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HELPING RESPONDENTS GET IT RIGHT THE FIRST TIME: THE INFLUENCE OF WORDS, SYMBOLS, AND GRAPHICS IN WEB SURVEYS

LEAH MELANI CHRISTIAN
DON A. DILLMAN
JOLENE D. SMYTH

Abstract We utilize and apply visual design theory to experimentally test ways to improve the likelihood that web respondents report date answers in a particular format desired by the researcher, thus reducing possible deleterious effects of error messages or requests for corrections. These experiments were embedded in a series of web surveys of random samples of university students. We seek to examine the sequential and cumulative effects of visually manipulating the size and proximity of the answer spaces, the use of symbols instead of words, the verbal language of the question stem, and the graphical location of the symbolic instruction. Our results show that the successive series of visual language manipulations improve respondents' use of the desired format (two digits for the month and four digits for the year) from 45 percent to 96 percent. These results suggest that writing effective questions for web surveys may depend as much or more on the presentation of the answer categories/spaces as the question wording itself.

Many web surveyors utilize features unique to the web in their survey designs. For example, surveyors commonly program error messages that appear when respondents leave a question blank or when their answer is not in the format desired by the surveyor. These messages often inform respondents that they must correct their ''error'' before proceeding to the next question, thereby ensuring their responses are in the desired format.

LEAH MELANI CHRISTIAN is with the University of Georgia, Carl Vinson Institute of Government, 201 North Milledge Avenue, Athens, GA 30602-5482, USA. DON A. DILLMAN AND JOLENE D. SMYTH are with Washington State University, Social and Economic Sciences Research Center, PO BOX 644014, Pullman, WA 99164-4014, USA. Address correspondence to Leah Melani; e-mail: leahmc@uga.edu

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However, error messages have been shown to increase respondent frustration and survey termination (Best and Krueger 2004). Therefore, it is important to effectively design questions and instructions to help respondents ''get it right the first time.''

Research on visual design suggests that numbers, symbols, and graphics, in addition to words, influence how respondents answer both paper and web surveys (Redline et al. 2003; Christian and Dillman 2004; Tourangeau, Couper and Conrad 2004, and Dillman and Christian 2005) and that survey designers can manipulate these features to effectively convey instructions to respondents. These instructions can be particularly important when there are multiple ways of providing the requested information, but the surveyor desires one specific format. For example, it is common in U.S. culture to provide dates using variations of either a long format (e.g., October 25, 2005) or an abbreviated format (e.g., 1/15/05 or 10-5-2003). Thus, without specific instructions, respondents can input dates in a variety of combinations of alpha and numeric characters which may lead to error messages if their answer is not in the format desired by the surveyor.

Our purpose in this article is to report results from three consecutive web surveys in which we embedded a series of experimental manipulations designed to influence web respondents to report date answers in a particular format, two digits for the month and four digits for the year. We include several comparisons testing the effects of manipulating the size of the answer spaces, the use of words versus symbols, the location of respondent instructions, and the verbal language used in the question stem. The results of each survey influenced the design of subsequent experiments such that the sequential manipulations could identify the most effective combination of words, symbols, and graphics that communicate to respondents how their answers should be formatted. Our goal is to contribute to a growing body of literature on the effects of visual design on survey responses and to suggest ways to help surveyors obtain accurate answers in a desired format while minimizing respondent burden.

Applying Visual Principles to Designing Instructions for Web Surveys

Schwarz (1996) argues that in self-administered surveys, the survey instrument represents the researcher's half of the conversation; respondents assume the material provided in the instrument is relevant to the survey ''conversation.'' While previous research on improving question wording and instructions has focused almost solely on effective verbal communication, or the actual words used to convey meaning (Schuman and Presser 1981; Sudman and Bradburn 1974), Schwarz's theory suggests that respondents

to paper and web surveys also rely on ''formal'' features of the questionnaire including information communicated visually through numbers, symbols, and graphics. Symbols can be particularly useful because they often communicate information in a type of shorthand that might otherwise take several words or even multiple sentences to convey.

Graphical paralanguage is the visual conduit through which other elements are transmitted, meaning that graphical features, such as size, color, brightness, and shape, influence how words, numbers, and symbols are interpreted (Redline and Dillman 2002). Graphical elements such as location and orientation can also independently convey information and influence how respondents interpret meaning. Jenkins and Dillman (1997) have proposed that Gestalt principles of pattern recognition can be used to help understand how survey respondents use such graphical elements to visually group information. According to the principles of similarity and proximity, images are more likely to be perceived as related if they resemble one another and/or are located in close proximity to one another (Jenkins and Dillman 1997). More recently, Ware (2000) pointed out that connectedness, often achieved through smooth and continuous lines between visual elements, is another important grouping principle and one that can even be more powerful than proximity and similarity. In addition to these grouping principles, Kahneman (1973) discusses how respondents focus their attention on a foveal region of only about two degrees or nine characters in width such that placing important information within this region ensures that respondents will see it without having to move their eyes. Taken together, this research suggests that instructions to respondents should be located within the respondent's foveal view and in proximity to where they will need to apply them.

The application of visual design techniques to web surveys can help instruct respondents to report their answers in the desired format before error messages occur. Helping respondents ''get it right the first time'' can reduce respondent frustration and often data management costs helping to increase overall response efficiency. During cognitive interviews conducted with respondents to a web prototype of the National Science Foundation's (NSF) Earned Doctorate Survey, several respondents became frustrated after receiving error messages on a question asking them to report the date their degree was granted (Altheimer and Dillman 2001). Respondents were provided with two answer boxes (one smaller than the other) separated by a slash and a symbolic instruction to the right of the year box to indicate the number of digits they should use 

. Several respondents tried to enter alphabetic abbreviations for the month (e.g., Aug., Dec.) or to report the year using only two digits and subsequently showed signs of frustration when they received error messages indicating their answer was not in the desired format and forcing them to figure out what they had done wrong before they could proceed.

In this article, we report a series of experiments, influenced by the date question from the NSF Earned Doctorate Survey, that explore the sequential effects of manipulating the words, symbols, and graphical presentation of instructions designed to influence respondents to report date answers in a particular format, two digits for the month and four digits for the year. Specifically, we compare a version with equal size month and year answer spaces to one where the month space is about half the size of the year space. We also test the effects of using word labels versus symbols (MM YYYY) to indicate the number of digits respondents should use when answering and different graphical placements of the symbolic instruction in relation to the month and year answer spaces. Finally, we test two versions of the question stem to see the effects on respondent answers.

Procedures

We discuss the results of several experimental comparisons that were embedded in a series of three web surveys asking students about their experiences at Washington State University's Pullman campus conducted from Spring 2003 to Fall 2004. Each survey included 21 to 25 questions and three to four experimental versions (to which students were randomly assigned). Response rates ranged from 53 percent to 60 percent (the details for each survey are provided in the notes of tables 1, 2, and 3). The web survey screens were constructed using HTML tables where proportional widths were programmed in order to maintain a consistent visual stimulus regardless of individual screen or window sizes. Cascading style sheets were used to automatically adjust font size and accommodate varying user browsers and screen resolutions.

All students sampled were initially contacted using postal mail, and provided a two-dollar incentive. Each respondent was assigned a unique identification code to access the survey. Respondents for whom we had an email address (about two-thirds of each sample) were also sent an initial email, which included a link to the survey and the access code. Subsequent contacts to nonrespondents were sent using postal mail and e-mail. Additional detail about the implementation of the web survey is provided in Christian, Dillman and Smyth (2005).[1] Throughout the analyses, chi-square tests are used to test for statistically significant differences in responses across the experimental comparisons within each survey.

1. A more detailed discussion of the procedures and analyses of the data presented here is available from a report to the National Science Foundation by the same authors: Christian, Leah M., Don A. Dillman, and Jolene D. Smyth. 2005. ''Instructing Web and Telephone Respondents to Report Date Answers in Format Desired by the Surveyor.'' Social and Economic Sciences Research Center Technical Report 05-067, available at http://sesrc.wsu.edu/dillman/papers.htm.

TABLE I. Experimental Comparisons from Survey 1 (Spring 2003)

	Q2. When did you first begin your studies at WSU?					
	Size of month box		Word labels versus symbols		Grouping of symbols	
	Equal size month and year boxes	Half size month box	Word labels below boxes	Symbols below boxes	Symbols to the right of both boxes	Symbols grouped below boxes
						
n	367	351	367	438	435	438
Desired format (2-digit month & 4-digit year)	**55.3**	**63.3**	**55.3**	**90.6**	88.5	90.6
1 digit month	**18.3**	**20.5**	**18.3**	**3.4**	2.5	3.4
2 digit month	80.4	78.9	**80.4**	**96.1**	97.5	96.1
Word month	1.1	0.6	1.1	0.2	0.0	0.2
2 digit year	**32.4**	**21.7**	**32.4**	**5.5**	**9.9**	**5.5**
4 digit year	**67.3**	**76.9**	**67.3**	**94.0**	**89.9**	**94.0**

NOTE.—Bold numbers indicate chi square test $p \leq .100$.
Survey 1: Twenty-one questions, four experimental versions, response rate: 53 percent (1591 completes/3004 sampled).

TABLE 2. Experimental Comparisons from Survey 2 (Fall 2003)

	Question 1 of 25 **What month and year did you begin your studies at Washington State University?**			
	Question wording		Word labels versus symbols	
	When did you begin your studies at Washington State University?	What month and year did you begin your studies at Washington State University?	Word labels 	Symbols 
n	393	446	423	446
Desired format (2-digit month & 4-digit year)	89.3	87.2	**45.4**	**87.2**
1 digit month	1.0	2.7	**17.5**	**2.7**
2 digit month	90.3	88.1	**50.6**	**88.1**
Word month	1.5	1.8	**25.1**	**1.8**
2 digit year	1.0	0.9	**7.8**	**0.9**
4 digit year	92.1	91.7	**85.1**	**91.7**

NOTE.—Bold numbers indicate chi square test $p \leq .100$.
Survey 2: Twenty-five questions, four experimental versions, response rate: 56 percent (1705 completes/3045 sampled).

TABLE 3. Experimental Comparisons from Survey 3 (Fall 2004)

	Question 1 of 25 **When did you begin your studies at Washington State University?**		
	Symbols above 	Symbols to the left 	Symbols to the right 
n	351	379	352
Desired format (2-digit month & 4-digit year)	94.0	95.8	92.9
1 digit month	2.6	1.6	2.3
2 digit month	95.2	96.0	93.5
Word month	2.0	2.1	3.7
2 digit year	1.1	0.3	0.9
4 digit year	98.6	99.5	98.6
Chi-square tests desired format	Symbols above versus left; $\chi^2 = 1.2$ $p = .278$ Symbols above versus right; $\chi^2 = 0.4$ $p = .548$ Symbols left versus right; $\chi^2 = 2.9$ $p = .091$		

NOTE.—Survey 3: Twenty-five questions, three experimental versions, response rate: 60 percent (1082 completes/1800 sampled).

Experimental Comparisons and Results

SURVEY 1

Size of month box: In the first web survey, we examine three experimental comparisons. We first compare a version where the month and year boxes are equal sizes to a version where the month box is about half the size of the year box; both versions also include the words ''Month'' and ''Year'' located underneath their respective answer spaces (table 1). The design of this experiment was influenced by previous evidence that providing answer spaces sized consistent with the expected task facilitates respondent's answering the question using the desired format (Couper, Traugott, and Lamias 2001). Thus, we expect the size of the month box to convey additional information to respondents—that fewer digits should be used for the month than the year. This should help facilitate respondents providing their answers using two digits for the month and four for the year. Consistent with this hypothesis we find that respondents are significantly more likely to report the date in the desired format (63.3 versus 55.3 percent, $\chi^2 = 4.7$, $p = .031$) when the month box is about half the size of the year box (table 1). While reducing the size of the month box does not significantly impact how respondents report the month, it does significantly increase the likelihood that respondents report the year using four digits (76.9 versus 67.3, $\chi^2 = 9.9$, $p = .002$).

Word labels versus symbols: Next, we compare two versions with equal size boxes, one with word labels and the other with symbols (MM YYYY) located below each box. We are not aware of any research conducted about the effectiveness of using letters to symbolize the number of digits people should use when providing a date answer, although this is common practice on the Internet. We expect respondents to be more likely to report their answer in the desired format when provided the version with the symbolic instruction because the symbols convey more specific information than the word labels; the use of two M's and four Y's indicates the number of digits respondents should use when reporting their answer. Consistent with our hypothesis the symbols significantly and dramatically increase the likelihood that respondents report their answer in the desired format (table 1); 55.3 percent of respondents to the version with word labels report the date using the desired format whereas 90.6 percent of respondents to the version with the symbolic instruction report the date using the desired format ($\chi^2 = 131.2$, $p = .000$).

Grouping of symbols: In the third test, we compare a version with symbols located together to the right of both the month and year box to a version with symbols located below each corresponding box (table 1).

The Gestalt grouping principles suggest that placing instructions to respondents within the foveal view as well as visually grouping them with the corresponding answer space using proximity, should increase the number of respondents complying with the instruction. This suggestion has been supported by web survey research where respondents visually group questions or response options when they are located on the same web page and/or when they are located in close proximity and visually distinguished from other information (Couper, Traugott, and Lamias 2001; Smyth et al. 2006). Thus, we expect grouping the symbolic instructions with their answer spaces to increase the likelihood that respondents use the instructions when answering.

We find that the difference in the use of the desired format between the two versions is not significant (90.6 versus 88.5 percent; $\chi^2 = 1.1$, $p = .302$; table 1). However, a significantly greater percentage of respondents (94 versus 89.9 percent, $\chi^2 = 5.9$, $p = .015$) report the year using four digits when the symbols are located below each corresponding answer space than when they are grouped together and located to the right of the answer spaces. We attribute this finding to the year instruction falling outside of the foveal view on the version with the symbols placed to the right of both boxes. Thus, respondents were less likely to see and apply the instruction when reporting their year answer.

SURVEY 2

For the second web survey, we adopted the use of the smaller month box (about half the size of the year box) across all versions to keep the graphical size of the box consistent with the instruction to report answers using half the number of digits for the month (2) than the year (4).

Question wording: The first comparison from the second survey allows us to examine the effects of verbal changes in the question stem. We compare asking students ''When'' versus ''What month and year'' did you begin your studies at Washington State University (table 2). We expect the more specific ''month and year'' instruction to increase the percent of respondents using the symbolic instructions provided at the time of response and as a result reporting their answer in the desired format. However, the results indicate that the symbolic instruction located with the answer spaces, where they need it at the time of response, effectively instructs respondents to use the desired format regardless of whether they are asked ''When'' or ''What month and year'' they began their studies. When comparing across the two formats there are no significant differences ($\chi^2 = 0.9$, $p = .348$) in the percent of respondents reporting their answers in the desired format (89.3 versus 87.2 percent; table 2).

Word labels versus symbols: In the second web survey, we also included a second test of the effectiveness of symbols over word labels to confirm the results from Survey 1 (table 2). In doing so, we adopted the question wording ''What month and year'' for both versions. Consistent with the results from the first survey, the symbols located underneath their respective answer spaces significantly increased the likelihood that respondents report their answer in the desired format (word version 45.4 versus symbols version 87.2 percent; $\chi^2 = 171.4$, $p = .000$).

Proximity and connectedness: A programming change between the first and second surveys resulted in increased space between the month and year answer spaces so that they appeared connected on the first web survey and visually distinct or separated on the second survey. We noticed a substantial difference in the number of respondents reporting their answer in the desired format between the two surveys (55.3 percent when the spaces are connected and only 45.4 percent when the spaces are separated). These changes in the use of the desired format resulted from more respondents reporting the month using words (25.1 versus 0.6 percent) and slightly more respondents reporting the year using four digits (85.1 versus 76.9 percent) on the version with the answer spaces graphically separated. These changes are consistent with the Gestalt psychology principles of proximity, similarity, and the principle of connectedness. The separation between the boxes encourages respondents to interpret how to report their answer for the month and the year individually resulting in more respondents using alpha characters for the month and digits for the year. When the spaces are connected, respondents are more likely to use numbers, and frequently the same number of digits (two), for both the month and the year. We cannot state conclusively the independent effects of this change because of the differences in question wording between the two versions and because the results are from two separate surveys. Further research is needed to test the independent effects of this change within one survey.

SURVEY 3

Location of grouped symbols: In the final survey we also adopted the smaller month box and symbolic instructions in all versions and tested the effects of locating the instructions mentioned earlier, to the left, and to the right of the answer spaces (table 3). We expect placing the symbolic instructions within the navigational path (i.e. above or left) to produce the highest use of the desired format because they are located in the natural reading order, before the corresponding answer space. Overall, a greater percent of respondents report their answer in the desired format in survey 3 than in the previous two surveys. Adopting the half size month box, separating the month and year box, and grouping the symbolic instruction with the corresponding answer box resulted in between 92.9 percent and 95.8

percent of respondents reporting their answer in the desired format with the highest compliance on the version with the symbols placed to the left of the answer spaces (95.8 percent). However, the chi-square difference between this version and placing the symbols to the right (92.9 percent) only approaches moderate statistical significance ($p = .091$).

Discussion and Conclusions

Our experimental comparisons across three sequential web surveys indicate that manipulating the size of the answer spaces, providing symbols instead of word labels, and grouping the symbolic instruction with the answer spaces each independently and jointly increase the percentage of respondents reporting their answer in the desired format. Specifically, we find that providing respondents with a smaller box for the month and larger for the year, instead of equal size boxes, increases the percentage of respondents reporting their answer using four digits for the year thereby significantly increasing the percentage of respondents using the desired format by eight percentage points from 55 percent to 63 percent. The use of symbols (e.g., MM YYYY) rather than words (''Month'' and ''Year'') greatly increases the percentage of respondents using the desired format by 35 percentage points in the first web survey and 42 percentage points in the second web survey. The symbols convey additional information to respondents (i.e., the number of digits expected) and communicate that information in a short hand that might otherwise take several words or even sentences to explain. We also find that graphically manipulating the symbols by grouping them with their respective answer spaces increases respondents' use of the desired format; however, the location of the instruction once it is grouped seems to have less influence. Finally, we find that verbal language changes in the query have little influence when web respondents are already provided instructions located with the answer spaces where they will need them at the time of response[2]. When all of these elements are combined, we find that from 93 percent to 96 percent of respondents report their answers in the desired format.

While a drop down menu or calendar format could have been used to ensure that answers to this particular date question were provided in the desired format, there are many instances in which using this format may be inappropriate (e.g., respondent's unfamiliarity with drop down menus or how

2. In a telephone survey conducted using the same population and simultaneously with the third web survey, we found that respondents were most likely to report the month and the year they began their studies when explicitly asked in the question stem ''What month and year'' (83.7 percent) than ''What date'' (49.5 percent) or ''When'' (13.4 percent). The differences between each of the three versions are highly significant ($p = .000$) suggesting that changes in question wording have more powerful effects on telephone than web surveys.

to use this type of calendar interface) or too cumbersome (e.g., when there is a large number of possible options like birth years ranging from 1900 to present). The set of issues addressed in this article have wider applicability in web survey research beyond this particular example. In addition, the use of new eye tracking technology can enhance our understanding of how respondents visually process and navigate self-administered surveys.

These findings contribute to the growing literature detailing how web respondents rely on multiple types of information within the questionnaire; respondents actively make use of words, numbers, symbols, and graphics to determine meaning and interpret how to answer survey questions. This article demonstrates that since respondents interpret meaning from these various visual features, survey designers can strategically use them to support and complement one another to communicate specific expectations or instructions to respondents throughout the entire presentation of the question. Thus, effective visual design of survey questions can increase response efficiency and improve the survey experience for respondents by helping them ''get it right the first time'' thereby avoiding error messages that may increase their frustration and likelihood of survey termination.

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