A Comparison of Multiple Selections using Multiple Checkbox Selections and List Boxes

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Abstract. Website forms are commonly used for collecting information from users. Users choose one or more alternatives from a list. However, data input can be time-consuming. We therefore set out to explore which multiple selection method is the fastest and perceived most positively; the ones relying on multiple checkboxes or list boxes. An experiment with 24 participants was conducted involving 20 multiple selection tasks. The result shows that the mean response time to select three options in each question of multiple checkboxes was faster and more positively perceived than multiple list boxes. The results thus suggest that web developers should use multiple checkboxes instead of multiple list boxes.

Keywords: Multiple Checkbox, Multiple List Box, Interactive Form

1   Introduction

Many companies and governmental institutions rely on interactive online web forms as the main contact point with its customers and users. Such forms should therefore be carefully designed, as they may impact whether an online transaction succeeds or fails. Users usually visit a website with an intention, which relates to the content of that site, for example, purchasing a product, gathering information, etc. [1].

Most web forms rely on standard html elements such as text fields, radio buttons, dropdown lists, links, and checkboxes [2]. Web form design has been studied extensively within HCI, for example label placement in forms, layout optimization on web forms, the content of the web forms, types of input methods such as form controls, form submission methods, and ways of handling errors in forms [3]. Moreover, html forms comprise as a structured collection of variables which can be conveniently tied to database storage, data retrieval and data display [4].

A checkbox (check box, tick box) is a GUI widget that permits the user to make a binary choice such as a choice between one of two possible mutually exclusive options. For example, the user may have to answer 'yes' (checked) or 'no' (unchecked) on a simple yes/no question [5]. It can make a checkbox in the dropdown list that can pull down or hide options.

A list box is a graphical control element that allows the user to select one or more options from a list contained within a static, multiple-line text box. The user clicks to

select an option inside the box. When mouse clicks are made in combination with Shift or Ctrl to make multiple selections (or unselect) [6].

Both multiple checkbox selections in the dropdown and multiple list box selections can be used in web form. This study set out to explore the differences between the two in terms of task completion time and perceived preference.

2   Related Work

Web forms are the primary medium for user input on the web and are used for a variety of reasons, including registration, e-commerce sales, and security purposes. Sometimes, the process of completing these web forms can be complex [7]. A free-form query mechanism has been proposed where vocabulary is restricted to the keywords commonly used in the grid domain with a tailored matching algorithm [8].

Sometimes web forms have reduced user experience and are inefficient due to page refresh each time the form is submitted. Form validations on both the client-side and server-side may be triggered unnecessarily. It is therefore recommended that web forms should employ more responsive designs using interactive technology such as Ajax [9].

Studies of historical data have revealed how users have made use of regular expressions over time on various websites. Although regular expressions are increasingly being used, their use is highly repetitive; on the most popular websites, only 4% of the regular expressions were unique [10]. Form auto-complete mechanisms can be achieved by exploring the relationship between user inputs. Auto complete may help reduce the prevalence of repeatedly entering the same information by reusing the user's previous inputs [11].

Dropdown menus, which are often used on web page to select items, can also be problematic. Designers use dropdown menus to make better use of web page real-estate. Dropdown menus only allow the available options to be selected, and users are unable to input their own alternatives as with text fields [12].

3   Method

A within-groups experiment was designed comprising one independent variable and three dependent variables. The independent variable input type had two levels, namely multiple checkbox selections in the dropdown and multiple list box selections. The time to select the answers, success rate, and subjective preference scores were dependent variables. A total of 24 participants volunteered to complete the experiments. As the study was conducted during the COVID-19 pandemic the participants were acquired through convenience sampling. Experiments were conducted remotely.

Dropdown multiple checkbox selections (see Fig. 1) and multiple list box selections (see Fig. 2) were implemented using HTML5, CSS3, jQuery, and data were collected using a MySQL database. Response time measurements were implemented using JavaScript. The tasks comprised making three selections. For example, if shown pink, gray, red means participants selected pink, gray, and red to get 1 point correct, 0 points otherwise. The tasks had to be completed without breaks. It took several minutes to

complete the 20 tasks, comprising 10 multiple checkbox tasks and 10 multiple list box tasks. Moreover, each task had 12 options. Participants were instructed to use either a notebook or a desktop computer. Smartphones and tablet were not allowed to keep the independent variable constant, as touch interaction is quite different to keyboard and mouse interaction. Participation was anonymous as the experiment was conducted in a single session [13].
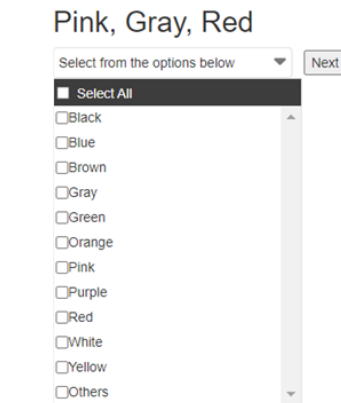

Fig. 1. Dropdown multiple checkbox selection

The dropdown menu had 12 options (see Fig. 1). One point is gained if only "Pink, Gray, Red" are selected. The users click on "Next" to go to the next task. All options were selected when clicking "Select All", and unselected if "Select All" was clicked again. It defaulted to hide options. However, they were shown when the arrow was clicked.

The multiple list box selection had 12 options (see Fig. 2). Options were moved from left to the right list box when the user selected one or more items and clicked on the right double arrow. Ctrl+click was used to select multiple options. Moreover, a double click on a option would move it to the opposite list box. The "Next" buttons were used for moving to the next task.

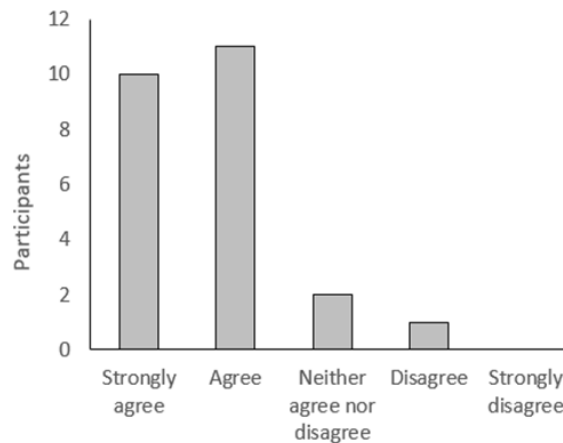**Fig. 2.** Multiple list box selection. Selected items appear on the right.

The last question asked participants to voice their subjective preference by responding to "Is it better to use multiple checkbox selections in the dropdown than multiple list box selections?". Participants responded using a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree).

Table 1. Mean and standard deviation (SD) of the multiple checkbox and multiple list box

	Multiple checkbox	Multiple List box
Mean response time (s)	9.7	10. 7
Std. Deviation response time (s)	2.5	2.2
Success rate (%)	98%	96%

4 Result

Descriptive statistics show that multiple checkboxes yielded both shorter response time and higher success rate than multiple list boxes (see Table 1). A t-test reveals that the response time differences were statistically significant ($t(23) = 2.811$, $p = .01$). A Shapiro-Wilks test confirmed that the observation distribution did not deviate from normality.

Fig. 3. Distribution of responses to the subjective preference question.

The responses to the question about whether multiple checkbox selections in the dropdown is preferable over multiple list boxes revealed a clear agreement with a preference for multiple checkbox selection ($M = 4.25$). None of the participants strongly disagreed and only one participant disagreed, while only 2 participants responded neutrally.

5 Discussion

There were differences in response time between the two input types. The hypothesis that multiple checkboxes are more effective than multiple list boxes was supported. Most of the participants managed to select the correct options. They had to click four

times with the multiple checkboxes using the dropdown menu; first one clicks to show the dropdown, then three clicks are needed to select the three options.

The participants had varying backgrounds in terms of age, gender, and occupation. Most of the participants did not know, or find out, that it was possible to double click in multiple list boxes. Several participants clicked to select the option, one by one, and then clicked on the triangular arrow (resulting in six clicks to make three selections as opposed to three double clicks). Obviously, the six clicks took longer than four clicks. If they had known about the possibility of double clicking, their response times might have been comparable to, or shorter than, what was observed with multiple checkboxes.

Several participants did not read the instruction and chose their preferred options instead of the instructed answer. One participant thought the task was to click as many times as possible without making selections. Some had never used multiple list boxes before, and they did not understand how it should be used. We did not record the extent to which the controls were correctly used. In some instances, participants only clicked on an option without moving it to the right (only the first step of the two-step process).

6 Conclusion

This study explored the differences between drop down menus and list boxes for making multiple selections. An experiment with the 24 participants was conducted to assess differences between the two input mechanisms in terms of task completion time and subjective preference. The results showed that the multiple checkbox approach led to a significantly shorter response time. This input mechanism was also preferred by the participants. The results also show that established conventions such as holding the control button while clicking is not universally known and used by all computer users.

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