Simple but Brucial User Interfaces in the World Wide Web: Introducing 20 Guidelines for Usable Web Form Design

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1. Introduction

Most websites use interactive online forms as the main contact point between users and website owners (e.g. companies, governmental institutions, ect.). Therefore, a proper design of such forms is crucial to allow smooth information exchange. It can be decisive on the success or failure of an online transaction. Users mostly visit a website with an intention that is related to the content of that site (e.g. purchasing an article, gathering information). Hence, they do not visit a website with the intention or goal of filling in a web form. Let us illustrate this with an online shopping example: Once users have chosen the items that they wish to buy, they want to finish their shopping as quickly, easily and safely as possible. But to successfully complete the shopping process users have to provide some personal data such as shipping address or credit card information. In the users perception, an online form may be perceived as a hurdle. There is evidence that unusable web forms lead to customers aborting the transaction prematurely, resulting in loss of profit (Wroblewski, 2008). To prevent such dropouts from the buying process, a revision of the form is necessary. A successful redesign of a suboptimal online form may result in an increased completion rate in the range of 10%-40% (Wroblewski, 2008). For instance, the eBay User Experience and Design Group reported that a redesign of the eBay registration form made a significant contribution to eBay's business and user success (Herman, 2004).

The World Wide Web contains a wide range of different web form design solutions for similar interface aspects and problems. Exemplarily, Figure 1 shows four different ways of implementing and communicating format restrictions to users. It can be seen, that even website developers of major companies choose very different ways to solve the same problems. This raises several important questions: Are these solutions equivalent or are there ways that lead to superior web forms in terms of an enhanced usability? Would it not be advantageous to use similar solutions for similar problems, so that predictability for users can be increased? Are there different solutions that may be used depending on the developer's intentions?

In the last years a growing body of research and guidelines have been published on how to make online forms more usable. They answer to a certain extent the questions mentioned

(1) Form using no visual format restriction. Users are not informed in advance about the password policy (amazon.com).

(2) Form using format example: Users are shown that the Yahoo ID equals the e-mail adress (yahoo.com)

(3) Form using format specification. Users are told that the minimum lenght for the password is 8 characters (google.com).

(4) Form using format example and specification. Users are informed about the password policy in detail (ebay.com).

Fig. 1. Examples of various ways to communicate format restrictions to users.

above. Some publications are based on empirical data; others instead have been gained from experience and best practice of usability experts (eg. Beaumont et al., 2002; Wroblewski, 2008).

This chapter reviews the different topics, studies and publications. Based on these findings a set of 20 practical guidelines are derived, that can be used to develop usable web forms or improve the usability of existing web forms.

2. Theoretical background

In the last decade, many aspects of online forms have been explored. To simplify the overview, the different topics are classified as follows: (1) form content, (2) form layout, (3) input types, (4), error handling and (5) form submission. This section provides a brief summary of the most important results within these areas.

2.1 Form content

The way an online form should be designed heavily depends on the information asked from the users. This information has consequences for the entire form layout. On this note, to facilitate data input, Beaumont et al. (2002) suggest keeping an intuitive order of the questions, e.g., first ask for the name, then the address and, at the end, for the telephone number. A basic concept of user-centered design is to map the natural environment, which is already familiar to users, as closely as possible to the virtual one (Garrett, 2002). If users are familiar with a concept in real life, it is probable that they will also understand this concept if it is applied to the online environment. In the case of web forms, this may for example be achieved by using a layout analogous to paper forms.

In addition, reflecting on which information is essential and which is dispensable, is crucial. To keep forms simple and fast, Beaumont et al. (2002) recommend asking only those questions that really need to be answered, e.g., the shipping address in the case of an online shop. Other "nice-to-know" questions only annoy users and require more time to fill in the form. However, such "nice-to-know" questions may provide insight into the user population and may be helpful for marketing purposes. Users must be enabled to distinguish between required and optional fields at any time (Linderman & Fried, 2004; Wilhelm & Rehmann, 2006). Nowadays, this is often realized through the use of asterisks. Pauwels et al. (2009) examined whether highlighting required fields by color coding leads to faster completion time compared to an asterisk next to required fields. Participants were faster, made fewer errors, and were more satisfied when the required fields were highlighted in color. Tullis and Pons (1997) found that people were fastest at filling in required fields when the required and optional fields were separated from each other.

2.2 Form layout

Online forms consist mainly of labels and input fields of varying design (e.g. free text entry, radio buttons, check boxes, etc.). These elements can be placed in different variations. Penzo (2006) examined the position of labels relative to the input field in a study using eye-tracking. He compared left-, right- and top-aligned labels and came to the conclusion that with left-aligned labels people needed nearly twice as long to complete the form as with right-aligned labels. Additionally, the number of fixations needed with right-aligned labels was halved. The fastest performance however was reached with top-aligned labels, which required only one fixation to capture both the label and the input field at the same time. As a result of this study, Wroblewski (2008) recommends using left-aligned labels for unfamiliar data where one wants users to slow down and consider their answers. On the other hand, if the designer wants users to complete the form as quickly as possible, top-aligned labels are recommended. Another advantage of top-aligned labels is that label length does not influence placement of the input fields.

In terms of form layouts, Robinson (2003) states that a form should not be divided into more than one column. A row should only be used to answer one question. Concerning the length of input fields, Wroblewski (2008) recommends matching the length of the field to the length of the expected answer. This provides a clue or affordance to users as to what kind of answer is expected from them. Christian et al. (2007) examined the date entry with two separated text fields for month and year. Participants gave more answers in the expected format (two characters for the month and four for the year) if the field for the month was half the size of the one for the year. In another study by Couper et al. (2001), people gave more incorrect answers if the size of the input field did not fit the length of the expected input.

2.3 Input types

Another question in web form design relates to which input type (user interface elements) should be used. Miller and Jarret (2001) recommend not using too many different input types in one form as this can confuse users. As mentioned, Beaumont et al. (2002) recommend using textboxes as often as possible as they are preferred by users. However, if the number of possible answers has to be restricted, radio buttons, checkboxes or drop-down menus can be used (Linderman & Fried, 2004). These input types are also recommended to avoid errors, prevent users from entering unavailable options and simplify the decision process. Radio buttons and drop-down menus are used for choosing only one option (single choice); with checkboxes, users can select as many options as they like. For multiple selection, there is also the list-box element, which saves screen real estate. Bargas-Avila et al. (2009) conducted a study that compared these two interface elements (checkboxes and list boxes). Results showed that participants in general were faster and more satisfied using checkboxes. Concerning the use of drop-down menus and radio buttons, Miller and Jarret (2001) see the advantage of radio buttons in the fact that all options are visible at once, whereas the advantage of drop-down menus lies in the saving of screen real estate. With the help of the Keystroke-Level Model (Card et al., 1980), it can be theoretically calculated that interaction with a drop-down menu takes longer than interaction with radio buttons, mainly because of the additional click needed to open the drop-down menu. In an empirical study, Healey (2007) found that on the single-question level, radio buttons were faster to choose from than drop-down menus, but the use of drop-down menus instead of radio buttons did not affect the overall time to fill in the whole questionnaire. Hogg and Masztal (2001) could not find any differences in the time needed to select answers between radio buttons and drop-down menus. Heerwegh and Loosveldt (2002) found that people needed significantly more time to select options from drop-down menus than from radio buttons, but these findings could not be replicated in a second study. Concerning the drop-out rate, no differences between radio buttons and drop-down menus could be found (Healey, 2007; Heerwegh & Loosveldt, 2002; Hogg & Masztal, 2001). According to Miller and Jarret (2001), radio buttons should be used when two to four options are available; with more than four options they recommend using drop-down menus. When drop-down menus are used, Beaumont et al. (2002) suggest arranging the options in an order with which the user is already familiar (e.g. for weekdays, the sequence Monday, Tuesday, etc.). Where there is no intuitive sequence, an alphabetical order should be considered.

A frequent issue concerning data input is the design of date entries. With date entries, it is important that they are entered in the expected format to avoid confusion between month and day. There are many different ways of designing input fields for date entries and many possibilities for how they have to be completed. Christian et al. (2007) examined date entries where the month and year field consisted of two separate text boxes. Their study revealed that 92.9%-95.8% provided their answer in the correct format when symbols (MM and YYYY) were used to state the restrictions. Positioning the date instructions to the right of the year field led to fewer correct answers. Linderman and Fried (2004) suggest using drop-down menus to ensure that no invalid dates are entered. Bargas-Avila et al. (2009) compared six different versions to design input fields for date entries. The results revealed that using a drop-down menu is best when format errors must be avoided, whereas using only one input field and placing the format requirements left or inside the text box led to faster completion time. Concerning the formatting of other answers, accepting entries in every

format is recommended, as long as this does not cause ambiguity (Linderman & Fried, 2004; Myers, 2006). This prevents users from having to figure out which format is required and avoids unnecessary error messages.

2.4 Error handling

It is important to guide users as quickly and error-free as possible through forms. Errors should be avoided from the start by explaining restrictions in advance. Field format restrictions are often used in online forms to impose certain formatting and content rules on users such as minimum password length or date entry format. Bargas-Avila et al. (2009) examined *if* and *how* format restrictions for fields in online forms should be communicated to users. Results show that providing format restrictions to users in advance leads to significantly fewer errors and trials. The most efficient way to communicate field format restrictions is by stating the imposed rule (format specification) but without providing an example, because this method leads to a low error rate and uses minimal information.

Often, errors cannot be avoided; in this case, it is important to help users to recover from them as quickly and easily as possible. To assure usable error messages in the web, Nielsen (2001) and Linderman and Fried (2004) state that an error message must be written in a familiar language and clearly state what the error is and how it can be corrected. The error must be noticeable at a glance, using color, icons and text to highlight the problem area. Nielsen (2001) also advises never deleting the completed fields after an error has occurred, as this can be very frustrating for users. Bargas-Avila et al. (2007) compared six different ways of presenting an error message, including inline validation, pop-up windows and embedded error messages. People made fewer consecutive errors when error messages appeared embedded in the form next to the corresponding input fields or one by one in a pop-up window. This was only the case if the error messages showed up at the end after clicking the send button. If the error messages appeared at the moment the erroneous field was left (inline validation), the participants made significantly more errors completing the form. They simply ignored or, in the case of pop-up windows, even clicked away the appearing error messages without reading them.

2.5 Form submission

At the end of the fill-in process, the form has to be submitted. This is usually realized through a button with an action label. Linderman and Fried (2004) suggest disabling the submit button as soon as it has been clicked to avoid repeated submissions due to long loading time. Some web forms also offer a reset or cancel button in addition to the submit button. Many experts recommend eliminating such a button as it can be clicked by accident and does not provide any real additional value (Linderman & Fried, 2004; Robinson, 2003; Wroblewski, 2008). After a successful transaction, the company should confirm the receipt of the user's data by e-mail (Linderman & Fried, 2004; Wroblewski, 2008).

3. Twenty guidelines for usable web form design

Based on the summarized theoretical and empirical background, 20 guidelines for usable web form design are derived. The main goal of these guidelines is to support website developers in designing usable web forms. The following sections summarize these guidelines, using the same structure as in the theoretical background (see section 2).

3.1 Form content
Concerning form content, these guidelines are suggested:

Guideline 1: Let people provide answers in a format that they are familiar with from common situations and keep questions in an intuitive sequence (see Beaumont et al., 2002; Card et al., 1980; Miller & Jarret, 2001).

Guideline 2: If the answer is unambiguous, allow answers in any format (see Linderman & Fried, 2004).

Guideline 3: Keep the form as short and simple as possible and do not ask for unnecessary input (see Beaumont et al., 2002; Wroblewski, 2008).

Guideline 4: If possible and reasonable, separate required from optional fields and use color and asterisk to mark required fields (see Tullis & Pons, 1997; Pauwels et al., 2009).

3.2 Form layout
To ensure optimal form layout, the following guidelines are suggested:

Guideline 5: To enable people to fill in a form as fast as possible, place the labels above the corresponding input fields (see Penzo, 2006).

Guideline 6: Do not separate a form into more than one column and only ask one question per row (see Robinson, 2003).

Guideline 7: Match the size of the input fields to the expected length of the answer (see Christian et al., 2007; Couper et al., 2001; Wroblewski, 2008).

3.3 Input types
Regarding answer input types, the following guidelines are proposed:

Guideline 8: Use checkboxes, radio buttons or drop-down menus to restrict the number of options and for entries that can easily be mistyped. Also use them if it is not clear to users in advance what kind of answer is expected from them (see Linderman & Fried, 2004).

Guideline 9: Use checkboxes instead of list boxes for multiple selection items (see Bargas-Avila et al., 2009).

Guideline 10: For up to four options, use radio buttons; when more than four options are required, use a drop-down menu to save screen real estate (see Healey, 2007; Heerwegh and Loosveldt, 2002; Miller & Jarret, 2001).

Guideline 11: Order options in an intuitive sequence (e.g., weekdays in the sequence Monday, Tuesday, etc.). If no meaningful sequence is possible, order them alphabetically (see Beaumont et al., 2002).

Guideline 12: For date entries use a drop-down menu when it is crucial to avoid format errors. Use only one input field and place the format requirements with symbols (MM, YYYY) left or inside the text box to achieve faster completion time (see Christian et al., 2007; Bargas-Avila et al., 2009).

3.4 Error handling
Regarding error handling, the following guidelines are proposed:

Guideline 13: If answers are required in a specific format, state this in advance communicating the imposed rule (format specification) without an additional example (see Bargas-Avila et al., 2009).

Guideline 14: Error messages should be polite and explain to the user in familiar language that a mistake has occurred. Eventually the error message should apologize for the mistake

and it should clearly describe what the mistake is and how it can be corrected (see Linderman & Fried, 2004; Nielsen, 2001; Tzeng, 2004).

Guideline 15: After an error occurred, never clear the already completed fields (see Nielsen, 2001).

Guideline 16: Always show error messages after the form has been filled and sent. Show them all together embedded in the form (see Bargas-Avila et al., 2007).

Guideline 17: Error messages must be noticeable at a glance, using color, icons and text to highlight the problem area and must be written in a familiar language, explaining what the error is and how it can be corrected (see Linderman & Fried, 2004).

3.5 Form submission

To ensure optimal form submission, these guidelines are suggested:

Guideline 18: Disable the submit button as soon as it has been clicked to avoid multiple submissions (see Linderman & Fried, 2004).

Guideline 19: After the form has been sent, show a confirmation site, which expresses thanks for the submission and states what will happen next. Send a similar confirmation by e-mail (see Linderman & Fried, 2004).

Guideline 20: Do not provide reset buttons, as they can be clicked by accident. If used anyway, make them visually distinctive from submit buttons and place them left-aligned with the cancel button on the right of the submit button (see Linderman & Fried, 2004; Robinson, 2003; Wroblewski, 2008).

3.6 Overview of the guideline's empirical foundation

Not all guidelines are supported by empirical data. Some are derived by experts from best practice and experience. Table 1 provides an overview of the 20 guidelines with their corresponding foundation.

4. Discussion

Twenty guidelines for usable web form design have been presented. This compilation of guidelines enables an easier overview of important aspects that have to be considered when designing forms. Many guidelines already exist, scattered about empirical and practical studies and reports. This paper provides a comprehensive and structured summary of applicable design guidelines, which are highly relevant not only for research but also for practitioners. Applying only few of these guidelines may already have a major impact on usability and economical benefits.

Future research should examine to what extend the overall application of these guidelines improves usability, shortens form completion time, prevents errors, and enhances user satisfaction. Further, it should be investigated whether the postulated guidelines lead to higher completion rates of web forms. It remains to be seen if the catalog is complete, or if there are important aspects that are currently missing.

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Guideline	Based on	Supported by empirical data
1	Let people provide answers in a format that they are familiar with from common situations and keep questions in an intuitive sequence.	No
2	If the answer is unambiguous, allow answers in any format.	No
3	Keep the form as short and simple as possible and do not ask for unnecessary input.	No
4	If possible and reasonable, separate required from optional fields and use color and asterisk to mark required fields.	Yes
5	To enable people to fill in a form as fast as possible, place the labels above the corresponding input fields.	Yes
6	Do not separate a form into more than one column and only ask one question per row.	No
7	Match the size of the input fields to the expected length of the answer.	Yes
8	Use checkboxes, radio buttons or drop-down menus to restrict the number of options and for entries that can easily be mistyped. Also use them if it is not clear to users in advance what kind of answer is expected from them.	No
9	Use checkboxes instead of list boxes for multiple selection items.	Yes
10	For up to four options, use radio buttons; when more than four options are required, use a drop-down menu to save screen real estate.	Yes
11	Order options in an intuitive sequence (e.g., weekdays in the sequence Monday, Tuesday, etc.). If no meaningful sequence is possible, order them alphabetically.	No

Guideline	Based on	Supported by empirical data
12	For date entries use a drop-down menu when it is crucial to avoid format errors. Use only one input field and place the format require-ments with symbols (MM, YYYY) left or inside the text box to achieve faster completion time.	Yes
13	If answers are required in a specific format, state this in advance communicating the imposed rule (format specification) without an additional example.	Yes
14	Error messages should be polite and explain to the user in familiar language that a mistake has occurred. Eventually the error message should apologize for the mistake and it should clearly describe what the mistake is and how it can be corrected.	Yes
15	After an error occurred, never clear the already completed fields.	No
16	Always show error messages after the form has been filled and sent. Show them all together embedded in the form.	Yes
17	Error messages must be noticeable at a glance, using color, icons and text to highlight the problem area and must be written in a familiar language, explaining what the error is and how it can be corrected.	No
18	Disable the submit button as soon as it has been clicked to avoid multiple submissions.	No
19	After the form has been sent, show a confirmation site, which expresses thanks for the submission and states what will happen next. Send a similar confirmation by e-mail.	No
20	Do not provide reset buttons, as they can be clicked by accident. If used anyway, make them visually distinctive from submit buttons and place them left-aligned with the cancel button on the right of the submit button.	Yes

Table 1. Overview of the 20 guidelines for usable web form design.