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Survey Design for Visually Impaired and Blind People

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Abstract. This paper presents guidelines for the design of self-administered surveys for visually impaired and blind people within a mixed mode approach. The different needs of the target group are fulfilled by offering different modes of participation (paper-based, braille-based, Web-based). Reading aids have in common that they enhance the focus of a specific piece of text or single word. This advantage turns into a disadvantage in terms of a clear overview and arrangement of the text elements on a page. Therefore text needs to be designed with cognitive processes and accessibility standards in mind. This is especially true for a survey questionnaire where each question and answer item has to convey its own special meaning independent from context. Design problems and their solutions are described and illustrated with experiences from pretesting and a case study.

Keywords: Accessibility, mixed mode, self administered surveys, visual design, Web, online, paper, braille, visually impaired, blind, 504c.

1 Introduction

This paper is concerned with the questionnaire design and the conduction of surveys for visually impaired and blind people. These people are challenged by the readability and usability of traditional paper-based text. Associations for visually impaired and blind people cope with the special requirements by providing various possibilities to obtain textual material. The text corpus may be printed in a bigger font, text may be converted to braille[1] paper or be read aloud to provide audio material. Additionally, text may be obtained electronically and listened to with the help of a screen reader or read by means of a braille display. Special devices can be used (enlargers) which magnify text while allowing for increase in contrast and changes in color (e.g. yellow on black instead of black on white text). All these aids have in common that they enhance the focus of a specific piece of text and sometimes just a single word. This

[1] Braille is a system of printing textual material with raised dots so that it can be read by touching them. Letters and numbers are represented by a specific combination of dots.

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advantage turns into a disadvantage in terms of a clear overview and arrangement of the text elements on a page. Therefore text needs to be designed with cognitive processes and accessibility standards in mind. This is especially true for a survey questionnaire where each question and answer item has to convey its own special meaning independent from context.

We developed several design guidelines for a large font paper-based version, a Braille version and an online version of the same questionnaire. These guidelines for the different modes support the various ways in which the target group is used to reading and responding to written material.

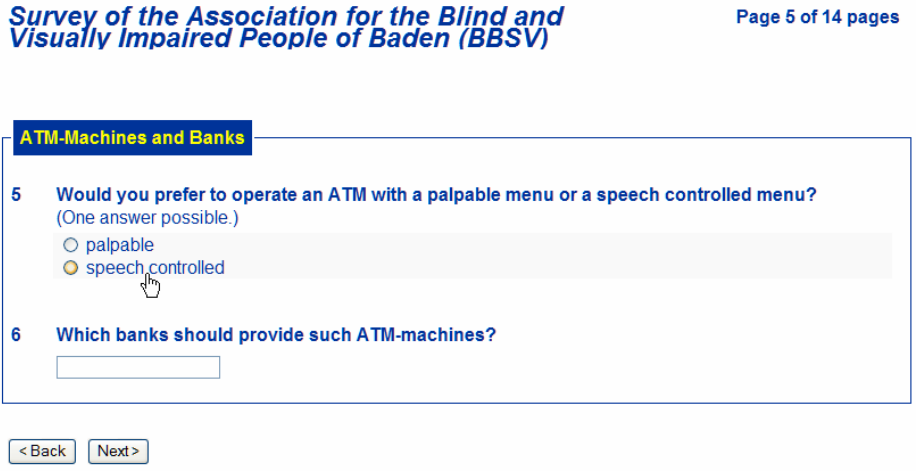

Fig. 1. Screenshot of page five of the Web Survey version. The original survey was conducted in German. Technical note: The use of label-tags in the HTML-structure make it possible to give an answer by clicking on the answer text and allow screen readers to identify the correspondent radio buttons. Usage of the field-tags results in the grouping of the two questions with a heading and a frame.

2 Mixed Mode Approach: Paper and Pencil, Braille and Web

This paper originates from a survey conducted among the members of the Association for the visually impaired and blind people of Baden in Germany. Prerequisites were a low budget which ruled out the possibility of a telephone survey, due to the fact that anonymity of respondents should also be guaranteed. This made it necessary to outsource the monitoring of data collection to the Center of Survey Research and Methodology (ZUMA) which supported the project through all stages with methodological consultating, questionnaire development, design, and implementation. To ensure that each member is able to receive information provided by the association it is a standard procedure to develop several versions of a text in different modes. The newsletter for example is provided as braille, large font, normal font and e-mail. Thus,

it was a requirement to develop a braille version, a large font version and an online version of the questionnaire.

The content of the questionnaire was related to demands for supporting equipment, assistance, training, attitudes to social activities and basic demographic data. It consisted of twenty questions and was restrained to three basic question types: check one that applies, check all that apply and open question formats. Respondents were able to provide additional information for some questions with an answer item which read "Other, please specify:___ ". Figure 1 shows a design example for the Web survey implementation.

All members of the association were invited to participate in the survey (n=518). Table 1 shows the number of responses for the different survey modes. All members of the association received either a large font version or a braille version of the questionnaire identical to the mode in which they receive information material from the association. A free return envelope was enclosed. About three quarters of the members have subscribed to receive textual material. Each questionnaire informed about the possibility to take the Web survey instead of filling out the paper version.

Because approximately twenty persons receive e-mail newsletters, we were able to roughly estimate the response rates for the different survey modes, if we assumed that these twenty persons were likely to take the Web survey. The response rates for the Web and large font versions were expected to be about fifty percent, showing a high commitment of the members and giving evidence to the success of the implemented design. The braille paper version had a lower response rate of thirty percent which is still very good given the fact that answering the questionnaire with a braille typewriter is a very time-consuming task which can easily take more than an hour for only twenty questions.

Of the 235 respondents 46 percent were males and 54 percent were females, resulting in a total response rate of 45 percent. The mean age was 67 with a standard deviation of 14 years. Respondents were either blind (55.6%) or visually impaired (42.7%). Only four participants (1.8%) reported to have good eyesight.

The answers about Internet usage ("How often do you personally use the Internet at home?") reveals that the majority (81,5%) do not use the Internet or do not have Internet access. Only 15.1% are using the Internet two times per week or more often. In the large font version 70% reported that they needed help from a second person to fill in the questionnaire, whereas in the braille version only 19% and in the Web survey none requested help from others to participate. Overall, participation was perceived as rather easy (17.9%) or easy (77.7%).

Table 1. Distribution of responses according to survey mode

Mode	Response	Percent
Large font paper version	192	81.7
Braille version	32	13.6
Web survey	11	4.7
Total	235	100

3 Cognitive Aspects of Survey Design for Visually Impaired and Blind People

Modern approaches in survey research develop questionnaires based on the knowledge from cognitive psychology [1]. In recent years principles of good Gestalt were adapted to questionnaire design [2] and the usability of a questionnaire [3, 4] especially in Web surveys [5] has become an important issue. Despite these new developments, the traditional concept of burden, early defined by Bradburn [6], still plays an important role in assessing some of the problems involved in survey design. The following subsections explain how cognitive concepts shape the design specifications for surveys for visually impaired and blind people.

5. What would you prefer in an ATM?
I prefer a palpable menu ..... ☐
I prefer a speech controlled menu ..... ☐

Fig. 2. Traditional standard layout in a paper-based questionnaire

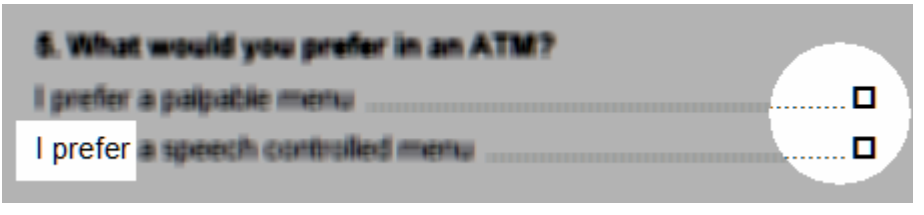

Fig. 3. Demonstration of possible restrictions of the visual field due to a magnifying device (rectangle) or tunnel vision (circle) with the question of figure 2. The background is blurred and shaded to stress the visible parts.

5. Would you prefer to operate an ATM with a palpable menu or a speech controlled menu? (One answer possible.)
a) palpable ☐
b) speech controlled ☐

Fig. 4. Redesigned survey. Copy of the top part of page three of the paper-based survey. The original survey was conducted in German and the size was 14 point. This example demonstrates the implementation of the guidelines for an enhanced overview at question level, resulting in improved navigation, orientation and easier cognitive processing.

Challenges can be categorized into three main aspects: (1) providing overview (e.g. position markers), (2) navigational aids (e.g. clear identifiers to distinguish between questions and answers on the left border), and (3) supporting the sequence of the questionnaire flow (e.g. allowing answer checks at the immediate right end of an answer option in the paper version which destroys the usual visual alignment of right checkmarks).

3.1 Provide and Support Overview

A questionnaire should provide information about the survey to foster the overview on (a) a general level and (b) at the level of specific questions. People with an impaired visual field, e.g. a tunnel view find it difficult to get an overview of a page. Several single aspects must be viewed separately and put together to actively form a whole which is not visible at one glance. Similar problems occur with enlarger devices, braille paper and screen readers. Figure 2 shows the traditional layout of a question in a paper-based questionnaire. The corresponding Figure 3 illustrates the challenges of restricted visual fields. The light rectangle exemplifies the visible part when using an enlarger, the circle can be seen as the result of tunnel vision.

The beginning of a questionnaire should therefore explicitly include information about the length of a survey in terms of number of questions and number of pages (also a footer indicating "page 1 of 6" should be added). As in traditional surveys the topic should be noted. Furthermore, instructions on how to participate need to be stated ("Please fill in the questionnaire and send all pages back to us with the enclosed envelope, which we did address and stamp for your convenience."). In the braille version we included additional instructions for the use of a braille typewriter. Respondents were asked to write the number of the question and their answer in full text: "At the end of the questionnaire you will find three sheets of paper suitable for your braille typewriter. To answer a question, please write the question number together with your preferred answer. For example to answer question 13 with 'female' you would write: 'question 13 female'. Please start each answer in a new line." The Web version implemented a textual progress indicator. In the same manner a footer was placed in the large font version.

Besides the providing of a general overview, extra information is also helpful within each question. Each question has to make clear how a response should look like, i.e. whether it is a "check one", "check all that apply" or "write your answer" question type. It is important to note that in contrast to the usual wording mentioned above the wording chosen was in such a way that the first word indicated the question type. The large font paper version used extra information as follows: "(One answer is possible)", "(Several answers are possible)".

The braille version provided additional information about the amount of possible answers and instructions to answer the questions. Examples for a set of extra information per question in the braille version are: (Several answers are possible among 5 answers), (One answer is possible among 3 answers), (Please write your age on the answer sheet). If the extra information was redundant for the question, it was not included, so that respondents did not feel fooled: For example “Are you male or female?” was not followed by “(One answer is possible among 2 answers)”.

The guidelines to improve overview are as follows:

1. Reduce the number of question and answer types to as few as possible.
2. Inform about the topic of the survey.
3. Provide instructions on how to fill in and return the questionnaire.
4. Provide information about the length of the survey. Add a footer or header with page numbers and the total amount of pages.

5. For a braille version indicate the amount of available answer options after each question.
6. Indicate the type of answer after the question. For example: "One answer is possible", "Several answers are possible".

3.2 Provide Navigation and Orientation Aids

People suffering from restrictions of their visual field find it impossible to benefit from the traditional layout of paper-based questionnaires. One may think that the two answer options in Figure 2 are easily identified. On the contrary, this is not the case for people using a magnifier or suffering from tunnel vision (figure 3). The fact that both answer options start with the same eight letters makes them harder to distinguish from each other. When moving the paper to the left under the enlarger device in order to read to the right and then turning back to the next line with one quick move, respondents might have the impression that they had accidentally positioned the paper in the same line. As a consequence they move further down and skip the second answer alternative. Pretesting revealed that with the fast and often practiced movements involved with enlargers some questions and more often answer categories were easily missed in the case of traditional survey layout. A similar consequence of such restrictions is that identical wording at the end of an answer option (in this example the word "menu") adds an additional hurdle to match the answer field with the distinctive meaning of an answer option. Thus, respondents need to be extra careful and crosscheck their paper or eye movements to avoid unintended line switching.

A restriction of the visual field makes it more difficult to orientate oneself on a sheet of paper and to focus the attention on the desired parts. Loosing orientation or the focus of attention could lead to the following outcomes:

1. A page is skipped and gets lost.
2. A question is skipped.
3. Answer categories are skipped and not considered.

An example how a page could be skipped was revealed through pretesting with a braille version of the questionnaire. The participants started by flipping through the pages, reading parts of the top and the bottom which contained the numbering. The paper sheets were turned so to also scan the backside of the papers for text. Each paper was then laid on the table or kept on the knees. By accident a paper sheet was put on the table aside from the other paper sheets. The remaining pile lead to the impression that the survey consisted of fewer pages resulting in unintentional partial nonresponse.

The derived guidelines draw from the principle that questions and each answer option should be distinguishable from each other. Figure 4 shows part of the redesigned questionnaire for the large font paper version. The following measures proved to be successful navigation and orientation aids:

7. Start each question with a consecutive number followed by a period, making each new question distinct from the very beginning.
8. Include empty lines (spacers) only before each new question but not between answer categories, nor between the question and the answers. By this question and answers are visually grouped together.

9. Start each answer category with a consecutive letter beginning with a) for each question. This helps to distinguish the answer options from each other and differentiates them from the questions which are numbered.
10. Reformulate the answer options towards a maximum of different letters in the beginning and at the end of each item, while keeping the meaning. This ensures that each item is easy to distinguish at the start of the line and in the region of the answer options.

3.3 Streamline the Answering Process

Usually, the layout of a questionnaire is based on principles of good Gestalt, like proximity and grouping [2]. As a result, check boxes are aligned on the right hand side of a page in paper-based surveys (sometimes with dotted lines to aid the eye movement) and the left hand side in Web surveys. This is only reasonable if a respondent is able to see the whole of the line and can easily connect the answer boxes with the answer categories. Obviously, respondents who only see a few words at a time (some people enlarge only one word at a time) may have difficulties reaching beyond the white gap or following the dotted line between answers and check boxes. What is worse, pretests made it clear that due to the fact that the right hand side looks like a column of similar boxes only, the correctly corresponding right box is difficult to reach and remains unclear. The intentional effect of such visual grouping does not hold in our case and the linkage between answers and answer fields is broken. As a solution, traditional grouping may be avoided. Still, the answer fields are put to the right to allow an immediate response after reading without the need for an errorprone return to the beginning of the answer option.

As a second point, processing all answer options can be time consuming when scanning the lines is not possible. Reaching a valid answer and considering the available options can easily be supported by formulating all answer options into the question. As a positive side effect such wordings do also reduce acquiescence [7]. For example instead of asking "What would you prefer in an ATM?" the question reads “Would you prefer to operate an ATM with a palpable menu or a speech controlled menu?”

The guidelines supporting the answer process are as follows:

11. In a paper-version include check boxes directly after the answer text, leaving a ragged right. Instruct respondents to mark either the checkbox at the right end or the character at the beginning of an answer option.
12. Formulate the questions to include all answer categories wherever possible, i.e. if only a few answer categories exist. Such a procedure is known to reduce burden for the respondents.

4 Conclusion

This paper puts forth twelve guidelines for the design of self-administered questionnaires for surveys with visually impaired and blind people. Several modes have to be considered to accommodate to the various channels of communication which visually impaired and blind people are used to. The discussed approach is

appropriate for projects where a personal or telephone interview is out of scope. Such cases might occur when there is a need to stay within the online medium (e.g. in website evaluation forms), with missing phone numbers or simply under-funded budgets. Considering the expected difficulties with written material and the advanced age of the target group the response rate exceeded our expectations. Concepts from cognitive psychology, especially Gestalt theory, in combination with user tests have shown to be a valuable source for deriving possible solutions and developing the design guidelines for surveys with visually impaired and blind people.

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