

Factors that Influence Reading and Comprehension in Self-Administered Questionnaires

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Abstract

In this paper we examine a particular type of item non-response that is especially perplexing to users of self-administered paper questionnaires. It is the tendency for branching instructions to be ignored, misread, or otherwise not appropriately followed so that item non-response (or in other occasions erroneous completion) occurs for follow-up questions that only some respondents are expected to answer. We hypothesize that seven features of question complexity may affect the reading and comprehension of branching instructions: high number of question words; high number of answer categories; last categories branch; all categories branch; write-in responses; location at the bottom of a page; and high distance between the answer box and branching instruction. Largely, these variables reflect the proposition that complexity increases competition for the respondents' attention, making it less likely the branching instructions will be read and processed correctly. A logistic regression analysis revealed that as predicted, question complexity had a tendency to increase errors of commission (that is, respondents answering questions other than the ones they were directed to answer). Five of the seven characteristics demonstrated this effect (high answer categories, all categories branch, write-in responses, bottom of the page, and high distance). But contrary to prediction, complexity did not increase errors of omission (respondents leaving questions blank). Only two of the six characteristics demonstrated this effect (write-in response and bottom of the page), the reasons for which are explored in this paper. The results of this research confirm our general expectation that the visual and verbal complexity of information on a questionnaire affects what respondents read, the order in which they read it, and ultimately, their comprehension of the information.

Introduction

Item non-response, the failure to answer survey questions that should be answered, is greater in questionnaires that include branching instructions than in those that do not (Turner, Lessler,

George, Hubbard and Witt, 1992; Featherston and Moy, 1990). The problem of item non-response in such questionnaires is of particular concern because when the branching instruction is not seen nor followed correctly respondents may skip over series of questions that should have been answered, while answering many others that are not intended to apply to them.

Two recent studies have shown that modifications of the visual layout of branching instructions can reduce significantly the number of branching errors made by respondents to student (Redline and Dillman, 2002) and general public surveys (Redline, Dillman, Dajani and Scaggs, In Press). In both studies it was noted that branching errors occurred much more frequently for some questions than others.

Our purpose in this paper is to investigate possible causes of differences in branching error rates that occurred among items in our pursuit of design procedures that will improve the likelihood that respondents answer survey questions they are supposed to answer, and do not answer those that should be skipped. Specifically, we examine the effects of question complexity on whether questions and branching instructions are read and answered correctly.

Theoretical Development Of Test Elements

VISUAL AND VERBAL ASPECTS OF DESIGN

In spite of the fact that there has been a great emphasis in interviewer-administered surveys to provide respondents with exactly the same stimulus (Fowler and Mangione 1990), sufficient examples now exist to demonstrate that this often fails when interviewers are confronted with poorly designed questionnaires (e.g., Sanchez 1992; Smith 1995). If interviewers make errors in the face of training and support systems meant to minimize such errors, how much more apt are respondents to make errors in self-administered situations where the task of maintaining control over the reading and processing of information depends entirely on them and the design of the questionnaire itself? Regardless of whether we are talking about an interviewer- or self-administered questionnaire, however, it should be clear that understanding how a person *reads*

information is paramount to our goal of designing questionnaires that are understood correctly by all. Thus, we begin with what we know about this process to date.

Information on a questionnaire may be decomposed into one of four language types: (1) verbal language, which refers to the words, (2) numeric, which refers to the numbers, (3) symbolic, which refers to the check boxes, arrows, and other symbols on the questionnaire, and (4) the graphic paralanguage, which is the conduit by which all of the other languages is conveyed and includes the brightness, color, shape, and location of the information (Redline and Dillman 2002). This perspective grew out of early work, which demonstrated that variations in the languages of branching instructions could affect reading and comprehension rates. For instance, Turner et al. (1992) concluded that respondents had a greater tendency to see information to the right of an answer category if it was somehow made salient. In visual perception lexicon, “to the right of an answer” is a referent to the visual element *location* and “being made more salient” is a referent to being made more *visible*.

A probable explanation for this finding is provided by what was theorized to be the eye movements of respondents. It has been theorized that after respondents read through the response categories, their attention and therefore, their eyes, move back to the left to mark the answer boxes. Once respondents mark the answer box, their attention is diverted onto the next question. Consequently, a branching instruction that is located to the right of a response category may be overlooked in that position (Jenkins and Dillman 1995). This explanation is based upon early eye-movement research conducted by Kahneman (1973), who demonstrated that people’s vision is sharp only within 2 degrees (the foveal view), which is equivalent to about 9 characters of text. Thus, when a respondent is in the process of marking a check box, the branching instruction, which is located to the right of the answer category, is likely to be located outside of the respondent’s foveal view. Moreover, when a conventional branching instruction is printed in the same font and point size as the rest of the text, it is unlikely to be detected as different from the remaining text and something important to attend to (Wallschlaegar and Busic-Snyder 1992). Another way of expressing this is that people organize or group information according to similarity (Pomerantz 1981), which in the case of branching instructions could be deleterious. Recent eye-movement research with branching instructions provides support for this line of thinking (Redline and Lankford 2001).

Respondents' attention may also be diverted from the branching instruction and onto the next question because of the complex nature of perception. Both top-down processing (respondents' expectations of events) and bottom-up processing (the taking in of the actual stimulus) play a role (Jenkins and Dillman 1997). Cognitive research has suggested that respondents' expectations of the form-filling task are often simpler than the form's actual requirements (Dillman et al. 1999). In general, respondents expect to read a question, read the answer categories, mark a box, and then look for the next question. A discrepancy exists between respondents' perceptions of the process and what is really expected of them. For instance, Frohlich (1986) observed that respondents' decisions to read instructions appeared to depend upon a perceived need for additional information. In addition, a series of questions that does not contain any branching instructions may also impart the erroneous expectation that respondents are supposed to answer the questions sequentially.

Further, respondents may focus their attention on what they see as either the primary reason for the questionnaire, or the most interesting--the questions and response categories. This may reduce their attention to what they view as the less important or less interesting aspects of the questionnaire, like branching instructions. According to Wright (1980), there can be a mismatch between what the writer wants to write and what the reader wants to read, as evidenced by the fact that the instructions, which explain how to answer questions on forms, are often ignored.

A central theme in the above-cited reasons for making branching instruction errors is that respondents are not aware of the instruction at the moment that they make an error. Therefore, it becomes incumbent upon the questionnaire to bring the instruction to respondents' attention--in other words, to make it more visible. If errors are reduced as a result of making the instruction more visible, then this would provide evidence in support of the proposition that respondents were not aware of the instruction. If, however, errors are not reduced, then this may be an indication that respondents were aware of the instruction, but chose to disregard it.

Besides making the instruction more visible, however, other overarching strategies exist for reducing errors, depending on peoples' knowledge about a situation. If people have no knowledge stored in memory about the correct workings of a situation, then errors may be *prevented* by providing people in advance with a working knowledge of that situation; essentially they need to be trained (Wickens 1992). If, however, they already have a working knowledge stored in memory, then they may need to be reminded in advance to summon this

information to prevent errors (Norman 1992). The second strategy, then, for reducing errors, is to allow the user *to detect and correct* errors they have made through the use of feedback (Norman 1992).

Elsewhere we have delineated numerous ways to independently manipulate the graphical, symbolic, and verbal languages of information on questionnaires in an effort to increase its being read and comprehended, e.g. changes in figure/ground contrast, boldness, size, reverse print, and changes in location (Redline and Dillman 2002). Although, each could be manipulated individually, a more practical approach, and the one followed here, is to combine several of these into a more powerful stimulus, leaving for later the challenge of disentangling the individual effects. Thus, selected elements were combined under the prevention vs. detection methods of attracting and guiding respondent attention.

The Prevention Method. This method, which is illustrated in the first column of Figure 1, includes an instruction before each question to remind respondents to pay attention to the branching instructions. The purpose of these reminders is to prevent mistakes before they are made. On the first page, the reminders read “Attention: Check for a skip instruction after you answer the question below”, but as shown here, they are shortened on subsequent pages of the questionnaire to “Attention: Check for a skip after you answer...”. In addition, the prevention method employs three techniques to make the instruction more visible. First, the position of the check boxes and response categories are reversed, which makes it possible to place the branching instruction immediately beside the check box and presumably within the foveal view of respondents. Second, the font is enlarged. Third, the background is changed from a mustard color to white to increase the contrast between the bold lettering and the background even further. It is hypothesized that, taken together, these visual and verbal manipulations will decrease branching instruction errors in self-administered questionnaires.

The Detection Method. In this method, which is illustrated in the second column of Figure 1, the check boxes and the verbal branching instructions remain in their traditional locations. Since, as discussed earlier, this is not an ideal location for the branching instruction, the verbal branching instruction is made even bolder and larger to attract respondents’ attention to this location. Another difference between the detection version and the other versions is that the detection format is explicit about the non-branching situation. In both the conventional and the prevention formats, respondents are supposed to infer that in the absence of any explicit

instructions to branch, they are to go to the next question. In the detection format, however, a bold arrow comes off the non-branching check boxes on the left-hand side and points to a parenthetical phrase at the beginning of the next question, which is meant to provide feedback to respondents for self-correcting their mistakes. It is hypothesized that, taken together, these visual and verbal manipulations will decrease branching instruction errors in self-administered questionnaires.

The Control Method. Shown in the third column of Figure 1, this treatment uses a conventional branching instruction design, with the check boxes on the left, and the response options on the right. This is the format commonly used by the Bureau of the Census, including the long form of the 2000 Decennial Census. An arrow and the verbal branching instruction are placed to the right of the response option with no change in size or font from the rest of the text. However, there was one slight difference between the instruction and the rest of the type. The instruction is in Italics, whereas the rest of the type is not.

QUESTION COMPLEXITY CHARACTERISTICS

Reinterview studies have shown that some questions are more prone to response error than others (e.g., Thomas and Dingbaum 1992; Bureau of the Census 1986). One conclusion to be drawn from these findings is that simple questions are easier to process than more complex or difficult ones, and therefore, less prone to response errors. Also, different questions may require different demands of respondents, depending on where the questions are located on a page. For instance, advancing from a question located in the middle of the page to the next question on the page is a frequently repeated act, which is likely to require less processing from a respondent than a less frequent act, like advancing from a question on one page to another. Finally, not only are there differences in the complexity of the questions and their locality in a survey, but there are also differences in the complexity of the branching instruction task itself. For instance, a question that contains a single branching instruction should be easier for respondents to process than a question that contains multiple branching instructions.

Consequently, in addition to the design of the branching instruction, the following eight characteristics of a question were hypothesized to influence respondents' reading and comprehension of the branching instructions, and were built into the test questionnaire. Largely,

these variables reflect the proposition that greater cognitive complexity increases competition for the respondent's attention, making it less likely the branching instructions will be processed correctly.

Number of Words in Question. Lengthy or complex questions can exceed the respondent's capacity to process them (Just and Carpenter 1992). If questions with a higher number of words are more difficult to understand, then it may be that respondents need to concentrate more on understanding the question, at the expense of the navigational features of the question. Consequently, they may overlook the branching instruction. Another way of putting this is that the more words there are to process, the higher the demands on the respondents' processing system, which may result in problems of short-term memory (Eysneck 2001).

Number of Answer Categories. Research has shown that individuals can only retain approximately seven items or chunks of information in short-term memory (Miller 1956; Baddeley 1995). Therefore, questions with a high number of response categories may place more demands on the storing of information in short-term memory (Eysneck 2001). However, a competing hypothesis is that because there is more to process, respondents may also accidentally associate the wrong instruction with their chosen response option.

Last Categories Branch. Response-order effects have been shown to occur in surveys (e.g., Shuman and Presser 1981). It has been proposed that respondents to self-administered questionnaires have a tendency to choose earlier response categories in a self-administered questionnaire (Krosnick and Alwin 1987). This is known as a primacy effect. Our hypothesis is that while respondents may choose these earlier answer categories, they may go on to erroneously act upon branching instructions that are associated with later response options simply because these instructions stand out enroute to the next question. An example of a question in which the last category branches is provided for each treatment in the first row of Figure 2. As can be seen, there are two features of this branching instruction, which may cause it to be associated with the wrong category. The first is the increased amount of blank space around it (in comparison to some of the other branching instruction styles, like all categories branch). This space may make it more visible. Furthermore, its visibility might be exacerbated by its position within the question. The fact that it is the last piece of information, combined with its increased visibility, might cause respondents to accidentally read and act upon it, despite the fact that it is not associated with the earlier answer category they selected.

Alternating Branches. Questions with alternating branches, i.e. a category or categories that branch sandwiched between categories that do not branch, present respondents with more information than a question with a single branching instruction. Due to the increased amount of information, respondents may simply see the wrong instruction (one associated with an answer category above or below their answer choice). Or, as Baddeley (1995) asserts, the executive processor, which coordinates a person's attention system in short-term memory, may get directed elsewhere because of the increased amount of information being presented to the respondent. Consequently, respondents may read and comprehend the instruction correctly, but fail to recall it correctly a few seconds later when they actually need to act upon it (Neisser 1967).

Every Answer Branches. Again, respondents may simply see the wrong instruction. Or, in fact, the opposite may occur. Since every response option has a branching instruction, the branching instructions may blend into the response options causing respondents not to see them at all. Visual search tasks have demonstrated that a target item can be located more rapidly if it is made visually dissimilar from the nontarget items, which is not the case here (Foster 1979). As mentioned earlier, people organize or group information according to similarity (Pomerantz 1981), which in this case could be deleterious. A competing hypothesis, however, is that respondents may see the branching instruction, but fail to recall it correctly when the time is right because of competing information. An illustration of this question characteristic is shown in the second row of Figure 2.

Write-In Answers. Most survey questions are close-ended, which means that respondents choose their response to the question from among a preprinted list of responses and check a box that corresponds to it. In response to open-ended questions, however, respondents must do something different--they must generate their own answer and write it in a space provided. Respondents may be so focused on the more difficult task of generating their own answer and writing it down that they may forget to pay attention to the branching instructions (Eysenck 2001). Rogers and Monsell (1995) have shown that there are costs associated with switching between tasks, even when the switches are predictable and regular.

Furthermore, the write-in space must be large enough to reasonably accommodate an answer, which means that any branching instruction associated with this space tends to be even further to the right than when the responses are preprinted. Respondents may overlook the instruction

because it is even further from their sight now (Kahneman 1973). The third row in Figure 2 displays a branching instruction associated with a write-in box for all three treatments.

Location at the Bottom of the Page. Respondents get used to repeatedly moving down the page a little to find the next question. However, questions at the bottom of the page present respondents with an additional challenge, for they must change directions. Previous research has demonstrated that questions at the bottom of the page exhibit more item non-response than elsewhere (Featherston and Moy 1990). No doubt this is because there are costs associated with switching between tasks (Rogers and Monsell 1995). When a question at the bottom of the page includes turning a page, this task becomes even more difficult because the respondent must manipulate the physical structure of the questionnaire in addition to the visual structure. It follows, therefore, that questions at the bottom of the page which also contain branching instructions are at even greater risk, for respondents now need to remember the instruction instead of simply following it with their eye, while also attending to these other tasks (needing to change directions and possibly turning the page).

Distance Between the Answer Box and Branching Instruction. As explained earlier, questions with more distance between the answer box and the branching instructions may lead to higher error rates because people can only sharply see about 8 to 10 characters at one time (Kahneman 1973). Therefore, as respondents are marking a check box, the branching instruction may be too far away to be in their direct visual field. If respondents cannot see the branching instruction, they cannot comply with it.

Methods

TEST QUESTIONNAIRE AND IMPLEMENTATION PROCEDURES

In order to test the influence of design elements in conjunction with the effects of question complexity, a four-page questionnaire was developed in which twenty-four of the questions contained branching instructions. (Later a misprint was discovered in the branching instructions of one of the questions, so that question was dropped from any further analysis.) One criterion for developing the questions in the classroom experiment was that the questions be perfectly

independent from one another. That is, respondents could extract no clue from the content/context of the questions as to whether or not they should be answering them. So, for instance, the questionnaire did not ask “Do you own a bicycle?” followed by a topically contingent follow-up question, “What color is it?”. Instead it asked, “Do you own a bicycle?” followed by “If asked to choose from among the following activities, which one would you say you like doing the most?”. This was to assure that any improvement in branching instruction performance was due to the design of the branching instructions and not due to differential cues provided by the 23 questions under analysis and their follow-up questions.

However, because the questionnaires used in this experiment did not have topically contingent follow-up questions, it seems plausible that any influences of visual design and or question complexity might be mitigated, i.e., respondents would make fewer errors if they happened to review their answers and see that they could actually answer all of the questions. This concern led to the development of a protocol that emphasized keeping respondents on task, and avoiding their reviewing and possibly changing answers once they had completed going through the questionnaire.

The questionnaire in the classroom experiment was administered to 34 classes of undergraduate students at Washington State University in October and November of 1998. The classes ranged in size from 9 to 192 students. Classes were selected from two campuses, Pullman, the main university campus located in Eastern Washington where students are primarily residential, and Vancouver, a commuter campus where students tend to be somewhat older and none live on campus. An attempt was made to vary the subject matter of the classes that were selected to increase heterogeneity among the students.

The questionnaires were systematically handed out in envelopes, with every third student receiving a different questionnaire. Students were told at the beginning of the experiment that they were being asked to help with a Census Bureau sponsored evaluation of questionnaire designs and that all they were being asked to do was to fill out a brief questionnaire, and then exchange it for a “blue” sheet with six short debriefing questions about their reactions to the questionnaire. Students were instructed at the top of the test questionnaire to “Please answer the questions below and do not go back to reconsider or change your answers to any previous questions.” Following answering the last question, students were instructed to place the test questionnaire into the same envelope it had come in without reconsidering any of their answers.

When the research monitors observed anyone putting the completed questionnaire into the envelope, they immediately asked for the envelope and handed the blue debriefing form to the student. Through these procedures, we attempted to avoid a test mentality, whereby students who finished early might spend time correcting their answers (Dillman 2000). In total, 1,266 students filled out the test and debriefing questionnaires: 422 students filled out the control form, 421 students filled out the prevention form, and 423 students filled out the detection form.

A more recent experiment conducted on a general public sample as part of Census 2000 provides evidence that the results of the classroom experiment were not unduly influenced by the lack of topically contingent questions. The Census 2000 experiment compared prevention, detection and control strategies quite similar to the ones tested in this study. Two results from the census experiment give us confidence that the results of the classroom experiment provide inferential value. First, the overall pattern of error rates across treatments is similar in the two experiments (Redline et al In Press). This provides us with confidence that the treatments behave similarly under both conditions. The second is that the absolute error rates within comparable treatments are either the same or higher in the census than in the classroom experiment (Redline et al 2001). This counters any notion that the error rates in the classroom experiment may have been artificially inflated as a result of the experimental design.

MEASUREMENT OF RESPONDENT BRANCHING ERROR RATES

The alternate visual and verbal designs were evaluated by comparing the commission and omission error rates across designs. An opportunity to make an error of commission occurred when a respondent selected a response with a branching instruction associated with it. An error of commission occurred if the respondent answered a question other than one they were instructed to answer. An opportunity to make an error of omission occurred when a respondent selected a response that did not have a branching instruction associated with it. An error of omission occurred if the following question was left blank. It is also possible that the lack of response to a follow-up question may be due to a refusal by the respondent to answer the question. For this study, the possibility was unlikely, so all such missing responses were assumed to be unintentional and due to an error of omission.

For each question with a branching instruction, the error rates were calculated as follows:

- (1) Any respondent who provided no answer to the question (or provided more than one answer to the question) was removed from the sample.
- (2) For those remaining in the sample, the answer to the branching question was used to classify each respondent as *supposed to branch* or as *not supposed to branch*.
- (3) For those who were supposed to branch, respondents were only counted as executing the branching instruction correctly if they answered the question specified in the instruction and no intervening questions. If a respondent branched to the wrong question, that was categorized as an error. The number of those who made a commission error was used as the numerator in the commission error percent calculation and the number of those who were supposed to branch was used as the denominator.
- (4) For omission error candidates, response to the question following the branching question was used to determine whether or not an omission error had been made. The number of those who made an omission error was used in the numerator of the omission error rate, and the number of those who were not supposed to skip was used in the denominator.

The total number of commission errors and the total number of omission errors was computed for each respondent. Overall estimated commission and omission error rates were computed as weighted averages of the individual commission and omission error rates, with weights being the number of commission and omission error opportunities. Standard errors for the commission and omission error rates were computed using the VPLX variance estimation program using simple jackknife replication (U.S. Census Bureau 1999). Z tests were computed using these variances for overall error rate differences between the control, prevention, and detection forms. This procedure takes into account the clustering or correlation of answers within respondents when computing the variances.

MEASUREMENT OF QUESTION COMPLEXITY

Each of the eight question characteristics was defined as a binary variable and this definition was applied to each of the 23 branching instruction questions (See Table 1).

Number of words in question. This variable refers to the number of words in the questions only. It does not include the parenthetical instructions in the detection method or the reminder instructions to pay attention to the branching instructions in the prevention method, which vary by form type. If either the advance or parenthetical instructions on the experimental questionnaires had been included, then the design of the branching instructions would have been confounded with these additional words. Therefore, we used the median of the number of words in the *questions only* to categorize each question as containing either a high number of words (12 or more) or a low number of words (up to 11 words). Variables containing a high number of words were coded 1, and those with a low number were coded 0.

Number of answer categories. The number of answer categories range from 2 to 11. We used the median number of answer categories to divide answers into either a high number of answer categories (4 or more) or a low number of answer categories (up to 3). Those with a high number were coded 1 in the regression analysis and those with a low were coded 0.

Last Categories Branch. This variable was coded 1 if the last category or categories of the question contained a branching instruction and 0 if they did not.

Alternating Branches. This variable was coded 1 if the branching instructions alternated from category to category (or from categories to categories) and 0 if they did not. So, for instance, in question 12 the first answer category had a branching instruction associated with it, the second did not, the third did, and the fourth did not. In question 21 the first three answer categories had a bracketed branching instruction associated with them, the second three categories did not, and the last three categories had a bracketed branching instruction associated with them.

Every Answer Branches. This variable was coded 1 if every answer category contained a branching instruction, and 0 if at least one of the answer categories did not contain a branching instruction. By definition, when all of the answer categories have branching instructions associated with them, the opportunity to make an error of omission does not exist, so this variable (every answer branches) is not included in the analysis of omission errors.

Write-in answers. This variable is coded 1 if the question required a write-in response and 0 if it did not.

Bottom of the page. This variable was coded 1 if the question was located at the bottom of the page and 0 if not. Although question 35 was not physically the last question on the page (it

was the next to last), it was coded as falling at the bottom of the page because of a nuance. That is, all of its answer categories required respondents to branch. Thus, if respondents answered question 35 correctly, it should have been the last question they answered on that page.

Distance between the answer box and branching instruction We measured the distance between the right-hand edge of the check box and the beginning of the word “skip” in the case of branching instructions associated with check boxes, and the left-hand side of the write-in box and the beginning of the word “skip” in the case of branching instructions associated with write-in spaces. Unlike the previous variables, this variable varies by form type. The distance between the end of a check box and the beginning of the branching instruction is always 0.06 inches on the prevention form, except for the two write-in responses, where the distance increases to 2.69 inches. Thus distance is completely confounded with the write-in variable on the prevention form, and therefore, provides no additional information when it comes to this form. Consequently, we excluded the distances recorded for the prevention form from any further analysis. The distance between the answer spaces and branching instructions on the detection and control forms ranged from 0.44 to 2.81 inches. We used the median of these distances to divide answers into either a low distance (less than 0.97 inches) or a high distance (0.97 inches or more) on these forms.

LOGISTIC REGRESSION ANALYSIS

Logistic regression analysis was used because the dependent variables are binary (1= error made, 0= error not made) and because more than one aspect of complexity (the independent variables) were hypothesized to influence the making of errors. It can be seen from Table 1 that the independent variables were not necessarily mutually exclusive of one another. For instance, question 11 contained a high number of question words, all of its answer categories contained a branching instruction, it was located at the bottom of a page, and its branching instruction was distant from the check box. Logistic regression analysis attempts to take this into consideration by determining if an independent variable has a marginal effect on the dependent variable, conditional upon holding the other independent variables in the model constant. Alternating skips was dropped from the analytic models after determining that it was strongly correlated with a high number of answer categories. In addition, write-in and distance on the prevention form

are perfectly correlated, and thus distance was excluded from the initial analysis conducted with all three forms.

Two sets of four logistic regression analyses were conducted: one with the errors of commission as the dependent variable and another with the errors of omission as the dependent variable. Each set included an analysis of all forms together and a separate analysis of the control, prevention, and detection forms. PROC GENMOD in SAS was used to take into account the dichotomous nature of the dependent variables and the REPEATED statement was used to account for the clustering or correlation of answers within subjects (Allison 1999).

Results

Table 2 shows that on average the errors of commission were reduced by more than half, from a high of 20.7% for the control form to 9.0% for the prevention form and 7.6% for the detection form. The difference between the control form and either experimental form was significant at the .001 level of the Z test. However, the difference between the two experimental forms was not significant. According to Table 2, the errors of omission, however, more than doubled, from a low of 1.6% for the control to 3.3% for the prevention and 3.7% for the detection forms. Again, the difference between the control form and both of the experimental forms was significant at the .001 level of the Z test; however, the difference between the prevention and detection forms was not significant.

Substantial variation existed in the errors among questions, with the errors of commission ranging from 0 to 51.7% and the errors of omission ranging from 0 to 33.9% by question. As a result, it was hypothesized that questions possessing complex question characteristics would have higher commission and omission error rates than questions that did not possess them. Table 3 shows that all of the question characteristics have a significant effect on the errors of commission when the forms are analyzed together. Four of the six characteristics are in the predicted direction: high number of categories, all categories branch, write-in response, and bottom of the page. For instance, the odds of making an error of commission with questions containing a write-in response is nearly four and three-quarters times the odds of making an error

with multiple choice questions across all forms. The odds of making an error of commission with questions that contain a high number of answer categories is over one and a half times the odds of making an error with questions that have a low number of answer categories across all forms.

However, the odds of making an error of commission when the question contains a high number of words or the last category branches is significantly less than the odds of making an error with questions that do not possess these characteristics. This is the opposite of what was hypothesized.

Table 3 shows that when the results across all forms are parsed by treatment, two of the six question characteristics clearly exhibit differences in the predicted direction across all treatments: high number of answer categories and write-in responses. The odds of making an error of commission with questions that contain a high number of answer categories is 1.43 times the odds of questions containing a low number of answer categories in the control, 1.69 times the odds in the prevention method and 2.30 times the odds for the detection method. The odds of making an error of commission with questions containing write-in responses in the control method are a little over 3 times the odds of making an error with the multiple choice questions on that form. However, the odds jump to over seven times the odds for the prevention and detection methods, respectively. Also, the odds of making an error of commission when all of the answer categories instruct respondents to branch is over two and a half times the odds of making an error with all of the other questions in the detection method only. Finally, the odds of making an error of commission when the questions fall at the bottom of the page is significantly greater than the questions throughout the rest of the questionnaire on the control and detection forms only.

When the data are parsed, it becomes evident that the odds of making an error of commission when the question contains a high number of words are significantly less on the detection form, but not the other forms. The odds of making an error of commission when the last category branches are also less on the control and prevention form only.

When distance between answer box and instruction is added to the model for the only two versions to which it applies, i.e. the control and detection forms (Table 4), it too is significant overall, and in the predicted direction. However, the estimate is only significant for the control form, and not for the detection form.

Table 5 shows that four of the five question characteristics have a significant effect on the errors of omission when all forms are considered together: high number of question words, high number of answer categories, write-in response, and bottom of the page. (Since the “All Answers Branch” variable yields no omission opportunities, it is not included in the omission error models, and thus five variables are under analysis here compared to six for the commission error rate analysis.) Two of the four characteristics (write-in response, bottom of the page) are in the predicted direction, the other two (high number of question words and high number of categories) are in the opposite direction.

When the data are parsed by treatment, one variable remains significant across all treatments: bottom of the page. The odds of making an error of omission is approximately four and a half times the odds of making such an error elsewhere on the control method, and it was a little over two times the odds on the prevention and detection methods, respectively.

When the data are parsed by method, one can see that the non-significant effects of last category branches is due to the fact that the individual effects are moving in the opposite direction on the control and detection forms and canceling one another out. For instance, the odds of making an error of omission when the last category branches on the control form was 0.32 times the odds of doing so with the other questions on the form. However, the odds were nearly three times more on the detection form.

Addition of distance between answer box and instruction to the models for the control and detection forms (Table 6) reveals that it is significant, but not in the predicted direction as was the case for commission errors. It is significant for both the control and detection form as well as overall.

Discussion

The analysis has revealed, first, that altering the visual and verbal design of branching instructions has a substantial impact on how well respondents read, comprehend, and act upon the branching instructions. However, the analysis also revealed that respondents were more likely to read and act upon the experimental branching instructions, both when they were

supposed to (manifested by reduced commission error rates in Table 2), as well as when they were not supposed to (manifested by increased omission error rates). This means that the strategies to increase the branching instructions visibility and to prevent and detect errors worked to reduce errors of commission. However, by the same token these same strategies failed, or induced omission errors. In addition, it appears that the prevention and detection strategies worked or failed at about the same rate. These findings are evidence in support of our original hypothesis that for the most part branching instruction errors occur because respondents are unaware of them and not because they see the instructions, but deliberately choose to disregard them. If the latter were true, we would not have seen differences in error rates between the form types.

In addition, the results of the logistic regression analyses show that the complexity of the question in which the branching instruction was placed (that is, the surrounding information) also had an effect upon the reading, comprehension and execution of the branching instructions, although not always as predicted.

ERRORS OF COMMISSION

Tables 3 and 4 show that as predicted, question complexity had a tendency to increase errors of commission. Five of the seven characteristics had this effect (high answer categories, all categories branch, write-in responses, bottom of the page, and high distance). Holding all other complexity characteristics constant, respondents were less likely to read and act upon an applicable branching instruction taking all forms together when the questions contained a high number of answer categories. This was anticipated either because questions with a high number of response categories place more demands on the storing of information in short-term memory (Eysenck 2001) or because respondents associate the wrong instruction with their choice.

Since we conducted this classroom experiment, Redline and Lankford (2001) tracked the eye movements of 25 respondents filling out these same questionnaires. They found that respondents tended to make mistakes when the question contained a high number of answer categories because of the way they read through this information. Respondents were more likely to make mistakes if they read the branching instruction at the time they read the answer category with which it was associated, and they had not yet finished reading through the remaining answer

categories. The eye-movement analysis suggested that by the time they finished reading through the answer categories, they had forgotten the branching instruction. Thus, the reason for making errors of commission in the presence of a large number of answer categories appears to be related to errors of memory, and not due to associating the wrong instruction with their answer choice. Furthermore, these errors of memory appear to be related to the order in which respondents read the information.

The same reason respondents may have forgotten to act upon the branching instruction when there was a high number of answer categories (the fact that they did not read the branching instruction last in this case) could very well explain why their performance in our experiment improved when the branching instruction was the last item they read, that is, when the last category branched. As shown in Table 3, the odds of making an error of commission in the presence of a high number of answer categories was approximately one and one-half times that of the other questions on the questionnaires. However, it dropped to about three quarters of the other questions on the questionnaires when the last category branched. Thus, as predicted at the beginning of this paper, respondents do tend to see and act upon branching instructions associated with the last category, which turns out to be good when they have chosen that answer category.

These findings lend support for a principle of questionnaire design, which states that directions should be placed where they are to be used and where they can be seen (Jenkins and Dillman 1997). But it also shows the difficulty faced when such principles are applied to situations in which we do not clearly understand yet how respondents read and process information. Placing the branching instruction with the answer category with which it is associated could reasonably be interpreted as placing it ‘where it is to be used,’ that is, of using the grouping law of proximity advantageously (Pomerantz 1981), until it is understood that respondents may delay acting upon the branching instruction at the moment they read it in favor of reading through the remaining answer categories. The act of reading through the remaining answer categories appears to divert respondents’ attention away from the branching instruction, during which time they appear to forget it (Eysenck 2001). Thus, moving the entire answer category and its associated branching instruction to the last position or positions in the list may advantageously permit respondents to read and act upon the instruction without diversion, that is,

they will not need to encode and store the branching instruction in short term memory for any length of time.

Write-in questions were the greatest offenders when it came to increasing the odds of commission errors, one can only assume for either and/or both of the same reasons just discussed—either because respondents did not see the instruction and/or they forgot it. The distance between the beginning of the write-in space and the branching instruction was about 2-3/4 inches on all of the forms, whereas the median distance between the check boxes and the branching instructions for the multiple choice questions across the form types was much less than that--only about an inch. So, it is highly plausible that respondents overlooked the branching instruction associated with write-in spaces because it was clearly far from where they were writing. On the other hand, even if they did read the instruction in its distant position prior to their beginning to respond, they could easily have forgotten it by the time they finished generating and writing in their answer. Unfortunately, the design of this research does not allow us to determine which of these reasons are accountable for the errors, but it does suggest that the problem was not corrected by the redesign of the branching instructions in this study. However, one reason the odds of making an error of commission with write-in questions looks greater on the experimental forms than the control is because the experimental forms differentially improved the commission error rates with the other questions on the forms.

The odds of making an error of commission at the bottom of a page were greater on the control and detection forms. This is more evidence suggesting that respondents are vulnerable to making errors of commission when they experience a diversion between having read the branching instruction and acting upon it. This was certainly the case when there was a large number of answer categories, and could arguably be the case when respondents must generate and write-in their answers or move from the bottom of one page to the top of another. In other words, respondents' attention may be diverted as a result of having to change directions and possibly having to turn the page.

The odds of making an error of commission when respondents answered questions in which all of the answers directed respondents to branch was over two and a half times greater on the detection form. This is evidence in support of the feedback mechanism's efficacy, for only questions in which all of the answers directed respondents to branch lacked a feedback mechanism on the detection form.

It is interesting to note that question complexity had less of an effect on the prevention form than the other forms (four of the six question characteristics did not affect errors of commission on the prevention form). This may have been because the branching instruction was standardized on the prevention form. Not only did it always look the same, but also unlike the other forms, it was always placed in the same location throughout the form, which was a radical departure from the control and the detection form. There appears to be less interaction between it and the design of the question as a result. The only exceptions to this occurred when a question had a high number of answer categories and respondents were required to generate their own response, which makes sense because the changes made to the prevention method were not as radically different from the other methods when it came to these particular questions. The branching instruction was no more the last piece of information provided in a long list of answer categories on the prevention form than the other forms, and the branching instruction was as far to the right of the write-in space on the prevention form as the others.

It also appears from the analysis of combined results from the control and detection forms that a greater distance between answer boxes and branching instructions played some role in the occurrence of commission errors (Table 4). This result is consistent with our original hypotheses that the further away the branching instruction is from where respondents are actually marking their answers, the greater the likelihood respondents will overlook the instruction. However, it is also evident that when the data are parsed by form type, this effect was moderated on the detection form. This suggests that, as predicted, increasing the size of the branching instruction on the detection form helped to compensate for the increased distances by attracting respondents' attention to it more often than on the control. Also, increasing the branching instruction sometimes actually led to a decrease in the distance between the branching instruction and the check box because the answer category was forced to continue on a second line.

At the beginning of this study we hypothesized that respondents would make more errors when the questions contained a large number of words because of the increased complexity these situations present to respondents. However, the data show that for the most part, there was no relationship between the number of question words and the error rates. The exception to this occurred with the detection form in which performance was improved rather than weakened. The detection form was the only form to have altered the surrounding area of the question by

inserting a parenthetical feedback message in front of the question, so maybe the feedback message was responsible for this effect.

ERRORS OF OMISSION

Tables 5 and 6 show that question complexity had a less of a tendency to increase errors of omission. Only two of the six characteristics had this effect (write-in response and bottom of the page). In the case of write-in response and questions at the bottom of the page, the errors of omission were in the same direction as for the errors of commission, which means that not only did respondents have a tendency not to branch as instructed (errors of commission), but they also had a tendency to see and act upon branching instructions that were not associated with their answer category (errors of omission). Again, it is interesting to note that this occurred in questions that required respondents to do something different from what they had been doing. The one exception to this occurred with write-ins on the detection form, which suggests that the feedback mechanism may have worked in this particular case.

With a couple of exceptions, respondents' handling of the branching instructions was improved in the presence of a high number of question words, answer categories, and distance. At the beginning of this study we hypothesized that complexity and greater distances would interfere with respondents' reading and processing the instructions correctly. However, it is now evident that to avert errors of omission, the opposite is desirable—that respondents NOT read and act upon the branching instructions. Thus, the same behavior that leads to errors of commission—erroneously overlooking applicable branching instructions—can lead to the beneficial ignoring of inapplicable branching instructions, or fewer errors of omission.

The remaining variable (last category branches) registered as not significantly different from the other questions on the forms when all the forms were taken together, but it became clear that when the forms were parsed by form type, this was because the effects moved in the opposite direction and canceled one another out. The odds of making errors of omission on the control form were lower when the last category branched and they were higher on the detection form. This latter finding is in keeping with our original hypothesis, and might have occurred for precisely the same reason the errors of commission went down when the last category branched—because respondents were more likely to see it and act upon it, even when they were

not supposed to. And they were more likely to see it on the detection form than the control because of its increased size.

Conclusion

The results of this experiment extend previous research by showing that question complexity influences the extent to which respondents correctly follow branching instructions in self-administered questionnaires, in addition to the influence registered by the specific visual and verbal design of the branching instruction. As predicted, question complexity had a greater tendency to increase errors of commission. Five of the seven characteristics had this effect (high answer categories, all categories branch, write-in responses, bottom of the page, and high distance), which means that errors were more highly concentrated in questions with these characteristics. But contrary to prediction, these same question complexity characteristics did not increase errors of omission. Only two of the six characteristics had this effect (write-in response and bottom of the page).

These findings appear to be opposing faces of the same coin in that complexity (or competition for the respondent's attention) deleteriously diverts respondents' attention from reading, or as our research suggests, remembering branching instructions intended for them. By the same token, however, the results suggest that complexity (or competition for the respondent's attention) either has no effect or advantageously keeps respondents from mistakenly reading or remembering to act upon branching instructions not intended for them, except perhaps in those cases where they are presented with an additional out-of-the-ordinary task, as occurs with write-ins and being at the bottom of the page. These findings are not surprising in that they demonstrate the complex and often opposing forces at work in questionnaires, and the difficulties questionnaire designers face when searching for an optimal balance between them.

When looking at the forms individually, the control form, but not the experimental forms mirrored these findings. Question complexity wielded less influence over errors of commission, especially in the prevention form. Only four of the question characteristics were found to increase errors of commission in the detection form, and only two in the prevention form. However, there were two question characteristics that led to increased errors of commission,

regardless of form type and one that led to increased errors of omission. These can be thought of as strong determinants of error, and included requiring a write-in response, having a high number of answer categories, and being at the bottom of the page, respectively

This last finding has immediate practical implications. It suggests that questions with branching instructions should be avoided at the bottom of a page, and more thought should be put into how to design write-in spaces so that respondents will see and remember to act upon applicable branching instructions, while simultaneously not attending to inapplicable the branching instructions. Also, to lower error rates further, long lists of answer categories might be rearranged so that those associated with branching instructions are placed last. However, to the extent primacy effects are a concern (see Krosnick and Alwin 1987), one may also wish to avoid this accommodation.

Overall, the results of this research have shown that the verbal language of a questionnaire cannot be divorced from or thought of in isolation from the other languages of the questionnaire, nor can the physical structure of the questionnaire be ignored when questionnaires are designed, as all of these factors clearly combine to affect what respondents read and the order in which they read it. Research needs to continue to identify the factors that influence what respondents read and the order in which they read it, for the results of this paper have shown that comprehension, the retrieval of information, and ultimately respondent performance are affected.

In addition, the results of this research also suggest numerous other areas for research, some of which we have undertaken or have plans to undertake. We do not yet know the extent to which respondent characteristics, such as education, language skills, and other personal attributes affect respondents' performance with branching instructions. As noted earlier question content/context effects were controlled for in the classroom experiment. Although this feature allowed us to attribute improvements in respondents' performance to the experimental designs, it did not represent the usual branching situation in which additional clues are available from the questions themselves. However, a subsequent test of procedures for designing branching instructions has allowed us to test the effectiveness of slightly revised detection and prevention methods in situations where such clues were available. That test, was included in the 2000 U.S. Decennial Census which surveys all households in the United States (Redline, et al. In Press). Results from that test showed remarkable similarity to the error rates observed in the classroom test. The error rate for the control group in this national study was 20.8% (ranging from 1.9% to

79.2% for individual items); commission errors were significantly reduced to 14.7% for the detection method and 13.5% for the prevention method, while omission errors were significantly decreased from 5.4% for the control to 4.0 for the prevention method, but remained slightly higher (7.0%) for the detection method. The range of differences across items, while proportionately less, remained substantial. This subsequent national test provides additional evidence that improved visual design can significantly reduce commission branching error rates, and in the case of the prevention method may also reduce omission error rates. An additional research priority that remains is to determine the extent to which the complexity variables examined here might account for these variations.

Despite the enormous use of self-administered questionnaires by survey institutions, our knowledge of what people read and comprehend and why remains in its infancy. The study of branching instruction behavior has allowed us to obtain evidence of whether information on such questionnaires is seen, comprehended and acted upon. However, it is important that ways be developed to objectively measure whether respondents see, comprehend and act upon other information in questionnaires, where there is not such an obvious indicator of comprehension as there was with branching instructions. Our understanding of the quality of respondent answers to self-administered questionnaires and efforts to assure that respondents answer all questionnaire items appropriate to their situation depends upon it.

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Figure 1. Branching Instruction Designs.

Prevention	Detection	Control
<p>16 Attention: Check for a skip after you answer ...</p> <p>Do you own a bicycle?</p> <p>Yes <input type="checkbox"/> Skip to 18</p> <p>No <input type="checkbox"/></p>	<p>16 Do you own a bicycle?</p> <p><input type="checkbox"/> Yes → Skip to 18</p> <p><input type="checkbox"/> No</p> <p>↓</p> <p>17 (if no or sent here from an earlier question) If asked to choose from among the following activities, which one would you say you like doing the most?</p>	<p>16 Do you own a bicycle?</p> <p><input type="checkbox"/> Yes → Skip to 18</p> <p><input type="checkbox"/> No</p>

Figure 2. Examples of selected question characteristics by branching instruction treatment.

An example of a question from the questionnaire in which ...	Prevention	Detection	Control
1. the last category directs respondents to branch.	<p>24 Attention: Check for a skip after you answer ...</p> <p>Have you ever purchased the sound track of a movie?</p> <p>Yes <input type="checkbox"/></p> <p>No <input type="checkbox"/> Skip to 26</p>	<p>24 Have you ever purchased the sound track of a movie?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No → Skip to 26</p>	<p>24 Have you ever purchased the sound track of a movie?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No → <i>Skip to 26</i></p>
2. all answer categories direct respondents to branch	<p>35 Attention: Check for a skip after you answer ...</p> <p>About how often do you attend religious services?</p> <p>Once a week or more <input type="checkbox"/> Skip to 36</p> <p>2-3 times a month <input type="checkbox"/> Skip to 37</p> <p>Once a month <input type="checkbox"/> Skip to 37</p> <p>4-9 times a year <input type="checkbox"/> Skip to 38</p> <p>Once a year or less <input type="checkbox"/> Skip to 38</p> <p>Not at all <input type="checkbox"/></p>	<p>35 (If one of last two categories) About how often do you attend religious services?</p> <p><input type="checkbox"/> Once a week or more } Skip to 39</p> <p><input type="checkbox"/> 2-3 times a month } Skip to 37</p> <p><input type="checkbox"/> Once a month } Skip to 37</p> <p><input type="checkbox"/> 4-9 times a year } Skip to 38</p> <p><input type="checkbox"/> Once a year or less } Skip to 38</p> <p><input type="checkbox"/> Not at all }</p>	<p>35 About how often do you attend religious services?</p> <p><input type="checkbox"/> Once a week or more } <i>Skip to 39</i></p> <p><input type="checkbox"/> 2-3 times a month } <i>Skip to 37</i></p> <p><input type="checkbox"/> Once a month } <i>Skip to 37</i></p> <p><input type="checkbox"/> 4-9 times a year } <i>Skip to 38</i></p> <p><input type="checkbox"/> Once a year or less } <i>Skip to 38</i></p> <p><input type="checkbox"/> Not at all }</p>
3. a write-in response is requested.	<p>13 Attention: Check for a skip after you answer ...</p> <p>Who is your favorite sports star?</p> <p><input type="text"/> Skip to 17</p> <p>Mark this box if you don't have one. <input type="checkbox"/></p>	<p>13 (If basketball, wrestling, or sent here from an earlier question) Who is your favorite sports star?</p> <p><input type="text"/> → Skip to 17</p> <p><input type="checkbox"/> Mark this box if you don't have one.</p>	<p>13 Who is your favorite sports star?</p> <p><input type="text"/> → <i>Skip to 17</i></p> <p><input type="checkbox"/> Mark this box if you don't have one.</p>

Table 1. Coding of characteristics by question, with 1 representing the presence of the characteristic and a blank representing its absence.

Question	High Number of Question Words	High Number of Answer Categories	Last Category Branches	Alternating Branches	All Categories Branch	Write-In Answer	Bottom Of the Page	High Distance Control	High Distance Detection
5			1						
7							1		
8	1	1	1					1	1
9	1	1						1	1
11	1				1		1	1	1
12	1	1		1				1	1
13						1		1	1
16									
17	1	1	1				1	1	1
20	1							1	1
21	1	1		1					
24			1				1		
27	1							1	1
28	1	1		1					
30		1		1			1	1	1
34								1	
35		1			1		1	1	1
36	1						1	1	
37	1	1	1			1			
43	1		1						
45									
46					1				1
48			1						

Table 2. Overall mean percent of commission and omission errors by treatment, having taken into account the within subject effect.

	Commission			Omission		
	Control	Prevention	Detection	Control	Prevention	Detection
Error Percent	20.7%	9.0%***	7.6%***	1.6%	3.3%***	3.7%***
Std. Error	1.02	0.72	0.61	0.24	0.37	0.43
Number of Errors	875	368	318	52	98	109
Number of Opportunities	4237	4102	4171	3217	3026	2954
Number of Respondents	422	421	423	422	421	423

*p<.05, **p<.01, ***p<.001 Significant differences are in comparison to control group.

Table 3. Logistic regression analysis of commission errors over all forms and by treatment, having taken into account the within-in subject effect.

Independent Variable	All Forms			Control			Prevention			Detection		
	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio
High number of question words	0.12*	0.05	0.88	0.13	0.08	0.88	-0.05	0.11	1.05	0.31**	0.12	0.73
High number of answer categories	-0.51***	0.06	1.66	-0.36***	0.07	1.43	-0.53***	0.12	1.69	-0.83***	0.12	2.30
Last category branches	0.29***	0.07	0.75	0.39***	0.10	0.68	0.20	0.15	0.82	0.28	0.18	0.76
All categories branch	-0.39***	0.06	1.48	-0.20*	0.09	1.22	-0.25	0.14	1.28	-0.99***	0.13	2.68
Write-in response	-1.56***	0.10	4.74	-1.19***	0.15	3.27	-1.99***	0.17	7.33	-2.01***	0.21	7.47
Bottom of the page	-0.30***	0.06	1.35	-0.30***	0.08	1.35	-0.10	0.12	1.10	-0.59***	0.13	1.81
Intercept	-0.00	0.15	1.00	-0.05	0.21	1.05	-0.02	0.28	1.02	0.51	0.29	0.60
Number of Observations (opportunities)	12,510			4237			4102			4171		

*p<.05, **p<.01, ***p<.001

Table 4. Results of the variable distance when it is included in the commission error models¹.

Independent Variable	All Forms			Control			Detection		
	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio
High distance between answer box and instruction	-0.31***	0.07	1.37	-0.42***	0.10	1.51	0.12	0.17	0.89
Number of observations (opportunities)	8408			4237			4171		

*p<.05, **p<.01, ***p<.001

¹ Results of the other variables in these models are similar to those shown in Table 3, so they are not repeated here.

Table 5. Logistic regression analysis of omission errors over all forms and by treatment, having taken into account the within-in subject effect.

Independent Variable	All Forms			Control			Prevention			Detection		
	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio
High number of question words	0.51***	0.13	0.60	0.86**	0.30	0.42	0.35	0.20	0.71	0.52*	0.21	0.59
High number of answer categories	0.82***	0.16	0.44	-1.26**	0.44	0.28	1.15***	0.28	0.32	0.24	0.25	1.51.
Last category branches	-0.25	0.14	1.29	1.14**	0.41	0.32	0.02	0.25	0.98	-1.08***	0.20	2.96
Write-in response	-1.14***	0.22	3.14	-1.41**	0.43	4.09	-1.77***	0.32	5.88	0.23	0.46	3.62
Bottom of the page	-0.95***	0.15	2.58	-1.50***	0.38	4.46	-0.78**	0.28	2.19	-0.81***	0.21	2.25
Intercept	-2.54***	0.25	12.7	-4.20***	0.76	66.71	-2.31***	0.40	10.06	-2.69***	0.47	14.76
Number of observations (opportunities)	9197			3217			3026			2954		

*p<.05, **p<.01, ***p<.001

Table 6. Results from the variable distance when it is included in the omission error models².

Independent Variable	All Forms			Control			Detection		
	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio	Estimate	Std Error	Odds Ratio
High distance between answer box and instruction	0.73***	0.22	0.48	1.34***	0.40	0.26	0.81**	0.31	0.45
Number of observations (opportunities)	6171			3217			2954		

*p<.05, **p<.01, ***p<.001

² Results of the other variables in these models are similar to those shown in Table 5, so they are not repeated here.