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Abstract

Web surveys generally produce higher item nonresponse than face-to-face administration. This study examines alternative forms of motivational statements to reduce item nonresponse in a web survey, using an experiment in the UKHLS Innovation Panel. Findings show that a motivational statement following immediately after an unanswered item outperforms either the control, presenting only opt-out options after an initial skip attempt, or a later-placed motivational statement. The immediate prompt reduces item nonresponse to levels equivalent to a face-to-face version, whereas other versions show increased missingness. The results suggest practical design implications in reduction of item nonresponse when using a web design, particularly the use and placement of motivational statements.

Key words: item nonresponse, mixed mode survey, web survey

JEL classifications: C81, C83

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1. Introduction

Item nonresponse is an important and widely used indicator of data quality (Groves 1989, de Leeuw et al. 2003), as those responding may systematically differ from those who do not (Little and Rubin 1987). The causes of item nonresponse may include not knowing or inability to recall the answer, lack of respondent motivation, and concerns about confidentiality (Beatty and Herrmann 2002). Web surveys produce significantly higher item nonresponse rates than interviewer-administered surveys (Duffy et al. 2005, Heerwegh 2009, Jäckle et al. 2013, Lesser et al. 2012). This difference suggests there may be scope to reduce item non-response rates on web surveys if relevant aspects of the interviewer-administered context could be replicated. Attempts to reduce item non-response rates are important for all web surveys but particularly important in the context of mixed-mode surveys involving both web and interviewer-administered data collection, where it may be desirable to achieve similar data quality in each mode.

Several methods have been proposed to address the causes of item nonresponse. On interviewer-administered surveys, motivational statements have been found to increase respondents' willingness to provide effort and answer the question (Miller and Cannell 1982). Based on this finding, some studies have implemented motivational statements in web surveys. Oudejans and Christian (2011) found that including a motivational statement about the importance of a question reduced the item nonresponse rate for two out of four items tested. However, Smyth et al. (2009) found that a similar motivational statement actually increased item nonresponse for both of two items tested. Including a prompt immediately

after an item was skipped has been found to reduce missingness (Derouvray and Couper, 2002; Oudejans and Christian, 2011).

These previous studies have some limitations, however. Only one dealt with closed questions (Derouvray and Couper, 2002). Reasons for choosing to skip a question could differ between closed and open questions and hence so could the effects of motivational statements and subsequent prompts. Derouvray and Couper (2002) only tested the effect of a subsequent prompt in the context of initial questions that included an explicit "decline to answer" option. None of the studies tested prompts that did not come immediately after the attempt to skip a question. None of them provide any comparison with the interviewer-administered context.

To address these limitations, an experiment was conducted on wave 6 of the Innovation Panel (IP), part of the United Kingdom Household Longitudinal Study (UKHLS). This was in response to findings at wave 5, where an experimental design had revealed significantly higher item-nonresponse with a mixed-mode (web and face-to-face) design than with a single-mode face-to-face design, due to greater item nonresponse in the web survey (Jäckle et al. 2013). The experiments at waves 5 and 6 were part of a research programme aiming to identify mixed mode designs that could deliver, amongst other things, similar data quality to single-mode face-to-face. A specific objective of the wave 6 experiment reported here is therefore to identify design features that would deliver mixed-mode item non-response rates that are not significantly higher than those achieved face-to-face.

2. Data and Methods

The UKHLS-IP is a vehicle for experimentation regarding aspects of survey design in a longitudinal survey context. It is based on a stratified, multi-stage probability sample of persons and households in England, Scotland, and Wales. At each annual wave, interviews

are attempted with all household members 16 years of age and older.[1] Prior to wave 5, all interviews were conducted by interviewer[2].

At wave 5, a random two-thirds of sample households were allocated to a mixed-mode web and face-to-face design, while the other third were administered the standard single-mode face-to-face design. In the mixed-mode treatment, if any household member did not respond to the web survey within two weeks, an interviewer was sent to attempt a face-to-face interview. The same sample allocation was maintained at wave 6.

The experiment of interest in wave 6 compared three methods of asking questions in the web survey. It was implemented on questions identified as important items that may be prone to item nonresponse (based on analysis of wave 5 web data) and was limited to six questions unlikely to all be applicable to any respondent, in order to avoid repetitiveness and burden in the prompted questions.[3] These questions ask about gross pay at last payment, amount received in interest and dividends, net profit in the past year (for those self-employed), UK county of birth, hourly pay, and whether marital status had changed since the last wave.[4] In the face-to-face versions, these questions were asked without explicit "Don't Know" (DK) or "Prefer Not to Say" (PNS) options, but these were accepted as answers if given.

In the web version, these six questions were asked using three experimental variations, allocated randomly[5]. Initially, each question was asked without DK/PNS options available. The variation occurred if the respondent attempted to skip the question. The

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[1] Full details of the sample design and field procedures can be found in the IP user's guide at https://www.understandingsociety.ac.uk/d/61/6849_IP_waves_1to5_User_Manual.pdf

[2] Entirely face-to-face at waves 1, 3 and 4; with a mix of face-to-face and telephone interviewing at wave 2.

[3] Gross pay and hourly pay were asked only of those in paid employment; profit from earnings was asked only of those self-employed; only those born in the UK who had not answered the UK county of birth in prior waves were asked this question; and only those respondents who did not have the same cohabitating spouse/partner from the last wave were asked the marital status change question. Only the interest/dividends question was asked of all respondents.

[4] Exact question wordings appear in Appendix A.

[5] Each respondent received the same variation for all questions.

control condition repeated the approach from wave 5: respondents were immediately presented the question again, with DK and PNS options now available.

In the second variation, the *reactive motivational* condition, if the respondent skipped the question, the question reappeared immediately, but included the statement "If possible, please provide an answer to this question as this is one of the key questions in this study. Please be assured that the information you give us will be treated confidentially." If a respondent attempted to skip the question again, the DK/PNS options now became available. In the third variation, the *follow-up motivational* condition, respondents proceeded exactly as in the control condition, with an attempted skip followed by DK/PNS options being available. Then at the end of the survey the following statement was presented:

> Thank you for taking part in 'Understanding Society' this year. Earlier in the interview there were some questions that you did not answer. As you know, you do not have to answer any question you do not want to. However, X of these questions are important to researchers and we would be grateful if you could try your best to answer them.

where X was the number of the six questions for which they did not provide substantive responses. The respondent was then asked the questions they did not answer with the same text as initially, with the DK/PNS options also offered. The idea behind this third condition was that it may overcome possible repetitiveness and irritation with the reactive condition. The conditions are summarised in Figure 1 and screen shots are provided in Figure 2.

Figure 1: Experimental treatments

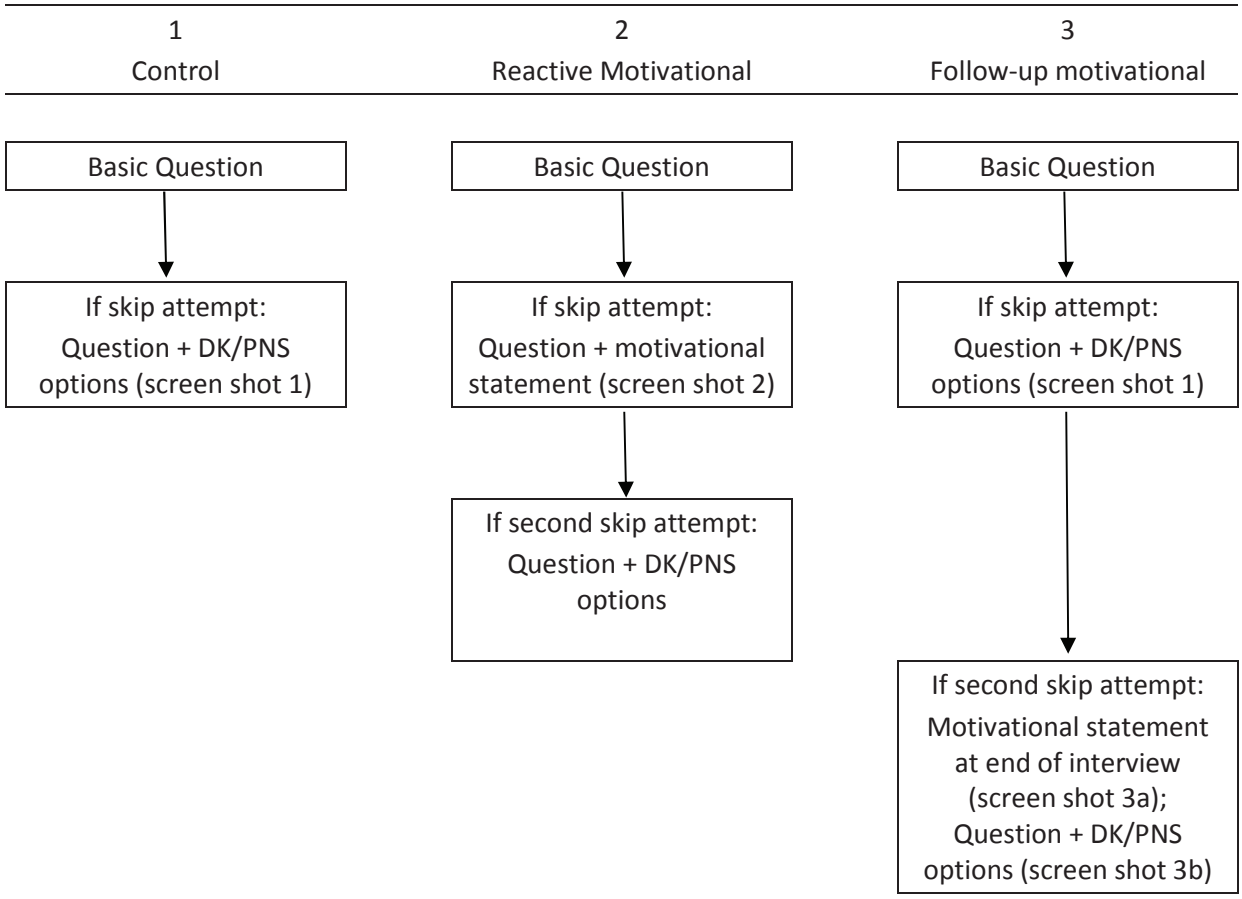
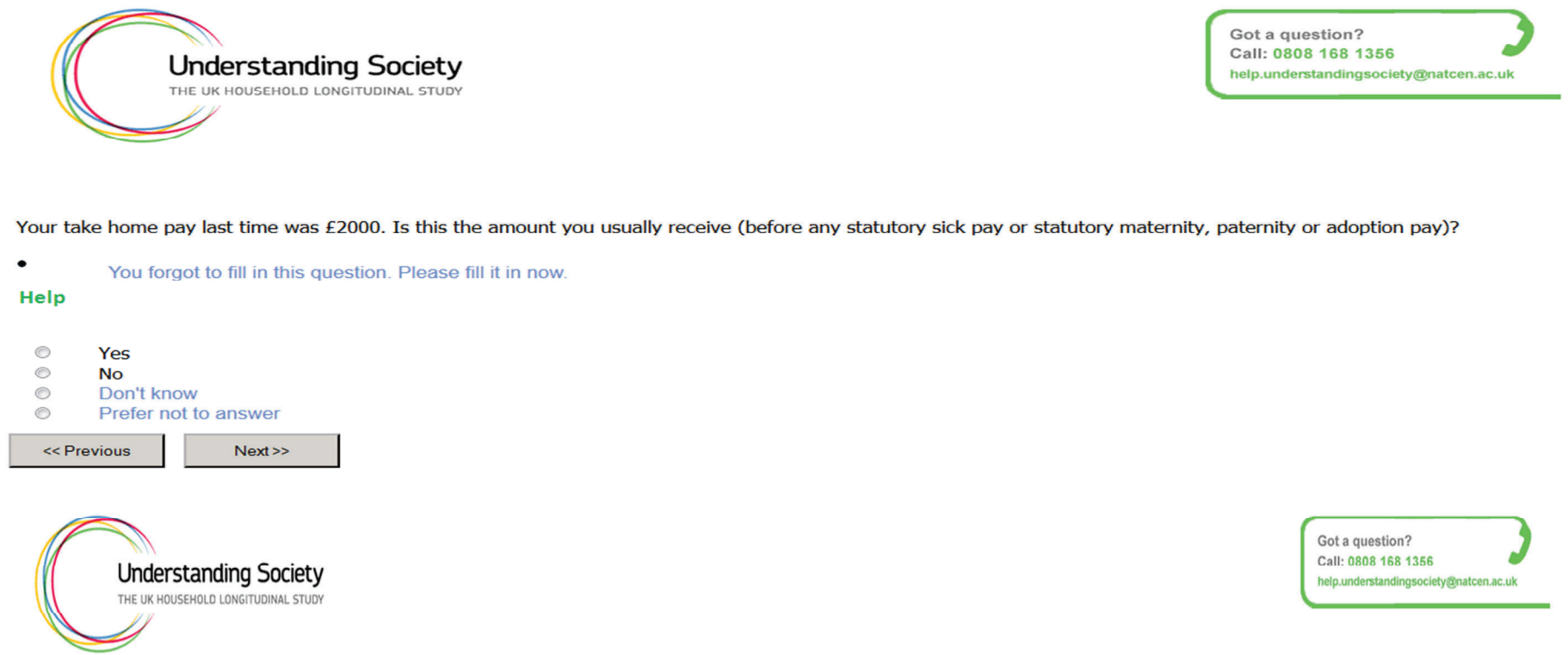


Figure 2. Screen Shots



Got a question?
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Thank you for taking part in Understanding Society this year. Earlier in the interview there were some questions that you did not answer. As you know, you do not have to answer any question that you do not want to. However, 1 of these questions are important to researchers and we would be grateful if you could try your best to answer them.

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In the past 12 months how much have you personally received in the way of dividends or interest from any saving and investments you may have? Please enter an amount to the nearest pound.

£

- ( ) Don't know
- (•) Prefer not to say

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There were 663 respondents in the single-mode face-to-face group and 1320 respondents in the mixed-mode group, of whom 513 were interviewed face-to-face while 807 completed the web survey: 260 in the control condition, 299 in the reactive motivational condition and 248 in the follow-up motivational condition. To assess the effect for web surveys, we first compare item nonresponse rates between conditions for web respondents. We then assess the effect for mixed-mode designs by combining the data from each of the web conditions in turn with the data provided by face-to-face respondents in the mixed-mode group. There are thus three mixed-mode estimates, representing the expected outcome for each web condition as part of a mixed-mode design. Since each web condition makes up only a fraction (n/807) of all web respondents, web respondents are weighted by the inverse of this fraction (807/n). Face-to-face respondents in the mixed-mode group received a weight of 1, so the weighted total for all three mixed mode designs is 1320. Generalized linear models using a logit-link and binomial distribution are used for all comparisons of item nonresponse rates.

3. Results

Due to routing, respondents were administered between 1 and 4 of the six questions. Of the 1983 respondents, 433 (21.8%) answered 1 question, 899 (45.3%) answered 2, 475 (24.0%) answered 3, and 176 (8.9%) answered 4. These percentages are similar across modes and conditions. There is wide variation in the number of respondents administered each question, with only 97 asked about UK county of birth, while all respondents were asked the question about interest and dividends. As no-one failed to answer the UK county of birth question, this item is not considered further, but is included in analyses of total missingness.

Final item non-response rates for each of the remaining five questions are presented for each condition in Table 1. Compared to the control condition, the follow-up motivational condition reduced item nonresponse rates for two items, but did not significantly reduce the

overall rate across all items. The reactive motivational treatment, on the other hand, significantly reduced the overall rate as well as the rates for two individual items. For a third item, gross pay, item nonresponse was significantly lower with the reactive treatment than with the follow-up treatment, though neither differed significantly from the control.

Rates for each of the three mixed-mode designs are presented in Table 2, along with the rates from the single-mode face-to-face design. As the contribution from face-to-face respondents is the same in each mixed-mode design, all differences are attributable to the web treatments. The total proportion of missingness for the six questions in each condition is presented in last row of the table. Significant differences in proportions between a mixed-mode and face-to-face design is denoted by a subscript.

Table 1: Item nonresponse rates by treatment; web respondents only

	Control	Reactive	Follow-Up
Gross pay	$0.159^{a,b}$ (n=138)	$0.127^{a,b}$ (n=166)	0.201^{a} (n=144)
Interest/Dividends	0.250^{a} (n=264)	$0.150^{b,c}$ (n=301)	$0.205^{a,b}$ (n=254)
Net Profit	0.654^{a} (n=26)	$0.556^{a,b}$ (n=18)	0.154^{c} (n=13)
Hourly Pay	$0.109^{a,b}$ (n=46)	0.039^{b} (n=51)	0.204^{a} (n=49)
Marital Status Change	0.028^{a} (n=106)	0^{b} (n=107)	0^{b} (n=97)
Total	0.211^{a} (n=264)	0.129^{b} (n=301)	0.181^{a} (n=254)

Note: Different superscripts within row indicate significant difference at $p<0.05$

Table 2: Weighted item nonresponse rates by treatment; mixed mode and face-to-face designs

	Mixed Mode Outcomes			
	Control	Reactive	Follow-Up	Face-to-Face
Gross pay	0.150	0.129	0.185^{+}	0.118
Interest/Dividends	0.209^{+}	0.146	0.192^{+}	0.136
Net Profit	0.583^{+}	0.452	0.228^{-}	0.404
Hourly Pay	0.108	0.057	0.166^{+}	0.061
Marital Status Change	0.016	0	0	0
Total	0.180^{+}	0.127	0.156^{+}	0.120

+ indicates mixed mode outcome significantly greater than face-to-face only outcomes at $p<0.05$
- indicates mixed mode outcome significantly less than face-to-face only outcomes at $p<0.05$

The reactive condition reduces overall item nonresponse in a mixed-mode design to levels comparable to the single-mode face-to-face design, outperforming the other mixed-mode conditions. None of the six item nonresponse rates are significantly different from the single-mode face-to-face design. The mixed-mode control condition has significantly higher item nonresponse than single-mode face-to-face for two of the five questions as well as overall. The control is also the only condition that has any item nonresponse in the marital status change question.

The follow-up condition produced higher item nonresponse rates than single-mode face-to-face for three individual items and overall. It produced lower item nonresponse for one item, net profit - the only instance where item nonresponse is significantly less in a mixed-mode condition. Few people were asked this question, however (mixed-mode weighted n=72.3, face-to-face n = 52).

Tests examining potential differences across respondent characteristics find no significant interactions between characteristics and experimental conditions.[6] The lack of

[6] The respondent demographics examined are sex, age (categorized), education (college/professional certification compared to all others), and race/ethnicity (British or Irish white compared to all others). The only significant main effect is for age $F(3,742) =4.19$, $p<0.01$. The oldest respondents are estimated to have the most item nonresponse, whereas those in the 30-49 age category are estimated to have the least.

significant interactions suggests that the conditions, while being differentially effective in reducing item nonresponse, are not differentially effective for different respondent groups.

Table 3 presents the number of additional substantive responses each condition garnered in the web survey when a respondent initially attempted to leave a question blank. The reactive condition added far more additional responses than either of the other conditions. The reactive condition obtained additional responses for all questions, except UK county of birth, reducing item missingness for every item prone to item nonresponse. The two additional responses to the marital status question brought the item missingness for this question to zero in this condition. Across all items, the reactive condition obtained 58 additional responses, 8.9% of all responses obtained. Conversely, the control condition only yielded five (1.0%) additional answers. The follow-up condition did not perform much better with a total of 10 additional responses across all questions, for a gain of 1.8% more responses.

Table 3: Additional Responses, Proportion of Total and Number by Experimental Conditions

	Web Condition		
	Control	Reactive	Follow-Up
Gross pay	0 n=0	0.114 n=19	0.014 n=2
Interest/Dividends	0.019 n=5	0.100 n=30	0.024 n=6
Net Profit	0 n=0	0.056 n=1	0 n=0
Hourly Pay	0 n=0	0.118 n=6	0.041 n=2
Marital Status Change	0 n=0	0.019 n=2	0 n=0
Total	0.009 n=5	0.089 n=58	0.018 n=10

Although less missingness may itself be considered an indicator of data quality, the question remains as to how the additional responses gained through different methods impact substantive response. Responses from the gross pay and interest and dividends question are examined as these two questions have the largest number of responses and the most additional responses. Given that the majority of respondents reported a zero value for the interest/dividends questions, we present separately the proportion of zero responses and mean values amongst non-zero responses. Table 4 presents three panels: in the first, initial response mean values for gross pay and non-zero interest/dividends and the proportion of zero responses for interest/dividends. The second presents the same for the additional responses obtained. The third presents the weighted final values from the mixed-mode as well as values from the single-mode face-to-face group.

The additional responses do not appear to greatly affect the estimates. There are no significant differences between any of the final estimates at $p<0.05$[7], though for both means the reactive treatment produces the estimates that are closest to the single-mode face-to-face estimates. The reactive and follow-up treatments both appear to reduce the proportion of zero responses to the interest/dividends question.

[7] Tests of the medians similarly returned no significant differences.

Table 4: Estimates of means and proportions for gross pay and interest/dividends, by treatment

	Web Conditions		
	Control	Reactive	Follow-Up
Initial Web Responses			
Mean weekly gross pay	731.20 (n=110)	523.29 (n=125)	764.57 (n=108)
Mean interest/dividends	457.62 (n=58)	817.63 (n=95)	568.00 (n=70)
Prop. interest/dividends zeroes	0.692 (n=130)	0.576 (n=129)	0.625 (n=115)
Additional Web Responses			
Mean weekly gross pay	None	541.90 (n=18)	473.08 (n=2)
Mean interest/dividends	None	183.21 (n=14)	161.25 (n=4)
Prop. interest/dividends zeroes	1 (n=5)	0.533 (n=16)	0.333 (n=2)

Final Outcome	Mixed Mode Outcomes			
	Control	Reactive	Follow-Up	Face-to-Face
Mean Gross Pay	921.71	762.60	934.88	527.73
Mean Interest/Dividends	752.51	876.54	768.77	861.08
Prop. Interest/Dividends Zeroes	0.737	0.655	0.697	0.698

4. Discussion

Our results suggest that a reactive prompt, with a motivational statement, presented immediately a respondent attempts to skip a question without answering, may be effective in reducing item nonresponse in web surveys to levels comparable to that of face-to-face surveys. In our experiment, the reactive mixed-mode condition outperformed both the control and follow-up conditions. The percentage of additional responses garnered by the reactive condition is several times greater than those obtained in the other conditions. If the lower item nonresponse is due to the timing of the motivational statement, it suggests immediate rather than delayed action. It should be noted that the reactive condition also had a statement

of confidentiality not present in the follow-up prompt, which may also have impacted results, increasing the impact as well as or instead of the timing.

The various conditions do not appear to affect item nonresponse differentially across respondent groups. This suggests that the same motivational messages can be used for a range of people. Our findings also suggest that the additional responses have a modest, if any, impact on estimates. However, this aspect warrants further investigation as our findings are based on small numbers of cases and variables with large variances. Other research, albeit on open-ended questions, suggests the possibility that additionally obtained responses in a web survey can be of lower quality (Oudejans and Christian 2011).

The frequency with which a reactive motivational prompt can be used is a subject of concern. To prompt a respondent after every missed question likely adds to their burden, as well as diluting the effectiveness of the motivational statement. We suggest that reactive prompts should be used sparingly, perhaps limited to items that are both substantively important and prone to item nonresponse. Further research could shed light on how often such a prompt could be used effectively.

Similarly, research should continue to examine the types of variables for which the reactive web prompt is best suited. The current study examined both numeric open-ended and categorical measures, with the greatest reductions in nonresponse being for the former. The reasons for this are unclear. Our categorical questions may have been particularly easy and non-intrusive, or the difference could have arisen because categorical questions are generally less difficult than numeric open-ended responses (Bradburn and Miles 1979). Further, our open-ended questions asked about monetary issues, which are generally seen as more intrusive and more prone to item nonresponse (Tourangeau et al. 2000).

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