A Comparison of Form Navigation with Tabbing and Pointing

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Abstract. The form is a widely used metaphor in information gathering. Users typically navigate between form elements using a keyboard or a pointing device. This study set out to empirically compare tabbing and pointing in form navigation using keyboards, mouse, and touch. A controlled experiment was conducted with 20 participants. The results show that there was no difference between the input methods for form completion, but the pointing input was significantly faster for correcting mistakes. Yet, most of the participants preferred tabbing over pointing.

Keywords: web, forms, tabbing, pointing

1 Introduction

The form metaphor is widely used in information systems to gather data as users traditionally reused their paper form experience to complete electronic forms without learning. The form metaphor seems effective even as the younger generations of users have less or no background with paper forms. The advantage of a form is that information is entered incrementally in a linear manner, and the completed parts serve as a mnemonic aid to the users after interruptions or pauses. Interactive forms can be implemented with effective error feedback mechanisms that can help users understand and successfully complete complex forms [1].

Traditional form fields are completed using text entry [2, 3], while graphical user interfaces also allow for richer sets of input methods for specific data types such as drop-down menus, date-selectors, time-pickers [4], etc. More abstract types of form input exist such as pointing cameras at QR-codes [5]. In this study we wanted to explore the movement between different form fields. Modern platforms provide several means of moving between form fields, most notably using tabbing with a keyboard-type device, or through direct pointing typically using a mouse, a touchpad or a touchscreen [4, 6]. Accessibility guidelines such as WCAG states that it should be possible to move between form fields with keyboard input, or some similar device, allowing users with reduced motor function access.

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In this study we particularly wanted to find out if it takes shorter time to tab between different form fields or by directly clicking on these fields, and what the differences between the two are during incremental form field completion, and form correction that involves larger jumps in the form. Also, we wanted to explore if users' preferences are aligned with their performance characteristics.

This paper is organized as follows. The next section reviews related work. Section 3 presents the methodology. The results are presented in Section 4 and these are discussed in Section 5. The paper is concluded in Section 6.

2 Related works

Various aspects of electronic forms have been studied in the past. Several branches of research have focused on accessibility of forms, in particular the ability to use keyboards in rich internet applications [7-11] and shortcut keys [12]. Others have compared voice-controlled interface navigation to keyboards and mouse [13-15] and the use of autocompletion for users with dyslexia [16]. Studies of general form use on small form-factor devices such as Smartphones suggest that scrolling should be replaced with other navigation mechanisms [17, 18]. Other form issues include error messages [19], speed of form completion [20], what makes respondent succeed or fail in forms [21, 22], and cultural factors [23]. Form error mechanisms has also received attention which have resulted in several explicit advice [1, 24-28].

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3 Method

3.1 Experimental design

A within-groups experiment was designed with input method as independent variable and navigation time, correction time, and perceived effectiveness as dependent variables. The input method had three levels, namely tabbing (keyboard), direct pointing (touch) and indirect pointing (mouse).

3.2 Participants

A total of 20 participants were recruited for the experiments using convenience sampling with a balance of females and males. Most of the participants (11 in total) were in their 20s, but the age range spanned from 19 to 68 (M = 31.6, SD = 13.0). None of the participants reported any reduced motor function, reduced vision [29, 30], or reduced cognition [31].

3.3 Task and materials

The participants were asked to complete simple forms comprising 16 fields. Each field was labelled with the letter of the alphabet and the participant had to write the letter of the alphabet into the corresponding field. Simply using a letter rather than a word or a sentence was intended to reduce bias caused by differences in reading abilities [32]. For one of the two questionnaires for each conduction an intentional error was inserted into the first field element which was reported once the field was submitted. The participants then had to go back and correct the mistake before resubmitting the form, using the assigned input method.

Six versions of the web form were implemented using HTML and CSS in the Norwegian language (see Fig. 1). The error logic was implemented using JavaScript. Black text on a white background was selected to ensure a high luminance contrast [33].

Fig. 1. The form used in the experiments (in Norwegian).

3.4 Equipment

Participants used their own equipment for the experiment and had to use a laptop or a desktop computer with a mouse, and a Smartphone or a tablet. For the tabbing condition task the desktop or laptop keyboard was used, while for the indirect pointing the computer mouse was used. For the direct pointing condition, the Smartphone or tablet touchscreen was used. Of the 20 participants 16 used a laptop (80%), while 4 used a stationary computer (20%). A total of 17 participants (85%) used a Smartphone, while only 3 participants used a tablet (15%).

3.5 Procedure

The experiments were conducted remotely using video/audio conference calls using Discord or FaceTime. The links to the questionnaires were sent via email. The participants were consulted individually. First, each participant was briefed about the experiment. They were asked to complete each condition in two trials, that is, a total of six trials. The participants had to assist with the time-taking, by orally indicating when they started and when they had finished. The experimenters measured the time and recorded the results.

Each session lasted 10-15 minutes. The experiment was anonymous since all observations were collected in single sessions. There was thus no need to link records across sessions [34]. Statistical analyses were conducted using JASP version 0.16.0.0 [35].

4 Results

The results show that there was a significant difference between the different input methods in terms of form completion times ($F(1.893, 35.974) = 4.9$, $p = 15.969$, $\eta^2 = 0.213$). A Greenhouse-Geisser correction was used since a Mauchly's test of sphericity indicated that the data did not satisfy the assumptions of sphericity although the effect size was very small. Post-hoc tests revealed that there was only a significant difference between tabbing and touch as tabbing was associated with a significantly shorter form completion time than touch ($p < .001$) and mouse ($p < .001$). However, the small effect size signals that this result is marginal. There were no significant differences in form completion times between mouse and touch ($p = 0.336$).

There was also a significant difference across the two sessions ($F(1, 19) = 28.306$, $p < .001$, $\eta^2 = 0.243$). As expected, the first session was associated with longer response times than the second session (see Fig. 2), but the small effect size indicates a moderate effect. No interactions between input method and session were observed.

A comparison of the times to correct the form (see Fig. 3) also revealed a significant difference ($F(1.472, 27.972) = 27.319$, $p < .001$, $\eta^2 = 0.590$) with a large effect size. Post-hoc tests revealed that tabbing was significantly slower (about 50%) than both using mouse ($p < .001$) and touch ($p < .001$). There was no significant difference in correction times for mouse and touch ($p = .990$).

In response to which input method the participants found most effective (see Fig. 4), a majority of 15 preferred tabbing (75%), while 4 participants preferred mouse (20%) and only 1 participant preferred touch (5%).

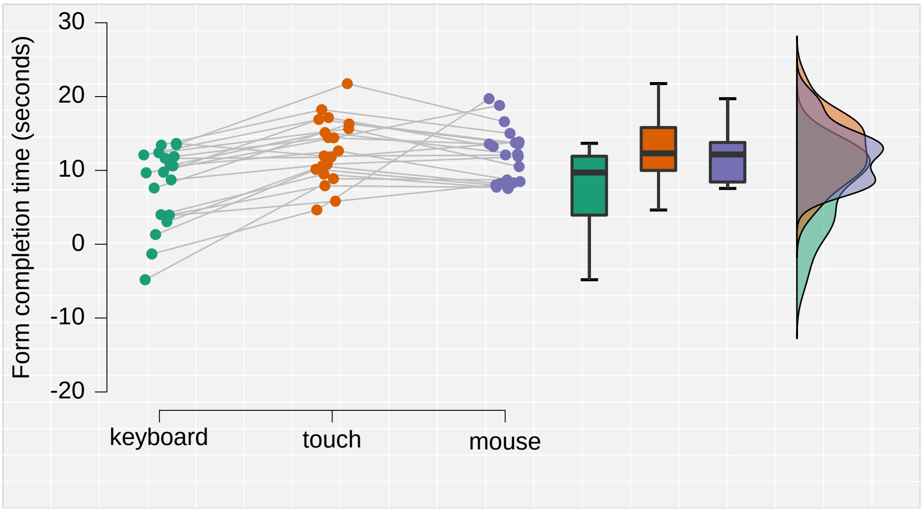

Fig. 2. Raincloud plot showing the form completion times (incremental jumps) for the second session across the three input devices.

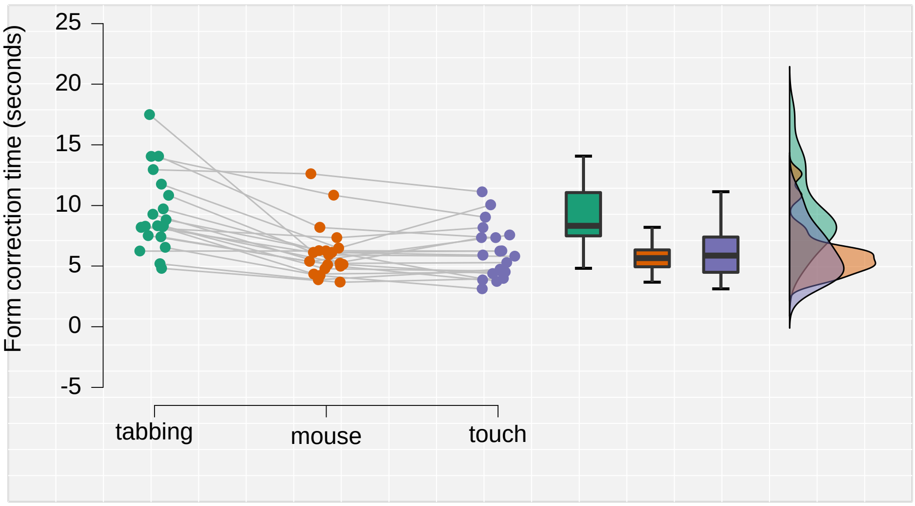

Fig. 3. Raincloud plot showing the distribution of the form correction times (large jumps) for the three input devices.

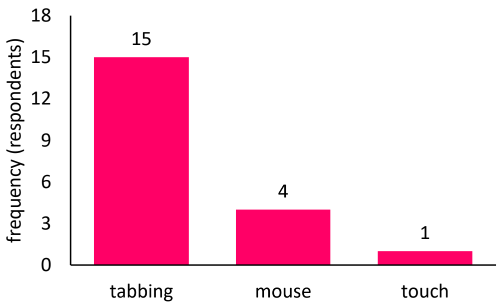

Fig. 4. Form navigation preference.

5 Discussion

The results partially confirmed our hypothesis that it is faster to navigate with tabbing than using either mouse or touch. This is probably because the user can maintain the same input modality for the (text) input and moving (tabbing) to the next field. While with mouse and touch the user will have to switch between virtual-physical text input to the pointing task of the next field. However, the effect sizes show that this difference is marginal.

However, the results showed that tabbing was significantly slower than mouse and touch for correcting errors. Clearly, the time to directly point at the field to be corrected using either mouse or tab was shorter than the repeated pressing of the tabbing key, although more conveniently available.

Although tabbing can be slower for correcting mistakes in forms the participants indicated that they preferred tabbing. This indicates that comfort and convenience of remaining in the text input mode with the tabbing key trump short task completion times of shifting from text mode to direct pointing mode.

Clearly, context of use also needs to be considered as tabbing is not a viable option in a mobile setting without a keyboard.

5.1 Limitations

This experiment had a small sample size. One should therefore be careful in generalizing from the results. The manual measurement of response times is a potential source of inaccuracy as there is a delay for the actual completion of the time, to the recorded completion time. Potential delays are introduced when participants utter that they have finished, when the experimenter perceives the utterance, and records the time.

It was also reported that it was hard to read the mobile version of the form on some devices which may have prolonged the response times. Still the correction times with touch was significantly shorter and it thus seems not to have affected the conclusion.

6 Conclusions

A controlled experiment was conducted to compare tabbing and pointing in form completion and correction. The results show that there were marginally shorter response times associated with completing a form using tabbing, while the direct pointing took a significantly shorter time during corrections. Most of the participants preferred tabbing. The results suggest the inclusion of both tabbing and pointing for navigating forms as it gives the users more flexibility.

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