not in work	44.4	45.5	31.4	
In work	55.6	54.5	68.6	<.001
North East	5.4	6.3	6.3	
North West	9.4	10.7	20.1	
Yorkshire and the Humber	10.5	11.5	11.2	
East Midlands	10.8	9.5	7.9	
West Midlands	10.4	8.7	10.2	
East of England	11.2	7.1	9.2	
London	11.2	10.7	5.9	
South East	13.2	13.0	10.9	
South West	9.3	8.3	6.6	
Wales	1.8	5.5	5.6	
Scotland	6.9	8.7	5.9	<.001
Home owned outright	39.0	50.2	18.7	
Home being bought with mortgage	43.9	36.9	49.8	
Home rented or other	17.0	12.9	31.5	<.001
Household size: 1	14.1	14.9	11.8	
Household size: 2	37.7	40.6	26.6	
Household size: 3	20.0	19.3	21.5	
Household size: 4	18.9	15.7	26.3	
Household size: 5	9.3	9.6	13.8	.003

Note. P-values from χ^2 tests.

Appendix C
Lee Bounds for Nonresponse

Lee (2009) developed nonparametric bounds for the effect of a randomized treatment in the presence of (possibly nonrandom) attrition or nonresponse (see also Tauchmann, 2014). We apply these bounds to the measure of objective knowledge, which has higher rates of item missing data or nonresponse in the web mode than face-to-face. These bounds make a mild assumption about the relationship between treatment and nonresponse: monotonicity. The monotonicity assumption is that treatment (which in our application is web mode) can either (weakly) increase probability of response for all potential respondents, or (weakly) decrease probability of response for all potential respondents, but it cannot increase the probability that some individuals respond while decreasing that probability for others. Under this assumption, only one group (treated, or control) has "extra" respondents, and differential item nonresponse across the two groups can be dealt with by trimming the excess respondents from that group. In our case, item nonresponse is higher in the treatment group (web mode) so that the excess observations to be trimmed are in the control group (F2F). The trimming, in turn, is done under two alternative extreme assumptions about the relationship between response and the outcome of interest. In our context, the outcome of interest is objective knowledge. We first assume that the excess observations are those with the highest objective knowledge scores, and then that the excess observations are those with the lowest objective knowledge scores. After each trimming the treatment effect is estimated in the usual way (but on the trimmed data). These two alternatives give logical upper and lower bounds on the treatment effect (assuming only monotonicity of the effect of treatment on response). Lee (2009) also provides methods to calculate confidence intervals for each of the bounds, and shows how covariates can be used to tighten the bounds.

We implemented the Lee bounds in two ways. First, continuing to treat partial item nonresponse to the knowledge questions as incorrect answers (and only a failure to answer any of the objective knowledge questions as nonresponse), and second, treating all missing answers as nonresponse. The results are presented below. In both cases, both the lower and upper bound of the mode effect are negative, but the confidence interval for the upper bound does not exclude zero. Attempts to use covariates to further tighten the bounds were not fruitful. Bearing in mind that the upper bound makes an extreme assumption about the missing answers in the web mode (that they have the highest levels of objective knowledge), we interpret this sensitivity analysis as showing that even if item nonresponse is nonrandom, the data strongly suggest a negative effect of web mode on objective knowledge.

Table C1
Lee bounds for missingness in objective understanding scores

Trimming		Web Mode	95% C.I.	
proportion	Bound	Effect	lower	upper
6.6%	Upper	−0.507	−0.649	−0.365
	Lower	−0.089	−0.227	0.048
7.1%	Upper	−0.473	−0.583	−0.362
	Lower	−0.052	−0.161	0.056