Form Feedback on the Web: A Comparison of Popup Alerts and In-Form Error Messages

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Abstract. The literature on form feedback mostly focuses on in-form error messages, yet popup alert messages are still prevalent on the web. This study therefore set out to identify the differences between popup alerts and in-form messages. A study involving *n* = 100 participants was designed. The results show only a small significant difference between popup alerts and in-form messages in terms of task completion time. Subjective evaluations of the two methods did not reveal any significant preference for either method.

Keywords: Error messages; in-form messages; alert boxes.

1 Introduction

The form metaphor is widely applied on the web for collecting information from users. Errors frequently occur when humans input data manually. Forms are often equipped with input validation mechanisms that provide users with feedback on their input allowing users to correct their erroneous data entries. One type of error messages is presented using popup alerts. Popup alerts emerge as new windows on top of the interface consuming its focus. The user's attention is then redirected from the interface to the popup window. After reading the message the user must close the popup before correcting the input. Another problem is that popup alerts do not provide any visual cues to which form fields that are erroneous.

An alternative to popup alerts is to display the error messages in the form. For example, the error message can be displayed at the top of the form, at the bottom, or next to the incorrect field. Two obvious advantages of displaying errors in the form are (a) visual clues to where the error has occurred can be provided and (b) the user can immediately start to correct the mistake. Erroneous form fields are often highlighted using color, such as displaying the field background or outline in red.

These inherent advantages may be the reason why most of the literature on error messages in forms are related to in-form presentations. Yet, many user interfaces in

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use today rely on popup alerts. The novel contribution of study was therefore to explore if the differences between popup alerts and in-form messages can be measured. It was hypothesized that the in-form method would be faster to use and preferred by users since there is no need to close the popup and the user is given visual cues to where the mistake is.

2 Background

These is a vast body of research into web forms and error messages. Stieger and Reips [1] explored what happens during the process of completing web-based surveys by measuring temporal and spatial mouse movement and keyboard patterns. They found connections between certain behaviors and questionnaire data quality, that is, negative effects of excessive clicking, excessive mouse movements, no responses, etc.

Husser and Fernandez [2] argued that the successful completion of online surveys is related to the form completion times. They compared the speed of entering numbers using clicking (on radio-button scales), entering numeric values and dragging. Clicking was the fasted while dragging was the slowest.

Alton et al. [3] collected empirical eye-tracking data about form instruction design. They concluded that instructions should not be hidden behind links, that instructions should be presented above the form field and not on the side of the field, and that accordion form layouts should not be used at all.

Flavián, Gurrea and Orús [4] explored the effect of layout on impression of usability and quality of information in context of product presentations. They explored both a list layout versus a grid layout as well as paragraph versus schema. The results show that users perceived a higher degree of usability on schema compared to paragraphs, while no significant difference was found between list and grid layouts. A different study of calendar layouts found that users with reduced cognitive function prefer lists to grid layouts [5].

Accounts have also been given on how to improve large surveys in order to increase the completion rates [6]. Firmenich et al. [7] discussed the assistance of web form augmentation. Web form augmentation involves a client that automatically changes a third part web form to better suit the user. This is typically achieved with JavaScript by modifying the DOM structure in the html-documents.

Recabarren and Nussbaum [8] argue that web forms could be adapted to suit different cultures. Based on Gert Hofstede's framework for comparing cultures they correlated web behavior patterns with Hofstede's cultural dimensions. They found that the number of help requests correlated negatively with a high degree of individualism. The number of help-request correlated positively with the level of uncertainty avoidance. Next, the number of errors made after soliciting help with a field was also higher with higher levels of uncertainty avoidance. Finally, the number of help-requests after making an error correlated negatively with power distance.

Design of forms that prevents errors is a preferable strategy over focusing on the error mechanisms. Often web forms require textual input and autocomplete functionality has been shown to be beneficial to dyslexic users [9].

In order to reduce copying errors during manual input of paper invoices in online banking [10] a mnemonic aid using words has been proposed to overcome the challenges of copying long digit sequences. Cruz-Benito et al. [11] addressed how the success rate of questionnaire completion could be improved by tailoring the questionnaire to the characteristics of the user by the means of machine learning. An alternative to filling in forms and avoiding issues of errors altogether is the use of digital information transfer for instance by the means of QR codes [12] or RFID [13].

Forms are also prevalent on self-service kiosks such as the ones found in airports, train stations and local public transportation hubs. Such kiosks may have to collect certain information via forms to complete a transaction [14]. Unlike the browser that is accessed through a familiar device a kiosk is a totally unknown environment to the user imposing even more severe demands on usability and accessibility [15].

2.1 Errors

Early work by Shneiderman focused on the content of error messages [16]. Some argue for the use of format restrictions and constraints to prevent users for making mistakes [17]. In this regard it has been found that drop down menus are effective means of guiding the user [18]. Next, it has been shown that it may be better to show error messages after the user has completed the form rather than during the filling-in process [19] as users tend to be in either a form-completion-mode or problem-resolution-mode. If users are in a form-completion-mode, they tend to ignore error messages. Empirical evidence has also shown that it is more effective to highlight required fields using color rather than asterisks [20].

The results of an empirical study of error message positions involving more than 300 participants [21] suggest that the optimal placement of error messages close to the erroneous field is more effective than placing the error message on top or bottom of the form. Moreover, presenting errors on the right side of the form field is more effective than placing the message on the left side. Alsalamen and Shahin [22] addressed smartphone web-forms in Arabic specifically. They found the optimal location for error messages to be below the field. They also identified a negative correlation between screen size and form errors.

Many of the specific best practices for form construction are summarized in guidelines [23]. In a short review of web form best practices [24] the authors proposed 20 form guidelines of which four related to error messages, namely 1) that error messages should be polite, explain the problem and outline a solution, 2) already completed form fields should be automatically cleared because of a user error, 3) always show error messages after the form has been sent and 4) using visual aids to make error messages noticeable.

Many studies employ basic form experiments, but studies have also involved the use of eye-tracking methodologies [25]. Instead of probing users, Inal and Ozen-Cinar [26] conducted survey among 73 software developers. They found that developers think of both the users and themselves when designing error messages, and thus tend to include error codes in the messages. They also found that developers' error-message preferences were affected by experience. Research into popup alerts [27] have focused on security issues.

Bargas-Avila et al. [28] also measured the effectiveness of various date selection methods comparing several types of text fields, drop down menus and visual calendar widgets. The results showed that drop down menus led to fewest errors while text fields with format requirements on the left were the fastest. The same authors also compared the selection of multiple items using check boxes and list boxes [29]. Their results showed that checkboxes were faster than list boxes while the difference diminished after multiple trials.

In a study of selecting dates on smartphones [30] the authors compared four input technologies, namely textbox, divided textbox, date-picker and calendar view. Their results show that the calendar view led to the most errors and was the slowest to use, while textbox was the fastest with fewest errors. User preferred the divided textbox.

Deniz and Durdu [31] investigated the effectiveness of several smartphone form controls as the mobile context is rather different from a desktop context. They found that buttons were faster with fewer items and the spinner was the fastest for larger number of items. Radio buttons were found to be the most effective for non-mutually exclusive tasks. In a similar study [32] they found that text fields were slower and associated with more errors while radio buttons were the fastest causing no errors. Input of time on smartphones have also been addressed [33].

Most of the studies identified addressed in-form error messages. It could be that this is due to a general notion that in-form messages are preferable over popup alerts. Yet, alert boxes are still prevalent on the web. This study thus set out to empirically compare alert boxes and in-form error messages in terms of task completion times.

3 Method

3.1 Experimental design

A between-groups experimental design was chosen with task completion time as dependent variable and feedback type as independent variable. The independent variable had two levels, namely popup alerts and in-form feedback. A between-subjects experiment was chosen to exploit the surprise element of the task.

3.2 Participants

A total of 100 participants was recruited for the experiment of which 16 were female and 84 were male. Of these, 13 participants were teenagers, 78 participants were in their 20s, 8 were in their 30s and one was between 50-60 years of age. All the participants were Norwegian students at the authors' institution.

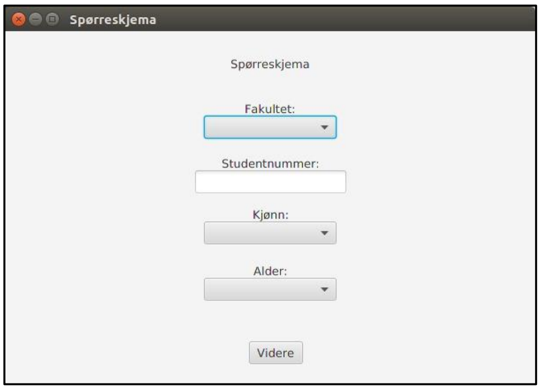

Fig. 1. The Form (in Norwegian).

3.3 Task

To investigate the effect of the two types of feedback on the task completion times a simple task was designed where the participants had to fill inn information about themselves in a form with four fields in addition to a submit button (see Fig. 1). The form asked about their faculty (drop-down menu), student number (text field), their gender (drop down menu) and their age range (drop down menu).

The student number was the focus of this experiment. This number comprises six digits and can be written with or without an *s* (for student) as prefix. Whichever way the participants wrote down this number it would be flagged as a mistake. That is, students who wrote the number with the *s*-prefix were asked to correct the error and write the number without the *s*, and the participants who wrote the student number without the *s*-prefix were asked to correct the input and add the *s*-prefix for the number to be correct.

Some of the participants were given feedback by the means of a popup alert (see Fig. 2), while the other participants were given textual feedback using a red error message next to submit button with the field highlighted in red (see Fig. 3). The type of feedback was assigned according to the last digit of the student numbers. Even student numbers were presented with popup alerts and odd student numbers were presented with in-form textual error messages. This resulted in 52 alert box cases (52%) and 48 in-form message cases (48%). Each task was completed once the participant had corrected the student input number. The experimental platform was implemented in Java.

3.4 Procedure

The experiment was conducted individually in a quiet room with three of the experiments present. Each experiment took approximately 2 minutes. After the task the participants were asked to indicate their satisfaction of dissatisfaction with the feedback on a 5-item Likert scale where 1 indicates dislike, 3 neutral and 5 like.

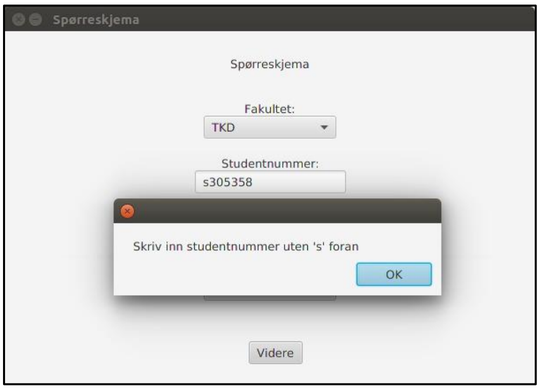

Fig. 2. Popup alert (in Norwegian).

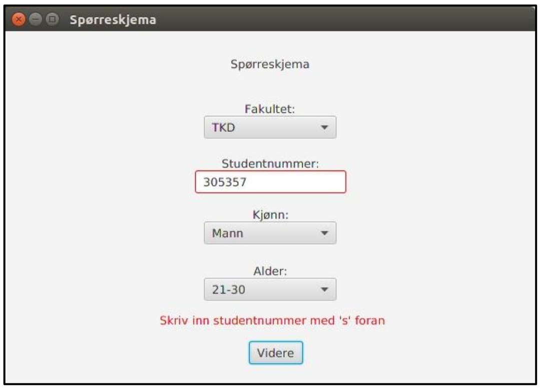

Fig. 3. In-form textual feedback (in Norwegian).

These subjective evaluations were collected from all apart from 8 participants (48 responses for alert box and 44 for in-form messages). The time to complete the task was recorded by the application. The observations were analyzed using JASP 0.8.6.0. The experiment was conducted during the autumn of 2017 before the introduction of the General Data Protection Regulation (GDPR).

4 Results

Fig. 4 shows the results of the experiment. The completion times were marginally shorter in terms of seconds (s) with the in-form messages (M = 7.69, SD = 3.98) than with the alert box (M = 8.70, SD = 4.25). That is the in-form messages took approximately one second less than alert boxes. A Mann-Whitney U-test shows that the completion times for the in-form messages were significantly faster than those for alert boxes (U = 1502, p = .040). A non-parametric test was chosen as a Shapiro-Wilk test revealed that the alert box measurements were not normally distributed.

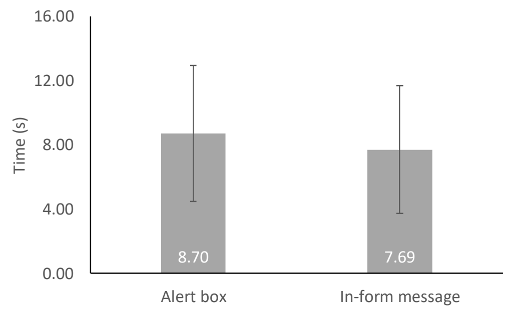

Fig. 4. Results of the experiment. Error bars show standard deviation (SD).

Also, the alert box observations are associated with larger spreads than the in-form error messages. This signals that the participants have a more consistent response to the in-form error messages compared to popups.

The subjective responses do not reveal a significant preference for in-form messages over alert boxes and vice versa (U = 922.0, p = .279), although the mean scores for the in-form feedback (M = 3.7, SD = 1.1) is marginally move favorable compared to alert boxes (M = 3.4, SD = 1.2). Moreover, there were no significant correlations between actual performance and subjective assessments ($r_s(92) = -.053$, p = .616).

5 Discussion

The results do support the hypothesis that in-form feedback leads to faster completion times than popup alerts, however, the difference is small. One explanation for this small difference could be that the form was relatively simple with only four fields. With only four fields is relatively easy to associate the alert message with the student number field. One may speculate that the difference may grow larger with longer forms as the scan time is related to the number of scanned items.

Time taken to close the popup alert is an absolute penalty which is not associated with the in-form messages. The one second mean difference could perhaps be explained by the popup alert closing operation. Next, the operations associated with making the actual correction in the form field are similar for the two methods and should take the same amount of time. The large variation in response time using the popup alerts is therefore most likely associated with cognitive load involved in determining the association between the popup message and which form field it is referring to. Hence, the larger variation may reflect a large diversity in either skills or strategies for performing this mapping. In comparison, to identify which field item that needs correction with in-form feedback is reduced to a simple visual search task where the user spots the red message.

It is also surprising that the subjective evaluations were not more differentiated. Although there was a non-significant higher mean score for the in-form messages, the mean score difference was only 0.3 points. One would perhaps have expected the in-form feedback to receive a higher mean score and the popup alert to exhibit a lower mean score. Perhaps the alert box is not as annoying as is often believed? One may speculate that an overall neutral score could be that tasks involving errors and corrections are somewhat negatively perceived.

5.1 Limitations

One possible shortcoming of this study is the specific cohort comprising only students as students may be more computer literate than other groups of people. Clearly, the task required knowledge of, and experience with, the student number notation. If the experiment had been designed for a wider cohort one may have gotten different results.

Another potential limitation is the simplicity of the task. Each participant only had to correct only one error. One may speculate whether a more complex form would have triggered a higher cognitive load and more negative perceptions. Instead, if the participants were asked to correct multiple errors one may speculate that the frustration with the popup alert may have been magnified. Future work should therefore consider including more errors per participant. More errors could be introduced by asking the participants to change textual fields into upper case if in lower case, or vice versa, numerical input could trigger input by imposing different numeric formatting conventions, etc.

6 Conclusion

Two methods of providing feedback was investigated, namely error messages communicated via alert boxes and presented directly in the form. The results show that there is a small but significant difference in terms of task completion time using the two methods. Yet, the subjective evaluations do not reveal any significant preference for either of the two methods. It seems that alert boxes are not as disturbing as it is often believed and that either method are acceptable for simple forms.

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