Positioning of Clarification Features in Web Surveys: Evidence from Eye Tracking Data

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Abstract

An eye tracking study (n = 108) was conducted to gain in-depth understanding of the optimal position of clarification features like definitions, retrieval cues or instructions and its impact on data accuracy. While answering a Web survey containing several split experiments on the positioning of clarification features in a lab setting subjects' attention to the various question components was recorded using eye tracking methods. Initial analysis of the survey responses concerning open-ended numerical and narrative questions provided only limited evidence that survey answers were actually altered by varying positions of clarifying information. However, eye tracking data offered direct evidence concerning differences in the respondents' visual attention depending of the position of clarification features. Findings indicate that the optimal position of clarification features mainly depends on the stage within the question-answer process the information provided in the clarification feature refers to.

Key Words: questionnaire design, definitions, instructions, question-answer process, eye movements, response quality

1. Introduction

A major concern in survey research is to optimize the quality of the answers provided by the respondent while at the same time to minimize response burden. One premise to ensure high data quality is that all respondents understand and answer a survey question in a consistent manner, and in accordance with the researcher's conception (Fowler, 1995). However, response accuracy is often constrained due to an incorrect or incomplete understanding of the question content, due to an insufficient retrieval of the relevant information, or due to answer formats not desired by the researcher. These shortcomings can stem from either a poor questionnaire design which makes it difficult for the respondent to provide answers of high quality, a lack of the respondent's motivation to expend the required effort to provide an optimal answer, or a combination of both (Cannell, Miller, & Oksenberg, 1981).

Open-ended questions in self-administered surveys pose a particular challenge to questionnaire design and the respondent's motivation in two ways: *First*, open-ended questions give ample scope for interpretation of the question content and the desired answer format since no orientation is provided by means of predefined response options clarifying the question meaning and the desired answer format. Thus, even if the respondent is highly motivated to provide a correct answer he or she may fail because of a lack of sufficient specification in the survey question. Furthermore, by requiring more cognitive effort open-ended questions may result in an increased response burden and can probably encourage the respondent's carelessness and superficial attitude regarding question meaning and answer format (Holyk, 2008; Krosnick, 1991). *Second*, especially in self-administered Web surveys these difficulties which might be associated with open-ended questions are aggravated by the fact that no additional advice can be provided by

an interviewer in explaining unclear terms or meanings, probing incomplete or ambiguous answers, or in keeping the respondent motivated (Cannell et al., 1981; Conrad & Schober, 2000; Couper, Kennedy, Conrad, & Tourangeau, 2011; Oudejans & Christian, 2010).

A means of preventing reduced response accuracy is to provide additional information in terms of clarification features: definition of key terms or vague concepts to prevent misinterpretation, generic examples making relevant information more accessible, as well as unambiguous instructions providing orientation may help the respondents to correctly understand a survey question from the beginning, and keeping the respondents motivated and their response burden to a minimum. Although clarification features can provably provide helpful information concerning the understanding of the overall question-answer process the key problem remains that respondents are often unaware of their need for clarification or not willing to engage themselves more intensely in the response task. Respondents rather rely on their everyday understanding of key terms and concepts, increasing the risk that their interpretations do not match the researcher's intended meaning. Thus, clarification features are likely to be ignored by the respondents while passing through the different stages when answering a survey question (Conrad, Couper, Tourangeau, & Peytchev, 2006; Conrad & Schober, 2000; Conrad, Schober, & Coiner, 2007; Redline, 2011; Schober, Conrad, & Fricker, 2004; Suessbrick, Schober, & Conrad, 2000; Tourangeau et al., 2006).

This raises the question how and where clarification features should be presented to enhance the likelihood that respondents take notice of and consider them while answering a survey question. Previous studies mostly relied on indirect measures such as the respondents' answers, response times, or mouse movements in order to assess the consequences of different positioning of clarification features (Christian & Dillman, 2004; Conrad et al., 2006; Peytchev, Conrad, Couper, & Tourangeau, 2010; Redline, 2011). In this study the respondents' eye movements were recorded while they completed a Web survey to gain more direct insight into the cognitive processing of clarification features and their integration within the question-answer process.

2. Background

2.1 Previous Finding Considering the Placement of Clarification Features

The *first* issue that has to be addressed is whether clarification features should be provided persistently for all respondents or demand-based solely when respondents need additional information. Especially in self-administered surveys when clarification features are presented by default the absence of their positive effect on response accuracy is commonly explained by a lack of attention to this additional information. Not all respondents need clarification at any point in time while answering a survey question. Thus, presenting clarification features by default irrespective of whether the respondent need the information or not can have negative effects on the overall frequency of use (Conrad et al., 2006; Conrad & Schober, 2005; Peytchev et al., 2010). However, contrary to expectation that interactive clarification features solely provided on the respondent's request gain more attention and are therefore more effective, several studies showed that presenting definitions of key terms by default was more effective because they were more likely to be consulted by the respondent (Conrad et al., 2006; Conrad et al., 2007; Galesic, Tourangeau, Couper, & Conrad, 2008; Peytchev et al., 2010). Thus, due to the respondent's low willingness to actively retrieve additional information clarification features get more attention and are more effective when they are always visible rather than being initially hidden and appearing respondent-initiated.

A *second* issue to consider is the location of clarification features in relation to the other components of a survey question. In general, clarification features should be located within the respondent's foveal region whereas sharp vision is limited to about 2 degrees (Kahneman, 1973). Because of this limited focus of attention clarification features should be placed exactly where the respondent needs the additional information (Dillman, 2000). Thus, it is assumed that clarification features are more likely to gain attention and being recognized by the respondent as a relevant part of the survey question when they are placed within the respondent's focus of attention and within their natural reading order. In accordance with this general assumption, Christian and colleagues (2005, 2007) showed that formatting instructions provided to the left of the corresponding answer space increased the proportion of correctly formatted answers. Christian and Dillman (2004) also found that placing branching instructions before the answer categories significantly increased the probability that instructions have been executed correctly compared to placing the instruction after the response options. Accordingly, it is essential that respondents process the content of an instruction after the question was read but before an answer is required.

These findings indicate that clarification features like definitions or instructions should be placed within the respondent's focus of attention, and exactly where the respondent needs the additional information. Based on this knowledge, a convention of placing clarification features immediately after the question text and before the answer space has been established (Christian & Dillman, 2004; Dillman, 2000; Galesic et al., 2008; Peytchev et al., 2010). However, other findings contradict placing clarifying information after the question. For instance, Oksenberg, Cannell and Kalton (1991) showed that interviewers were often interrupted by the respondent immediately after the question was proposed but before the interviewer had read the succeeding definition or other specifications. This behavior could substantially be reduced either by integrating additional specifications into the question text or by placing definitions before the question text. Accordingly, Redline (2011) showed in both a Web survey where clarification was provided visually and in an interactive voice response survey providing clarification orally that placing clarifying definitions of key terms before the question yielded a slightly higher overall effectiveness than placing them after the question. Despite the convention of presenting clarification features directly after the question text, these results offer initial support for placing clarifying definitions right at the beginning of a survey question.

2.2 Clarification at Different Stages of the Question-Answer Process

When answering a survey question respondents go through various cognitive processes. Established models of the question-answer process consist of four stages: understanding the question, retrieving relevant information, computing a response and reporting an answer. These four stages are not necessarily conducted in sequence, thus, feedback loops often occur (Sudman, Bradburn, & Schwarz, 1996; Tourangeau & Bradburn, 2010). In self-administered Web surveys clarification features might be of particular relevance in each of these stages. However, their application differs depending on the respective purpose being pursued within the question-answer process. Within the *first* stage of question comprehension, proving clarification features in terms of definitions of unclear or ambiguous terms or concepts is particularly important to ensure a correct and consistent understanding of a survey question in accordance with the researcher's intended meaning (Tourangeau & Bradburn, 2010). Depending on the respective interpretation of the question content respondents have to retrieve information in the *second* and *third* stage of the question-answer process. Retrieval cues in terms of

meaningful examples can help bring relevant information to mind by activating or directing memory search processes (Schwarz & Oyserman, 2001; Tourangeau & Bradburn, 2010). However, despite various efforts to ease information retrieval processes respondents are often not willing to expend the required cognitive effort to make for an optimal answer reflecting all potentially relevant information (Krosnick, 1991). When no interviewer is present who can motivate the respondent to think carefully and try hard to come to a thorough answer motivating instructions can be provided to prevent premature interruption of cognitive efforts (Schwarz & Oyserman, 2001). Within the *fourth* stage of the question-answer process, respondents are expected to format and edit their responses. Especially in open-ended questions when respondents have to format their answers without guidance by response categories clarification features can provide advice in terms of formatting instructions concerning the length or detailedness of answers to open-ended narrative questions or with respect to the format of amounts, dates or frequencies in open-ended numerical questions (Couper et al., 2011) (see section 4.2 for details).

3. Aim of the Study and Research Questions

As previous findings showed the provision of clarification features can help increase response accuracy, however, respondents do not necessarily recognize this additional information. The present study aimed at providing additional insights concerning the optimal position of clarification features by systematically comparing the effect of presenting definitions, retrieval cues, motivational statements, and formatting instructions either before or after the question text as well as after the answer space on survey responses. Additionally, a more direct assessment of the respondents' attention to and processing of clarification features was provided by means of eye tracking data. Comprehensive understanding of survey questions requires careful reading of all question components. The recording of eye movements allows detecting which position of clarification features increases the probability that respondents actually take notice of this information when looking at a survey question. Furthermore, by examining the respondents' scan path while reading the various components of a survey question eye tracking data enable to determine whether the effectiveness of clarification features depends on the adherence of a specific reading and processing order. Redline and Lankford (2001) conducted one of the few studies using eye tracking data to examine the optimal positioning of branching instructions as a special kind of clarification features. They found that branching instructions were more likely to be executed correctly when respondents read the instruction if and only if they are in the process of moving to the next question. Most branching errors occurred when respondents read the branching instruction too early which means that they had already read the instruction while they were still engaged in answering the actual question and failed to recall the branching instruction when they were supposed to execute it (Redline & Lankford, 2001). These findings provide first evidence that clarification features have to be placed exactly where the respondent needs the specific information depending on the stage within the question-answer process.

The present experiment was concerned with the optimal positioning of clarification features in Web surveys. It was assumed that survey responses differ depending on the presence or absence of clarification features. In addition, the magnitude of the effect on the responses was assumed to differ according to the positioning of clarification features. Based on these response differences, the study examined whether such effects could be explained by different scan paths of the respondent depending on the arrangement of question wording, answer boxes and clarification features. It was presumed that the positioning of the various elements of a survey question could

specifically be used to specify a prescribed navigational path a respondent is likely to follow when he or she views a survey page. This, in turn, substantially affects whether elements of a survey question are read at all and in which order these are considered (Christian & Dillman, 2004; Dillman, 2000). Taking the conventional "left to right" and "top to bottom" reading sequence of respondents into account the location of clarification features could be consciously chosen to meet the point in time when the provided clarification feature would be considered within the question-answer process. Thus, we aimed to clarify whether there was one optimal position for all types of clarification features which enhanced the likelihood that the respondent recognized the additional information as a relevant part of the survey question and took it into consideration when answering the question, or whether the optimal position of clarification features depended on the type of clarification feature. As mentioned above, the latter assumption was based on the fact that clarification features can have various purposes depending on the respective stage of the question-answer process, as well as on the general knowledge that the position of clarification features should be chosen in a way that they will be read exactly when they are needed in order to answer the survey question appropriately. Thus, it was assumed that the position of clarification features would interact with its intended purpose, and therefore, that the position should be adapted in accordance with its intended function to maximize the effectiveness of clarification features on data accuracy. These assumptions resulted in the following research questions:

(1) Does the position of clarification features affect survey responses?
(2) Is the effectiveness of clarification features on survey responses mediated
    a. by a differential intensity of attention to clarification features depending on their position, or
    b. more specifically, by a distinct processing order depending on the position of clarification features?
(3) Does the optimal position of clarification features vary depending on the respective stage within the question-answer process they refer to?

4. Method

4.1 Experimental Design

In a between-subjects lab experiment, participants (n=108) completed a Web survey on "satisfaction with life and studying" containing 38 questions in total. Eye movements were collected with the Eyegaze Edge™ (Interactive Minds) monocular, remote mounted eye tracking system with an eye tracking camera mounted under a 19 inch monitor (resolution 1280 x 1024). The system has a 60 Hz sampling rate recording the eye position every 16 milliseconds. The common threshold was applied to define fixations using a minimum criterion of 100 milliseconds with mean x/y location within a 25-pixel screen region.

General students of the Darmstadt University of Technology were recruited on campus in February 2012. 52 percent of the participants were female and 48 percent male, the age range was 20 to 34 with a mean age of 24 years. Most participants were experienced computer and internet users using the computer and the internet on a daily basis with 94 and 97 percent, respectively. The number of Web survey respondents participated in before ranged between 0 and 38. Thus, survey experience was classified as limited with an average of 2 surveys attended before participating in our survey. 31 percent of the participants indicated to wear glasses or contact lenses, however, complications caused by wearing glasses or contact lenses did not arise.

After a short introduction to the survey and the general process of eye movement recording, the experimenter initiated the automated calibration procedure. After a successful calibration the Web survey started with a welcome page and eight exercise questions on the participants' sociodemographics and their computer and internet use experience. These exercise questions should enable the participants to get used of the eye tracking procedure and were not part of the experiment. While the participants completed the survey, an experimenter stayed in the room next door to assist in case of questions or problems. The average survey completion time was about 25 minutes (including briefing and calibration). Participants received an incentive of 3€ and could participate in an additional lottery drawing.

The experiment reported in this paper referred to 6 questions evenly distributed throughout the second third of the questionnaire. All participants were randomly assigned to one of four experimental conditions varying in the position of the provided clarification features: either to one of the three experimental groups placing clarification features after the question text (EGa), before the question text (EGb), or after the response options (EGc), or to the control group where no clarification feature was provided.

4.2 Questions

In the present study, two different forms of open-ended questions were examined: open-ended numerical questions requiring short numeric information like dates, numbers, frequencies or counts within small text boxes, and open-ended narrative questions asking for extended answers in the respondent's own words using larger text areas. In the present experiment, no computerized formatting constraints (limitation of length or format, probes, etc.) were implemented. Guidance about the intended meaning of the question, instructions concerning the retrieval of relevant information, and instructions concerning the desired format of the answer were provided in terms of clarification features. These were constructed in such a way that the respondent's answer was affected when the provided clarification features were considered compared to the answers provided when respondents ignored the clarification features. Depending on the respective stage of the question-answer process clarification features were applied with differing purposes.

Stage I: Comprehension

By providing additional definitions key terms and concepts of survey questions can be clearly specified. In the present study, definitions were carefully worded in a way that the intended scope of the key concept was either extended or restricted. As a consequence, respondents should report on average higher incidences (when asked for time spent on communicating with classmates) when they were confronted with an extending definition, and vice versa, lower incidences (when asked for time spent on computer and internet usage) when confronted with a definition which restricted the scope of computer and internet usage.

Stage II: Information Retrieval

Retrieval cues were implemented to enhance recall of relevant information. The experimental question referred to the frequency of use of university counseling and care services. The selection of specific service examples aimed at being as exhaustive as possible to cover the overall service package and to avoid that the inferred question meaning would be constrained due to a selective choice of retrieval cues (Redline, 2011; Schwarz & Oyserman, 2001). Thus, by addressing all special services in this field

respondents were expected to report a higher number of incidences when they actually took notice of the examples while answering the question.

In self-administered surveys, respondent motivation cannot be supported by interviewers. Thus, clarification features in terms of motivating instructions can be provided to prompt the respondent to take time and try repeatedly to recall all relevant information since new information can still be added with every attempt despite several previous attempts (Cannell et al., 1981). By explicitly asking for an exhaustive answer covering all reasons which determined the respondent's choice of study subject the number of reasons mentioned should be higher when the instruction was read. For that, verbal open-ended answers were coded with respect to the number of distinctive reasons mentioned.

Stage IV: Reporting

Concerning open-ended narrative questions respondents are commonly encouraged to give detailed answers consisting of more than one or two words. Clarification features can be applied in terms of instructions which convey the expectations concerning the desired detailedness and length of the respondent's answer. Recent studies provided evidence for the effectiveness of such instructions (Oudejans & Christian, 2010; Smyth, Dillman, Christian, & McBride, 2009). Respondents spend more time to give longer and more elaborated answers when instructions are presented. In the present study, respondents were instructed to answer as detailed as possible when describing their study-related achievements. Compliance with this instruction should increase the number of characters used to provide the answer.

Especially in open-ended numerical questions numeric information is often desired in a specific format to prevent data cleansing and editing. However, the absence of formatting restrictions encourages answers deviating from the desired format, including value ranges, estimations, alphanumeric supplements, or even different measuring units (e.g. hours instead of minutes) which affect data quality negatively. Unambiguous formatting instructions can help increasing the proportion of correctly formatted answers (Couper et al., 2011; Fuchs, 2009). Thus, the proportion of answers provided in the desired format (hh:mm) should be increased when respondents considered the formatting instruction while answering the question concerning the time spent on non-university activities.

4.3 Dependent Variables

At the first step, survey data in terms of frequencies, number of characters, and proportions of correctly formatted answers (see section 4.2 for details) were analyzed to assess the effectiveness of clarification features on data accuracy depending on their different positions. In a second step, eye tracking data were applied to explain these differences in the effectiveness of clarification features. In detail, the present study examined whether the differences in reported answers could be explained by the level of attention respondents paid to clarification features or by different processing orders depending on the respective position of clarification features.

Eye tracking data were analyzed on the basis of predefined areas of interest (AOI). Three different AOIs were distinguished which cover the question text (Q), the respective clarification feature (C), and the answer space (A). Within these AOIs, fixation count and fixation duration were calculated as measures of the respondent's level of attention and cognitive processing. *Fixation count* as the number of all fixations within a target AOI indicates the respondent's interest and is interpreted as a measure of importance a respondent ascribes to the AOI. This means more important AOIs will be

fixated more frequently (Ehmke & Wilson, 2007; Jacob & Karn, 2003; Poole & Ball, 2005). At present, it is still controversial whether a longer *fixation duration* is equivalent to more difficulties in extracting and comprehending information or whether the respective information is more engaging (Jacob & Karn, 2003; Poole & Ball, 2005). In the present experiment none of the clarification features were especially difficult to comprehend why in this study longer fixation duration within a target AOI is interpreted as an indicator of a higher degree of interest and cognitive involvement of the information provided.

Both fixation count and fixation duration were restricted to the first 15 seconds after a survey page was loaded. This was assumed to be the appropriate interval which was long enough to cover the entire time when respondents actively read and processed a survey question but short enough not being biased by eye movements directed towards the keyboard and varying time needed for typing an answer.

Based on transition probabilities indicating the total number of transitions to and from each defined AOI (Holmqvist et al., 2011), *transition ratios* were calculated as a proportion of attention shifts between directly interrelated components of a survey question. Depending on the stage within the question-answer process to which clarification features refer to, components of a survey question are more or less directly interrelated. Concerning the first stage of the question-answer process it was examined by means of transition ratios whether transitions between the question text and the definition were more frequent, and thus, whether these two components were processed more directly interrelated fostering a correct understanding of the question depending on the positioning of the definition. Similarly, it was examined whether in the second stage motivating instructions and retrieval cues were processed in direct interaction with the actual question text depending on the respective positioning of the instruction. In contrast, in the last stage transitions from the answer space to the formatting instruction were considered to examine the effect of interrelated processing of these two components on the likelihood to get a right understanding of the correct answer format, again, depending on the respective position of the instruction.

Subsequently, participants with an insufficient AOI coverage as well as participants with incomplete gaze records within the first 10 seconds after page loading were removed from the data set to ensure a sufficiently high data quality. Due to this question-specific data cleansing up to 18 participants with poor or incomplete gaze samples were excluded per question.

5. Results

Stage I: Comprehension

To systematically examine the effect of definitions specifying key terms and concepts to ensure a consistent question comprehension within the first stage of the question-answer process, definitions with either an extending or restricting effect on the question meaning were implemented within questions asking for time spent on communicating with class mates and time spent on computer and internet usage. Depending on whether a definition was provided or not, and whether the definition was read when provided the time reported by the respondent should be increased due to the extending definition while it should be reduced in consequence of the restricting definition. As described in Table 1, both the extending and restricting definition yielded the expected effect with significantly higher mean hours spent on communicating with classmates based on all three experimental groups compared to the control group when no extending definition was provided in question #22 ($p < .05$). Also, mean hours spent on computer and internet usage considering all three experimental groups was significantly lower due to the

restricting definition compared to the control group in question #20 ($p < .001$).

Table 1: Survey data - reported time in hours spent on communicating with classmates and on computer and internet usage (mean) depending on the kind of definition provision

	(Q22) extending definition		**(Q20) restricting definition**	
experimental conditions	*n*	*mean*	*n*	*mean*
no definiton (CG)	20	6*	31	20***
after question (EGa)	27	9	23	11
before question (EGb)	23	13	21	9
after answer box (EGc)	28	11	24	12

Notes. *** $p < .001$, * $p < .05$. Overall F-test for the main effect comparing the control group vs. experimental groups.

With respect to the three experimental groups, placing definitions before the question text in EGb was most effective to convey additional information concerning the intended question meaning. The reported time was highest with 13 hours on average when the extending definition was placed before the question text (Table 1, left side). Also as intended, the time reported when using the restricting definition was lowest in EGb with 9 hours (Table 1, right side). However, differences between the experimental groups were statistically insignificant for both questions. Nonetheless, these findings were considered as initial evidence that respondents paid more attention to definitions concerning question comprehension when they were provided before the question text.

Based on eye tracking data it was examined whether these by tendency better survey results in EGb actually resulted from higher attention to definitions when placing them before the question text. As depicted in Figure 1 (left side), fixation counts referring to the first 15 seconds after page loading varied considerably depending on the respective experimental group. Regarding question #22, the extending definition attracted in fact significantly more attention in terms of a higher fixation count in EGb compared to EGa and EGc. In question #20, EGb also yielded a significantly higher fixation count compared to EGc whereas the difference between EGb and EGa reached marginal significance. Thus, according to higher fixation counts definitions specifying key terms and concepts were more salient and were perceived as more important when they were placed before the question text.

Considering Figure 1 (right side), EGb also obtained a significantly higher fixation duration within the first 15 seconds compared to EGa and EGc in question #22, and a significantly higher fixation duration in EGb compared to EGc in question #20. According to this, it was assumed that placing definitions before the question resulted in a higher level of cognitive processing.

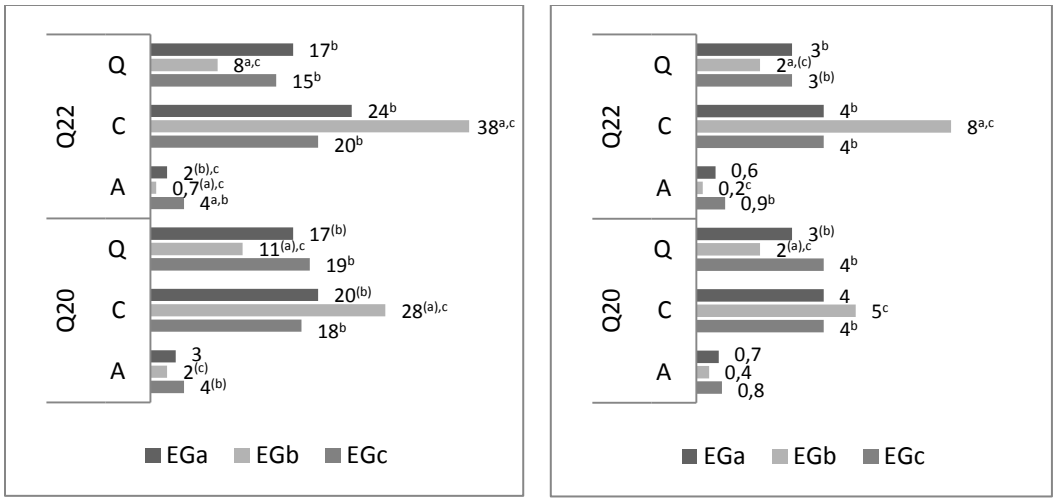

Figure 1: Fixation count (mean, left side) and fixation duration in seconds (mean, right side) for question #22 and #20 depending on three experimental groups. $^{a/\,b/\,c}$ $p<.05$, $^{(a)/\,(b)/\,(c)}$ $p<.10$ pairwise Bonferroni post-hoc tests between EGa, EGb and EGc with superscripts indicating significant differences to the specified experimental group; AOIs within the first 15 seconds: Q=question, C=clarification feature (*here*: definition), A=answer box.

Besides fixation count and duration, analyzing sequences of successive AOI fixations should provide further information concerning the processing order of several components of a survey question depending on the respective position of clarification features. Considering the transition ratios of direct attention shifts between the question text and the related definition text in question #22 and #20, there actually were significantly higher transition ratios in EGa (73 and 71 percent) and EGb (69 percent for both questions) compared to EGc (26 and 28 percent). Concerning both questions, EGa and EGb did not differ statistically significant, whereas EGa and EGb both differed significantly from EGc. Thus, placing definitions which refer to question comprehension directly before or after the question text could enhance the interconnected processing of the question and definition text.

Stage II: Information Retrieval

Within the second stage of the question-answer process concerning information retrieval instructions in terms of retrieval cues and motivating statements were implemented to enhance and optimize the recall of relevant information. Respondents were asked to report the frequencies of use of university counseling and care services (question #19). Also, they were asked for reasons determining their choice of study program (question #14). For question #19 we used a retrieval cue consisting of examples of university services. For question #14 a motivational statement was meant to enhance the number of reasons mentioned.

As shown in Table 2, providing retrieval cues yielded the expected effect with significantly higher overall frequencies in using university counseling and care services based on all three experimental groups compared to the control group when no retrieval cue was provided ($p < .01$) (Table 2, left side). However, presenting motivating instructions had no effect on the number of reported reasons determining their study choice (Table 2, right side).

Table 2: Survey data - reported frequency of university service and counseling use and number of reasons for the respondent's choice of study program (mean) depending on the kind of instruction provision

	(Q19) retrieval cues		**(Q14) motivating instruction**	
experimental conditions	*n*	*mean*	*n*	*mean*
no definiton (CG)	23	1**	27	2
after question (EGa)	33	5	24	2
before question (EGb)	19	4	20	3
after answer box (EGc)	20	4	21	2

Notes. ** p <.01. Overall F-test for the main effect comparing the control group vs. experimental groups.

With respect to the different experimental conditions, there were only small differences in mean values and none of these differences were statistically significant. According to this, the effect of retrieval cues and motivating instructions on responses seemed to be independently of their respective position.

Concerning eye tracking data (see Figure 2), results were mixed. In question #19, fixation count and fixation duration within the AOI addressing retrieval cues were highest in EGb when presenting them before the question text with a significant difference to EGc. In question #14, however, the motivating instruction yielded the highest fixation count and fixation duration when it was placed after the question text with a significant difference to EGc. There were no statistically significant differences between EGa and EGb (with the exception of a marginally significant difference in the fixation duration in question #19). Thus, placing retrieval cues and motivating instructions either before or after the question text both resulted in comparable high levels of attention and cognitive processing.

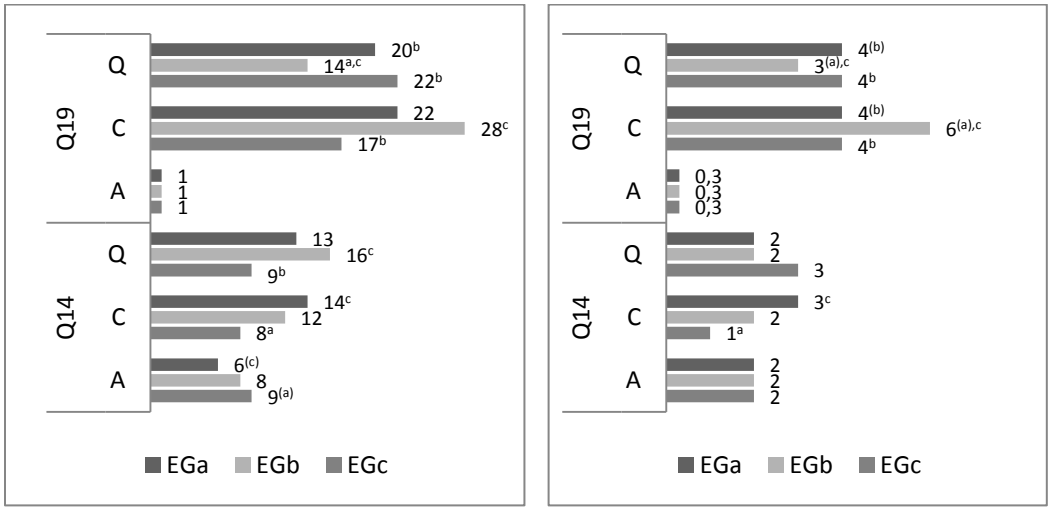

Figure 2: Fixation count (mean, left side) and fixation duration in seconds (mean, right side) for question #19 and #14 depending on three experimental groups. a/ b/ c p<.05, (a)/ (b)/ (c) p<.10 pairwise Bonferroni post-hoc tests between EGa, EGb and EGc with superscripts indicating significant differences to the specified experimental group; AOIs within the first 15 seconds: Q=question, C=clarification feature (*here*: instruction), A=answer box.

Considering transition ratios of direct attention shifts between the question text and the instruction in question #19 and #14, there were significantly higher transition ratios in EGa (71 and 54 percent) and EGb (83 and 53 percent) compared to EGc (49 and 12 percent) again. In question #14, EGa and EGb did not differ statistically significant whereas in question #19, EGb yielded with 83 percent a significantly higher transition ratio compared to 71 percent in EGa. Thus, placing instructions concerning information retrieval directly before as well as after the question text seemed to enhance the interconnected processing of the question and instruction text.

Stage IV: Reporting

To enhance the proportion of correctly formatted answers to open-ended numerical questions as well as the detailedness to open-ended narrative questions, formatting instructions were presented with the aim to enhance the proportion of answers in the desired format (hh:mm) in question #26 asking for time spent on non-university activities, and to increase the number of characters used by the respondents to describe their study-related achievements in question #16.

As expected, the proportion of correctly formatted answers in question #26 was drastically increased from 0 percent in the control condition without any formatting instruction to 47 percent over the three experimental groups ($p < .001$). Providing formatting instructions concerning the detailedness of the narrative answer in question #16 also achieved a significantly higher number of characters based on all three experimental groups (90 to 146 characters) compared to the control group when no such information was provided (69 characters; $p < .05$).

Table 3: Survey data – proportion of correctly formatted answers concerning the time spent on non-university activities (%) and number of characters describing study-related achievements (mean) depending on the kind of instruction provision

	(Q26) numeric answer		**(Q16) narrative answer**	
experimental conditions	*n*	*correctly formatted (%)*	*n*	*# of characters (mean)*
no definiton (CG)	23	0***	18	69*
after question (EGa)	28	43	26	105
before question (EGb)	24	38	25	90
after answer box (EGc)	25	60	25	146

Notes. *** $p < .001$, * $p < .05$. Overall F-test for the main effect comparing the control group vs. experimental groups.

Depending on the respective experimental group, there were large differences with EGc achieving the highest proportion of correctly formatted answers in question #26 with 60 percent as well as the highest number of characters with 146 characters on average in question #16. Providing formatting instructions after the answer space in question #16 seemed to be most effective concerning a high proportion of respondents who actually took notice and followed the instruction correctly. Despite the fact that none of the experimental groups differed significantly from each other these results were interpreted as initial evidence that the position of formatting instructions actually influenced survey responses.

Eye tracking data were examined to gain a better understanding of the underlying processes which influenced the effectiveness of formatting instructions especially when they were provided after the answer space. With respect to fixation counts and fixation durations within the first 15 seconds after page loading shown in Figure 3, formatting instructions in EGc got significantly less attention compared to EGa and EGb. Thus,

higher attention getting properties as well as higher level of cognitive processing within the first 15 seconds were not responsible for a higher effectiveness of formatting instructions in EGc. These findings suggested that fixation count and fixation duration were no appropriate indicators to determine the effectiveness of different positioning of clarification features concerning the formatting of an answer because formatting instructions provided after the answer space probably came into effect to a later point in time, why individual cognitive processes could not be isolated from one another at this late stage of the question-answer process. Presumably, effects of the positioning of formatting instructions were superimposed by diverse other processes.

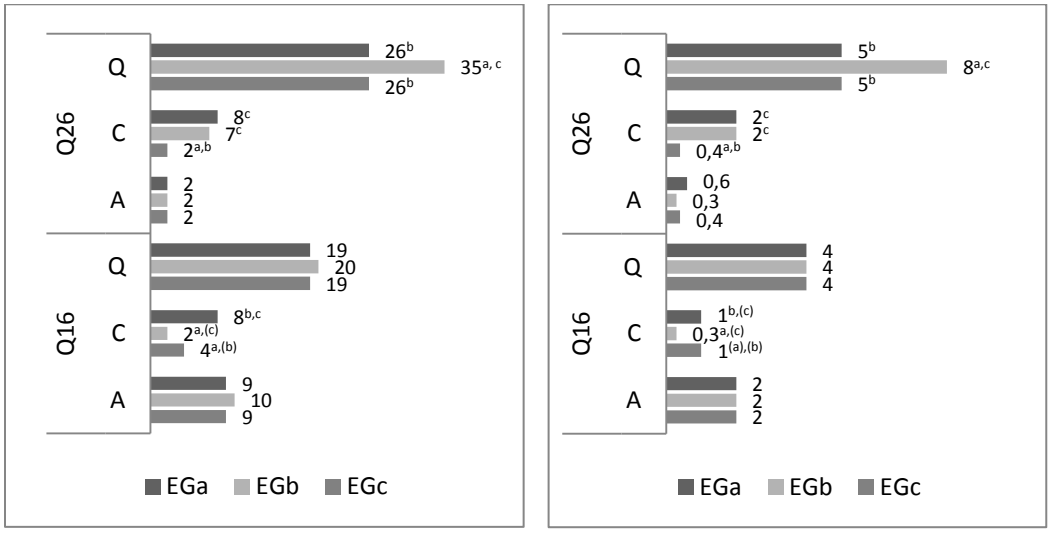

Figure 3: Fixation count (mean, left side) and fixation duration in seconds (mean, right side) for question #26 and #16 depending on three experimental groups. $^{a/\,b/\,c}$ $p<.05$, $^{(a)/\,(b)/\,(c)}$ $p<.10$ pairwise Bonferroni post-hoc tests between EGa, EGb and EGc with superscripts indicating significant differences to the specified experimental group; AOIs within the first 15 seconds: Q=question, C=clarification feature (*here*: instruction), A=answer box.

The transition ratio of direct attention shifts from formatting instructions to answer space in question #26 and #16 was significantly higher in EGa (16 and 30 percent) and EGc (19 and 31 percent) compared to EGb (4 and 3 percent). Concerning both questions, EGa and EGc did not differ significantly. These findings indicated that placing formatting instructions which refer to the last stage of the question-answer process after the answer space enhanced the interconnected processing of reading the instruction and providing an appropriate answer. Again, placing formatting instructions in the conventional sense directly after the question text in EGa also attained a high level of interconnected processing of correlated question components.

6. Summary

In self-administered questionnaires, clarification features such as definitions, retrieval cues, motivational statements or formatting instructions are often provided to prevent misinterpretation of questions, and problems with retrieving relevant information or with formatting the answer. However, it is well known that respondents are at a high risk of ignoring this kind of additional information when answering survey questions. The present experiment examined the effect of varying positions of clarification features to enhance their effectiveness on response accuracy. The objective was to enhance the level of attention towards the clarification feature as well as the integration and deeper

processing of this information within different stages of the question-answer process by changing its position.

Findings reported in this paper based on survey data provide initial evidence that, in general, the position of clarification features actually affects survey responses, and that an alternative position other than placing clarification features directly after the question text can attain higher effectiveness. To be more precise, placing definitions specifying question meaning before the question text and instructions indicating the desired format after the answer space has the potential to achieve by tendency higher effectiveness than the conventional position directly after the question text. Though, these results reach no statistical significance which is basically due to a small sample size, and which, in turn, requires replication on the basis of a larger sample size. Thus, conclusions on the basis of the present survey data have to be considered with caution.

However, eye tracking data revealed detailed information concerning the effectiveness of alternative positioning of clarification features indicating differences depending on the respective stages of the question-answer process clarification features refer to. In general, higher effectiveness of clarification features on survey responses due to their position can be explained by higher attention-getting properties in terms of higher fixation counts as well as deeper cognitive processing indicated by higher fixation durations. In addition, to ensure a high effectiveness of clarification features it seems to be important that question components which are directly related to each other are actually placed together in order to induce a highly interconnected cognitive processing of related question components. In fact, clarification features should be placed exactly where the respondents need the additional information. Therefore, it is especially important to consider the stage to which the respective clarification feature refers to within the question-answer process when deciding where the specifying information has to be provided. In the present experiment, eye tracking data clearly indicate several differences in effectiveness of clarification features depending on the respective processing stage.

Within the *first* stage of question comprehension, placing clarifying definitions which aim to enhance question comprehension before the question text provokes a higher level of attention compared to the conventional positioning directly after the question. Obviously, respondents ascribe a higher level of importance to definitions when they are provided before the actual question text. In addition, respondents spend more time on processing the additional information and recognize the need for an interconnected cognitive processing of related question components when definitions are presented before the question which, altogether, fosters a correct understanding of the question meaning. However, placing clarifying definitions after the answer space should be avoided because the provided information is obviously presented too late so that respondents do no longer consider the information in the question-answer process.

Concerning the *second* stage of information retrieval, again, eye tracking data clearly indicate that clarification features like retrieval cues or motivating instructions should not be placed after the answer space. Placing them either before or after the question text resulted in higher levels of attention and cognitive processing as well as enhanced interconnected cognitive processing of related question components.

Present findings suggested that formatting instructions which aim at encouraging a correct answer format, and thus, refer to the *fourth* stage are most effective when they are provided either directly after the question text or even directly after the answer space. In either instance, clarification is provided exactly where respondents need it whereby a highly interconnected cognitive processing of the related question components is favored. Formatting instructions placed before the question text seems to be presented too early in

the question-answer process so that respondents leave the instruction out of consideration when they actually format their answer.

In general, although some of the findings based on survey data are quite indecisive eye tracking data clearly indicate some differences in the efficiency of alternative clarification feature positions depending on the respective processing stage. Thus, the positioning of clarification features is recommended to be selected depending on the respective stage they refer to within the question-answer process.

References

Cannell, C. F., Miller, P. V., & Oksenberg, L. (1981). Research on Interviewing Techniques. *Sociological Methodology, 12*, 389-437.

Christian, L. M., & Dillman, D. A. (2004). The Influence of Graphical and Symbolic Language Manipulations on Responses to Self-Administered Questions. *Public Opinion Quarterly, 68*(1), 57-80.

Christian, L. M., Dillman, D. A., & Smyth, J. D. (2005). *Instructing Web and Telephone Respondents to Report Date Answers in a Format Desired by the Surveyor. Technical Report 05-067*. Pullman, WA: University of Washington, Social and Economic Sciences Research Center.

Christian, L. M., Dillman, D. A., & Smyth, J. D. (2007). Helping Respondents Get It Right the First Time: The Influence of Words, Symbols, and Graphics in Web Surveys. *Public Opinion Quarterly, 71*(1), 113-125.

Conrad, F. G., Couper, M. P., Tourangeau, R., & Peytchev, A. (2006). Use and Non-use of Clarification Features in Web Surveys. *Journal of Official Statistics, 22*(2), 245-269.

Conrad, F. G., & Schober, M. F. (2000). Clarifying Question Meaning in a Household Telephone Survey. *Public Opinion Quarterly, 64*(1), 1-28.

Conrad, F. G., & Schober, M. F. (2005). Promoting Uniform Question Understanding in Today's and Tomorrow's Surveys. *Journal of Official Statistics, 21*(2), 215-231.

Conrad, F. G., Schober, M. F., & Coiner, T. (2007). Bringing Features of Human Dialogue to Web Surveys. *Applied Cognitive Psychology, 21*(2), 165-187.

Couper, M. P., Kennedy, C., Conrad, F. G., & Tourangeau, R. (2011). Designing Input Fields for Non-Narrative Open-Ended Responses in Web Surveys. *Journal of Official Statistics, 27*(1), 65-85.

Dillman, D. A. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York: John Wiley & Sons.

Ehmke, C., & Wilson, S. (2007). *Identifying Web Usability Problems from Eye-Tracking Data.* Paper presented at the 21st British HCI Group Annual Conference on People and Computers: HCI...but not as we know it - Volume 1, Lanchester, UK.

Fowler, F. J. (1995). *Improving Survey Questions. Design and Evaluation*. Thousand Oaks, CA: Sage.

Fuchs, M. (2009). Asking for Numbers and Quantities: Visual Design Effects in Paper&Pencil Surveys. *International Journal of Public Opinion Research, 21*(1), 65-84.

Galesic, M., Tourangeau, R., Couper, M. P., & Conrad, F. G. (2008). Eye-tracking adata: New Insights on Response Order Effects and Other Cognitive Shortcuts in Survey Responding. *Public Opinion Quarterly, 72*(5), 892-913.

Holmqvist, K., Nyström, M., Andersson, R., Dewhurst, R., Jarodzka, H., & van de Weijer, J. (2011). *Eye Tracking. A Comprehensive Guide to Methods and Measures*. New York: Oxford University Press.

Holyk, G. G. (2008). Questionnaire Design. In P. J. Lavrakas (Ed.), *Encyclopedia of Survey Research Methods* (pp. 656-659). Thousand Oaks: Sage Publications.

Jacob, R. J. K., & Karn, K. S. (2003). Eye Tracking in Human-Computer Interaction and Usability Research: Ready to Deliver the Promises. In J. Hyönä, R. Radach & H. Deubel (Eds.), *The Mind's Eye: Cognitive and Applied Aspects of Eye Movement Research* (pp. 573-605). Amsterdam: Elsevier.

Kahneman, D. (1973). *Attention and Effort*. Englewood Cliffs, N.J.: Prentice Hall.

Krosnick, J. A. (1991). Response Strategies for Coping with the Cognitive Demands of Attitude Measures in Surveys. *Applied Cognitive Psychology, 5*(3), 213-236.

Oksenberg, L., Cannell, C., & Kalton, G. (1991). New Strategies for Pretesting Survey Questions. *Journal of Official Statistics, 7*(3), 349-365.

Oudejans, M., & Christian, L. M. (2010). Using Interactive Features to Motivate and Probe Responses to Open-Ended Questions. In M. Das, P. Ester & L. Kaczmirek (Eds.), *Social and Behavioral Research and the Internet* (pp. 215-244). New York: Routledge.

Peytchev, A., Conrad, F. G., Couper, M. P., & Tourangeau, R. (2010). Increasing Respondents' Use of Definitions in Web Surveys. *Journal of Official Statistics, 26*(4), 633-650.

Poole, A., & Ball, L. J. (2005). Eye Tracking in Human-Computer Interaction and Usability Research: Current Status and Future. In C. Ghaoui (Ed.), *Encyclopedia of Human Computer Interaction*. Pennsylvania: Idea Group, Inc.

Redline, C. D. (2011). *Clarifying Survey Questions.* Unpublished Dissertation, University of Maryland, College Park.

Redline, C. D., & Lankford, C. P. (2001). *Eye-Movement Analysis: A New Tool for Evaluating the Design of Visually Administered Instruments (Paper and Web)*. Paper presented at the Annual Conference of the American Association for Public Opinion Research (AAPOR), Montreal, Canada.

Schober, M. F., Conrad, F. G., & Fricker, S. S. (2004). Misunderstanding Standardized Language in Research Interviews. *Applied Cognitive Psychology, 18*(2), 169-188.

Schwarz, N., & Oyserman, D. (2001). Asking Questions About Behavior: Cognition, Communication, and Questionnaire Construction. *American Journal of Evaluation, 22*(2), 127-160.

Smyth, J. D., Dillman, D. A., Christian, L. M., & McBride, M. (2009). Open-Ended Questions in Web Surveys. *Public Opinion Quarterly, 73*(2), 325-337.

Sudman, S., Bradburn, N. M., & Schwarz, N. (1996). *Thinking About Answers: The Application of Cognitive Processes to Survey Methodology*. San Francisco: Josey-Bass Publishers.

Suessbrick, A., Schober, M. F., & Conrad, F. G. (2000). Different Respondents Interpret Ordinary Questions Quite Differently, *In American Statistical Association. Section on Survey Research Methods* (pp. 907-912). Alexandria, VA: American Statistical Association.

Tourangeau, R., & Bradburn, N. M. (2010). The Psychology of Survey Response. In P. V. Marsden & J. D. Wright (Eds.), *Handbook of Survey Research* (pp. 315-346). Bingley, UK: Emerald Group Publishing Limited.

Tourangeau, R., Conrad, F. G., Arens, Z., Fricker, S., Lee, S., & Smith, E. (2006). Everyday Concepts and Classification Errors: Judgments of Disability and Residence. *Journal of Official Statistics, 22*(3), 385-418.