# Developing an optimal screen layout for CAI

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## 1. Introduction

This paper describes the development of an optimal screen layout for Blaise to be used for Computer Assisted Interviewing (CAI) at the Australian Bureau of Statistics (ABS).

In making the transition from paper-based interviewing to computer assisted interviewing it is important to consider the screen interface that interviewers will use to administer questionnaires. Apart from ordinary screen useability issues it is also important to minimise the risk of measurement error that might come about from a sub-optimal design. While Blaise provides a good range of screen layout features, the default settings are not necessarily the best settings to use in all cases. Furthermore, the presentation standards that apply to paper questionnaires do not readily translate to the computer screen.

The screen layout recommendations, contained in this paper are based, in part, on papers by Dr Michael Couper and Mark Pierzchala. The design recommendations also take consideration of the hardware and operational circumstances at the ABS at this time.

This paper also describes the methodology employed in evaluating the proposed screen layout for ABS use.

## 2. Approach taken

The objective of developing a suitable screen layout for CAI is to optimise the interviewer's ability to interpret the screen presentation, read out the relevant question text with accuracy and at the same time follow any specified instructions such as showing a prompt card or recording multiple responses. This objective is no different from that which applies in the paper questionnaire environment.

In order to develop a screen layout that suits the ABS environment, the following approach was taken:

- a literature search was carried out to find relevant international material which dealt with screen design for CAI and Blaise;

- contact was made with major statistical agencies who make use of CAI, to identify current screen design practices;

- a sample of Blaise instruments used in some of these agencies was also obtained;

- the Blaise software was scrutinised closely to identify the various adjustments that are possible (also to identify any limitations which may exist);

- the relevant literature was discussed in an internal working paper and a set of draft recommendations for screen layout was prepared;

- comparative survey instruments were prepared using existing screen layout (based on some ABS paper questionnaire conventions and Blaise default settings) and using the recommended screen layout;

- initial useability testing was carried out to assess whether the proposed screen layout was preferable;

- more intensive useability testing was carried out to refine the proposed screen layout further; and

- a full field test was conducted using the proposed screen layout, as refined.

## 3. Basic elements of a Blaise CAI screen

Overall, the goal of the CAI screen is to focus the interviewers' attention rapidly on the key elements of the task, and allow them to complete those tasks efficiently and with minimal error (Couper et al, 2000). Screens often contain action items (the things that an interviewer needs to administer the questionnaire, such as the question to be read to respondent, the answer to be recorded and interviewer actions like showing prompt cards), information items (the things that facilitate the interviewer's delivery of the question and recording of the answer, but are not directly part of the question/answer process, such as help, question by question specifications, interviewer instructions), and auxiliary items (contextual information, such as case identifier, time/date displays, function key mapping, navigation tools, etc.).

The default Blaise screen is presented in Figure 1. Similar to Couper and colleagues (2000), the authors of this paper consider that the basic/default screen layout provided in Blaise requires several changes to facilitate the goals outlined above. The Mode Library component of Blaise permits a great deal of customisation.

**Figure 1: Basic Elements of a Blaise CAI Screen[1]**
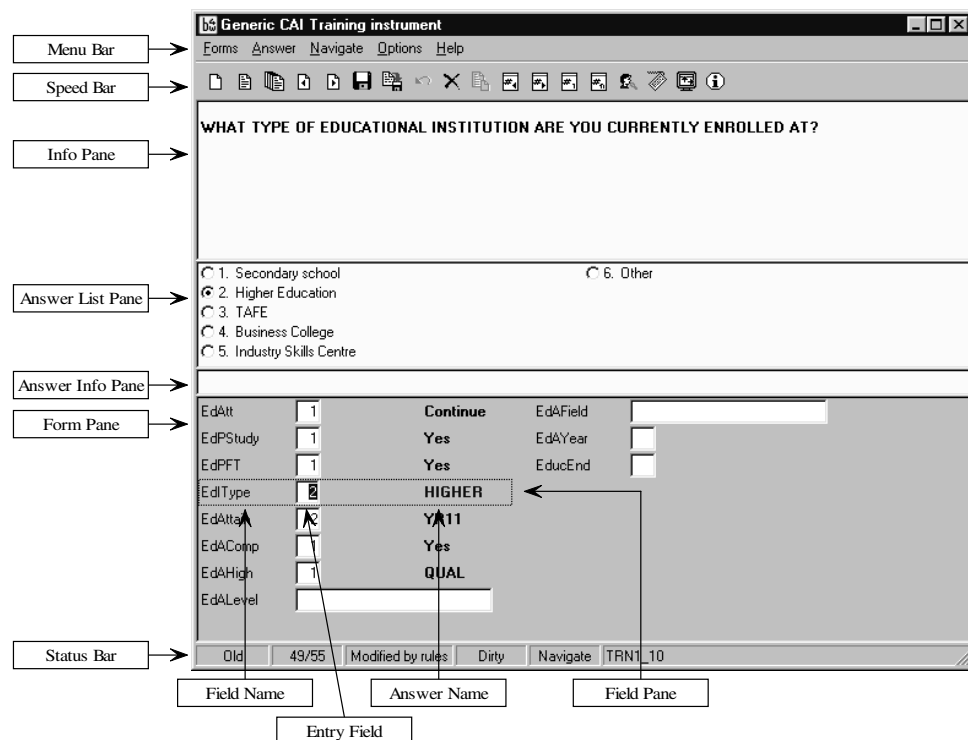


[1] When parallel blocks are used, tabs can be made to appear between the Speed Bar and Info Pane. For an example of this feature see Figure 4.

The interviewer collects data with the Blaise Data Entry Program (DEP), which features a distinctive split-screen display shown in Figure 1. The screen in Blaise refers to the entire area of the computer window, from the title bar on the top and extending to the status bar on the bottom.

The upper part of the screen is called the Info Pane. It contains question text and other information meant for the interviewer.

The lower part of the screen is the Form Pane or Page. It contains data entry cells and the cursor moves from one data entry cell to another. Question text displayed in the Info Pane corresponds to the position of the cursor in the Page. The Form Pane can be seen as reflecting a page in a paper questionnaire. The term is intuitive to the interviewer, and the Page Up and Page Down keys move backwards and forwards, one page at a time.

## 4. Screen Design Recommendations

There are many aspects of screen presentation, covering a range of items such as font type, size, colour, emphasis and positioning of text and other objects (icons, buttons etc). Each of these aspects then needs to be considered for each type of field element such as the question text itself, the instructions, the response set and data entry elements.

The screen design settings which follow are those which have been recommended for use as the default settings for all CAI instruments in the ABS. Flexibility exists to modify these settings to suit difficult questions or special data entry needs for particular surveys, in which case these recommendations could be used as a guide to the preferred presentation.

The screen design recommendations have been specified to suit a notebook computer screen set to a resolution of 1024x768, which is the conventional setting used on the current generation of computers at the ABS. Corresponding adjustments would be needed if the resolution settings on computer screens were changed.

A summary of the design recommendations is given in Table 1. A brief discussion of these settings follows.

**Table 1. Recommended screen design settings for screen resolution 1024x768**

| Element and attribute | Recommended setting |
|---|---|
| *General* | |
| Blaise window | Use full screen, disallow resizing or minimising |
| Menu bar | Provide essential items only |
| Speed bar | Provide a limited number of icons only |
| Parallel blocks | Use as a navigational aid. Add context and status text to label. |
| Windows task bar | May remain visible (default) |
| On-line help | Use Blaise language facility (for convenience) |
| *Info Pane* | |
| Margins | Left - 5mm, Top - 5mm, Right - 100mm |
| Question text font, size and colour | San Serif, 14 point, black, bold |
| Question text placement | Left justified within the margins specified |
| Question text case | Mixed case |
| Instruction text font, size and colour | San Serif, 12 point, blue, bold |
| Instruction text placement | Indent text by one tab stop (about 10mm) |
| Instruction text structure | Use upper case action word. Separate from other instructions by a blank line. |
| Context information font, size and colour | San Serif, 12 point, blue, bold |
| Context information placement | Indent text by one tab stop (about 10mm) |
| Use of symbols instead of words | Explore their use for common actions |

| Element and attribute | Recommended setting |
| --- | --- |
| Fill text | Blend with existing text (use a colour highlight for testing only) |
| Emphasis | Specific words that require emphasis are to be highlighted using underline (rather than italics or bold) |
| Borders | Remove borders which produce unnecessary lines across the screen |
| Answer list | Where possible keep these to a single column |
| Answer info pane | Do not display |
| *Form Pane* | |
| Margins | Left margin to match the Info Pane (i.e. 5mm) |
| Text font and size (applies to the whole Form Pane) | San Serif, 12 point |
| Columns | Two columns |
| Rows | Enough to fill the pane |
| Context information text colour | Dark red |
| Context information placement | Indent text by one tab stop (about 10mm). Add text to give the appearance of a heading line. Leave single line space before (if room). |
| *Field Pane* | |
| Field attributes displayed | Field description (brief), Remarks point, Field value, Answer name |
| Field text colour | Normal - black, Highlight - blue |
| Answer name text colour and emphasis | Bold, Normal - grey, Highlight - blue |
| *Status Bar* | |
| Attributes displayed | Relative page number (to know place in the questionnaire) |
| | Field Tag (for references to documentation) |
| | Field Name (for communication of problems) |

## 5. Info Pane settings

When interviewers set their eyes on the screen for the first time, they should be drawn immediately to the key features of the screen needed for successful delivery of the survey question and recording of the response (Couper et al, 2000). To do so requires a consistent design, visual discrimination among the different elements (so interviewers learn what is where, and know where to look), adherence to normal reading behaviour (i.e. start in upper left corner), and removal of unnecessary information (e.g. lines) or other display features that distract the interviewer from the task. Couper et al (2000) proposes that this would result in a cleaner design with more "white space" and a clearer distinction of the key components of the screen.

Increased font size has been chosen as the main way for attention to be drawn to the most important feature on the screen, namely the question text. Consideration was given initially to using a font size of 12 points for the question text on a screen with resolution 1024x768, with all other texts set to 11 points. This was soon changed, however, after some sample screens were prepared. Ultimately, it was considered appropriate to recommend a font size of 14 points for the question (and answer) text, with a size of 12 points for all other texts.

The use of bold rather than normal font for various text elements in the Info Pane and Field Pane has been done to make these important elements more distinguishable, especially under conditions that may include direct sunlight.

Special emphasis for particular words should be done through the use of underline rather than bold or italics. This is in line with conclusions drawn by Couper et al (2000) who found that underline was most distinguishable from normal text under a range of different font settings and lighting conditions. In fact, this convention was already in place for paper questionnaires.

Readability of text can also be adversely affected by line length, which is why the right-hand margin has been set to 100mm. The other margins have been defined to offset the text slightly from the borders of the Info Pane and Field Pane and thereby make the text more readily identifiable.

Some settings have been employed to keep the screen relatively free from "clutter" and enable the interviewer to focus on the important elements necessary to carry out interviewing functions. The main settings associated with this objective are the removal of various borders or lines on the screen, limiting the icons on the speed bar and, where possible, keeping the answer list to a single column.

Couper et al (2000) also recommends that the interviewer instructions and response categories be indented deeper than regular question text, as a way to further distinguish these items from the question. While the recommendation to indent interviewer instructions has been adopted for the ABS screen design, the indentation of response categories is not possible because this feature is not currently available in Blaise.

Colour has been used consistently as an identifying feature of particular text elements (e.g. Blue for instructions and context in the Info Pane, Dark red for context headings in the Form Pane). However, colour is not the only identifying feature, and other aspects such as placement or font size also help to distinguish various text elements. The background colours of cream (for the Info Pane) and light grey (for the Form Pane), which are set as the default colours in Blaise, are considered quite acceptable.

Mixed case has been recommended for screen text as it has been consistently found to facilitate reading speed (Schriver 1997, Galitz 1993). Pierzchala and Farrant (2000) also recommend using mixed case because it is clearer for interviewers to read. The recommendation to use mixed case does differ, however, from the ABS practice in relation to paper forms used by interviewers where upper case is used to signify text to be read out. While this change of practice could be seen as significant, it was considered that the use of CAI was sufficiently different from paper for a new set of conventions to be readily understood. This was one particular issue that was pursued in the useability testing.

One of the main features of CAI is the ability to tailor the question text to the circumstances of the interview through the use of "fill" text. Depending on the circumstances, the pronouns, dates and text references to previous answers in the survey can be "filled" with the appropriate words. In that way the interviewer can simply read the generated question texts and not be worried about adjusting the text as the interview proceeds. In early DOS systems for CAI at the ABS it was conventional to highlight the fill text through the use of colour or style change. Couper et al (2000) argues that fills should generally be indistinguishable from the surrounding text. This argument has been accepted for the ABS CAI screen layout, although a colour highlight is considered to be useful during testing and debugging of the instrument.

Couper et al (2000) recommends that some contextual information relevant to the interview be placed in the top right of the screen, but this is not currently possible in Blaise. Therefore, it has been recommended for the ABS screen layout, that context headings be placed in the Form Pane using dark red text and indented (see more on this below). Other context information, which might be required during the interview, such as the respondent's name or other details, should be treated in

the same way as interviewer instructions (i.e. one font size smaller than question text, blue and indented).

## 6. Form Pane settings

The Form Pane displays the fields specified in the questionnaire along with spaces for entering the responses. The Form Pane is analogous to a page in a paper questionnaire, it organises and displays related data elements together (Pierzchala and Farrant, 2000). The design and specification of the Form Pane is often neglected but is considered by Pierzchala and colleagues to be just as important as the design of the Info Pane. The authors of this paper agree.

The Form Pane is made up of a Grid, the cells of which form smaller elements called Field Panes. A Field Pane is an area where the field description, data entry cell, and other related elements can be displayed. There are several features that can be specified in the Form Pane that enhance the presentation for the interviewer. Most of the time, instrument designers/programmers end up using the default features and these are not necessarily the most appropriate features for survey interviewing (Pierzchala and Farrant, 2000).

Pierzchala and Farrant recommend the specification of readable Field Descriptions to identify each field (as opposed to the default Field Name), with heading labels that group related questions, using two columns in the Form Pane with data entry cells in each column. Use of the Field Description, as distinct from the default Field Name, gives more flexibility, since spaces can be included in the description. Field descriptions can also be multilingual and used as the field identifier in the edit jump dialog.

For the ABS screen layout, the recommendation of using the Field Description to identify each field (Pierzchala and Farrant, 2000) has been endorsed. The Form Pane should also be enhanced through the inclusion of blank lines to divide the list of fields into groups and the addition of suitable context headings. For the ABS screen layout it has also been recommended that the headings be presented in dark red text, with the addition of some text (five dashes at each end) to give the appearance of a line. The font size for all text on the Form Pane has been recommended to be 12 points (for screen resolution 1024x768) which is the same as for interviewer instructions and context information on the Info Pane.

While it is possible to include up to ten different elements for each field in the Form Pane, the following four elements have been recommended for the ABS screen layout: Field Description (brief), Remarks Point, Field Value, and Answer Name.

Initial implementation of CAI at the ABS considered it sufficient to show only the current question field in the Form Pane. The change to making more extensive use of the Form Pane, as reflected in the recommendations above, was considered an important aspect to assess in the useability testing. For that purpose the Form Pane was configured to show up to 18 fields. Logical headings were added to groups of fields along with blank lines and commands to start new page at logical points in the question flow.

## 7. Other settings

Couper et al (2000) recommends that the CAI screen be designed for keyboard use as distinct from mouse use. This is a valid recommendation, however in the ABS where some surveys are expected to be administered in both CAPI and CATI modes, and a mouse device is integrated into notebook computers, it is recommended that the CAI screen be designed to accommodate the use of both keyboard and mouse, with slightly more emphasis on the keyboard. This means providing relevant shortcut keys and menu options for keyboard use as well as

convenient mouse operated icons for common functions (e.g. exit, save). Consideration was also given to the fact that other facilities on the computer, being used by the interviewer, may also require use of the mouse. Therefore excluding it from use during the interview may be restrictive for interviewers who are comfortable with a mouse.

In the interest of keeping the screen as "clean" as possible, consideration was given to the removal of various screen elements such as the Speed Bar, Action Info Pane, Status Bar and the Windows Task Bar. The only element that has been recommended for removal (or non use) in the ABS screen layout, however, is the Action Info Pane. The other elements have been retained because they serve useful functions and are generally part of standard Windows software. The justification is, that interviewers will become used to these elements and their functions, and they will "blend" into the background during the interview because they are generally not needed. It has been recommended, however, that these retained elements be kept relatively free of objects and that their content be made relevant to the interview process. In the case of the status bar, the information recommended for display there (i.e. Relative page number, Field Tag, Field Name) provides the interviewer with discreetly placed additional information about the question in focus. These aspects of the screen design were also explored in the useability testing.

There are two ways that on-line help can be provided to interviewers when using Blaise. One method makes use of Winhelp and the other uses an alternate language within the instrument. Couper et al (2000) recommends using Winhelp because it integrates well with the Windows environment. Preparation of Winhelp files can be quite involved and requires software that is not generally part of the ABS software suite. Given that on-line help has not been used for any CAI surveys at the ABS to-date, it is proposed that a Blaise based solution be used for the ABS because it can be readily incorporated into the instrument. Winhelp may be reconsidered after some experience has been gained with the basics of on-line help.

Consideration has been given to the use of icons instead of text for certain common instructions in order to simplify the screen further. This can be readily achieved through the use of Windings font, although graphics can also be used. Icons have the advantage of not being confused with question text. This aspect of screen layout is expected to be explored further on the basis that useability testing indicates it has merit.

To avoid the segmentation effect, in which interviewers report losing their place in the instrument, Couper et al (2000) has suggested developing a "master control screen" to facilitate interviewer navigation and flexibility (see also Sperry et al, 1998). They suggest this could present a list of the sections of the CAI instrument. Those sections available for access could be designated as such, while those not yet accessible to the interviewer could be greyed out. The interviewer could then enter any section that was available. Upon completion of the section, the instrument would return to the master control screen for selection of the next section to do. Interviewers could also use it to tell at a glance their progress in an interview.

For the ABS situation it is recommended that consideration be given to using such a control screen for only the more complex surveys, at this stage. Instead, it is recommended that more work be done with the use of parallel blocks, a feature of Blaise that did not receive attention by Couper. The Blaise software has a special feature called Parallel Block that can be used to depart from the serial processing order that is specified in the rules. This feature allows different sections of a questionnaire to be completed in parallel to the main path. Once Parallel Blocks are in place the interviewer can access the parallel blocks through a menu option or through tabs at the top of the interview screen. The text, which appears on the tabs, can be tailored to the circumstances of the interview, showing respondents' names and status of their part of the interview. It is recommended that this feature of Blaise be used where flexibility of navigation is required.

There are many aspects of screen layout that are not discussed here but still need to be considered when preparing for CAI. Irrespective of the reasoning behind particular settings, it is important to conduct some useability tests to ensure that an appropriate level of functionality is achieved.

## 8. Useability Testing

Many of the techniques available for pre-testing paper questionnaires, can be used to evaluate CAI systems and survey instructions, including the effectiveness of CAI layout and design. However, instead of focussing on respondents' understanding of the questions, useability evaluation focuses on interviewer interaction with the CAI system and survey instrument.

To evaluate the proposed screen layout, it was decided to conduct two useability tests using a walk-through technique. This is a quick and flexible method for collecting user feedback regarding the design of user interface mock-ups and prototypes.

During the walk-through, users were presented with various screen designs associated with a workflow scenario and were prompted to respond to the screen design elements.

For the first test, two alternative survey instruments were prepared. The first instrument was developed using an existing screen layout, based in part on ABS paper questionnaires and Blaise default settings. A sample screen from this instrument is shown in Figure 2.

**Figure 2: Sample screen based on ABS paper questionnaires and Blaise default settings**
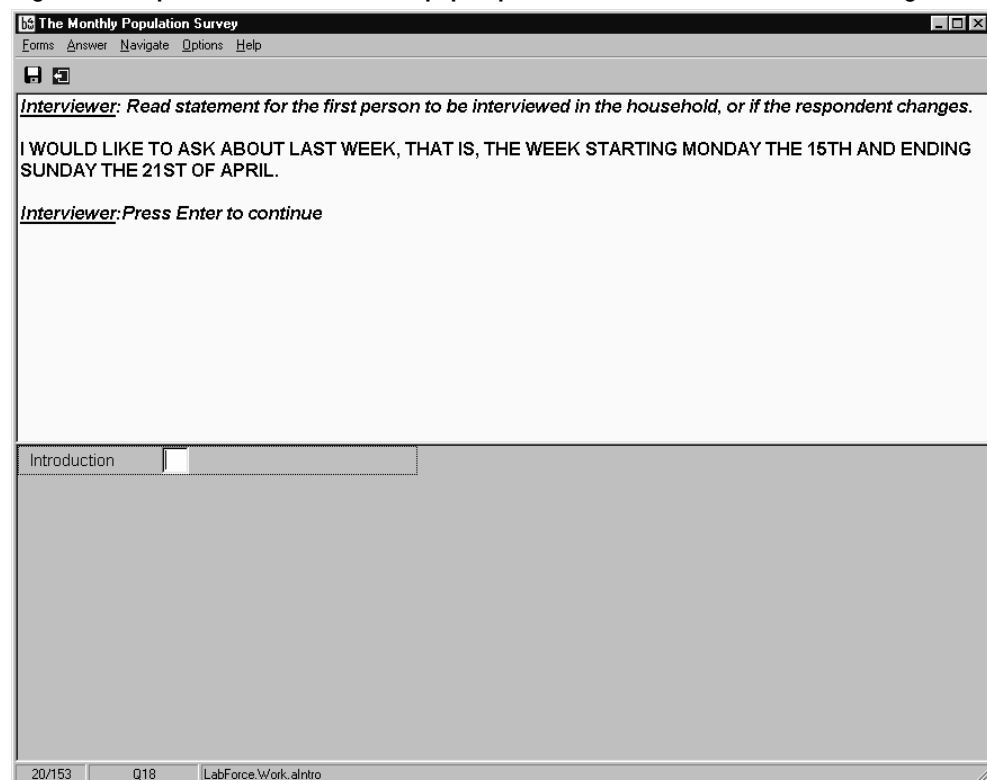


The second instrument was prepared using the using the settings in the recommended screen layout. A sample screen from the second instrument is shown in Figure 3.

**Figure 3. Sample screen showing new layout features**



For the first test, only a few parts of the standard labour force survey were placed into a test instrument.

For the second test, other components of the survey, such as the household roster and supplementary survey questions, were added, along with other features such as help icon and parallel block tabs. A sample screen from the instrument used in the second test is shown in Figure 4.

**Figure 4. Sample screen showing enhanced layout features**

Each test was conducted using six interviewers who were individually taken through a series of interview scenarios using the sample instruments. For the first test, half of the interviewers were exposed to the default Blaise screen layout first and the other half was given the recommended screen layout first.

The broad objectives of the useability testing were to gain user input to and evaluation of screen design elements.

The detailed objectives were to assess:

- readability of questions and interviewer instructions (i.e. font size, mixed case, bold, indentation/margins, font colour) between the two screen designs;

- use of icons and upper case words in the interviewer instructions;

- use and preferences for fill text to be blended with question text (i.e. in terms of colour, mixed case for respondents names, etc);

- use of field descriptions and section heading in Form Pane;

- use of help pop-up box, and what information interviewers would like to be displayed in the help function;

- use of speed bar and status bar (i.e. whether these should be displayed on screen) and if so, what information would be useful to display in them; and

- ease or difficulty in navigation through the instruments.

The main procedure followed in the walk-through was:

- introduction to the test and its objectives;

- obtain consent to /video tape the session;

- provide instructions on use of the notebook computer;

- review each scenario with the user (respondent played by facilitator, interviewer used the interface); and

- users tell the facilitator about the actions they would take and aspects they liked or did not like (during or after the scenario).

The testing was interactive, where the facilitator could interrupt users to probe behind the issues, being careful to make the participants feel at ease, encouraging and confirming their responses.

The video tapes were reviewed after the sessions were completed and detailed notes were made about the observations. A comprehensive report was produced after each test, containing summaries of the observations and recommendations for changes to be made for the next round.

## 9. Summary of results

The reports from each test were comprehensive and covered many aspects of the screen design. A brief summary of findings is presented here.

All interviewers reported they preferred the recommended screen layout to the layout that applied default Blaise settings (and paper conventions). The main screen design issues that interviewers preferred were:

- bolded, black text with indentation and margins, allowing for easier reading on the screen;

- interviewer notes in blue and indented because it helped them to stand out from the questions;

- interviewer notes being briefer, more efficient to read;

- contextual information presented in the Form Pane which allowed for easier navigation and the ability to identify and correct mistakes more efficiently;

- the screen looked clearer and wider, thereby aiding visibility.

## 9.1 Readability of questions and interviewer instructions

All participants reported that they had no difficulty reading the text on the screen, the font size was reported by all to be easy to read and all commented on their preference for the use of colour to differentiate between questions and interviewer notes (i.e. black, bolded for questions and blue for interviewer notes). The majority of interviewers preferred the mixed case question text to that which used all upper case.

## 9.2 Use of icons and upper case words in the interviewer instructions.

The majority of interviewers reported that they liked the use of symbols and short upper case words to aid the reading of notes to interviewers.

## 9.3 Use and preferences for fill text to be blended with question text

All participants reported a preference for fill text that was blended within the question. It was preferred, however, that fills match the text from previous answers as much as possible (e.g. questions on child-care should contain the names and ages of the children in the household for whom the questions are relevant).

When optional question text was presented in rounded brackets, interviewers reported that the impulse to read it out was stronger because the brackets did not stand out. However, upon seeing some optional question text enclosed in square brackets, some interviewers noted that these helped to make it stand out and they paused to notice whether it should be read or not.

## 9.4 Use of field descriptions and section headings in the Form Pane

All participants reported, when probed, that having the context displayed in the Form Pane was useful, especially when navigating back through the instrument or checking that a response had been entered correctly.

Participants also noted that the Form Pane tended to be in their peripheral vision most of the time because they were mainly entering responses using the response categories presented underneath the question in the Info Pane. However, when they were required to enter responses such as dates or numbers, this could only be recorded in the Form Pane yet participants were still looking to record the response in the Info Pane.

More specifically, participants felt they needed to constantly switch their attention up to the questions in the Info Pane and then to record these responses in the Form Pane and then back up to the question. This occasionally led to interviewers making the mistake of reading the next question from the Form Pane before realising that they needed to look back up to the Info Pane to read the question. All participants did note, however, that as they became more familiar with the CAI instrument, it was easier to shift attention back and forth between the two Panes. This was identified as a training issue.

## 9.5 Use of on-line help

Although the majority of participants did not accurately guess what the help icon referred to, once they pressed the F9 key, shown beside the icon, they accurately described it as some kind of help function. They all reported that a help option would be very useful, especially for new or difficult topics.

The majority of participants did caution that if a help pop-up box was to be used then it needed to be consistently used and presented throughout the instrument (i.e. if definitions are presented in the help pop-up box, then definitions should not be

presented on the screen underneath or along side the question text, as happened for some questions).

### 9.6 Use of speed bar and status bar

Most participants reported not noticing the status bar, and therefore did not pay attention to the information displayed in it. When it was pointed out to them that page numbers and question numbers were displayed in the status bar, they all reported this could be helpful, especially when reporting issues back to office staff. In relation to the speed bar, participants did not use it during testing, even after being probed about it and having its purpose described to them. All participants did acknowledge that, with greater familiarity and use of the notebook, they might make use of the speed bar in the future.

### 9.7 Ease or difficulty in navigation through the instruments

All participants tended to ask how to navigate back through the instrument to make a correction. However once directions were given, all participants reported navigation to be fairly easy and straightforward. Some participants noted they believed navigation was easy because contextual information was displayed in the Form Pane (i.e. context of preceding and forthcoming questions).

## 10. Further testing and conclusion

Useability testing has shown that the recommended screen layout, described in this paper, was functional and has been favourably received by the participants. As a result, the new layout has been adopted for the current series of CAI instruments at the ABS.

Field tests of the current CAI instruments are also likely to lead to further suggestions for improvement, as the issues relating to screen design and layout will continue to be included as discussion topics at debriefing. Where specific screen design issues need to be explored further, the option also exists for laboratory testing to be done.

It is recognised that there are many aspects to screen design and useability and this paper has covered but some of them. The CAI team at ABS will continue to examine the issues surrounding screen layout and functionality and make further improvements as required.

## 11. Acknowledgments

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