Do People Tend to Select a Delayed Item?

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Abstract. Dark patterns that lead users to unintentionally harmful behaviors are often used in e-commerce and social media, and consumer troubles are frequent. Dark patterns are also seen in choice situations, where some attempt to induce the user's behavior by making specific options prominent. Focusing on user interfaces that seem fair at first glance, but induce users to make a choice, we investigated the effect of delayed display of options for inducing users to make a choice. Specifically, we conducted a crowdsourcing experiment based on the hypothesis that *when only one choice is delayed, the delayed choice is more likely to be selected.* The experimental results showed no tendency for the delayed option to be chosen more often overall. However, we found that the effect of the delayed display of alternatives on choice varied from person to person. Specifically, it was suggested that a delayed display of the option in the upper left corner of the screen with a delay time of 0.1 seconds for early choosers and a delayed display of the choice in the center of the screen with a delay time of 0.2 seconds for late choosers might induce their choice behavior.

Keywords: Dark Patterns, Delay, UI, Selection Induction, Pop-out.

1 Introduction

It is now possible to collect and disseminate information, make purchases, make reservations, and do many other things on the Web. On the other hand, a problem called dark patterns has emerged [1]. Dark patterns refer to user interface designs that lead users to unintended behaviors. They are often seen, especially in mail-order sites and reservation sites. For example, a message that a product the user is browsing is almost out of stock and a countdown timer that tells the user how much time is left on a sale are among the dark patterns that use scarcity bias to encourage the purchase of a product.

Making certain choices stand out is a type of dark patterns. For such a case, it is easy for users to notice that it induces their choice behavior. However, there are cases in which selection behavior is unconsciously induced by a selection interface that does not appear to be guiding selection at first glance. For example, Yokoyama et al. [2] found that presenting a progress bar that guides the gaze before offering a choice biases the tendency to choose.

Here, we focused on induced visual interference [3], one of the dark patterns. Inspired by the fact that images are displayed with a delay due to network or system problems, we hypothesized that *displaying only one of the multiple choices with a slight delay would induce selection behavior*. To be concrete, we expected that if only one of the six choices were displayed with a slight delay, people would be more likely to choose the one with a delay (Fig. 1). If a delayed display affects selection behavior, it can induce selection behavior by disguising a delayed display as a delay caused by a network or system.

Therefore, we conducted a large-scale crowdsourcing study of the selection behavior when only one of the six choices was displayed with a delay. The analysis of the results revealed the effect of delayed display on selection behavior.

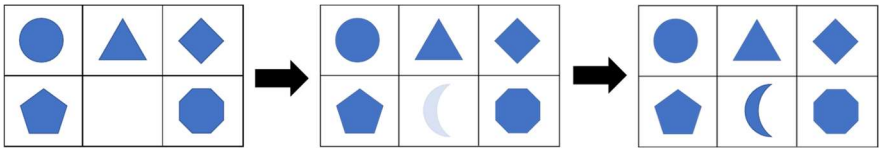

Fig. 1. Interpretation of delayed display of choices.

2 Related Work

Mathur et al. [4] developed an automated web crawler to extract dark patterns from over 11,000 shopping sites. They found 1,818 dark patterns consisting of 15 types and seven categories. They also discovered that dark patterns were more likely to appear on popular websites. Geronimo et al. [5] found that about 95% of 240 popular mobile apps contained at least one dark pattern. Gunawan et al. [6] conducted a comparative study of dark patterns in the mobile app, mobile browser, and web browser versions of 105 popular online services. They found 2,320 dark patterns across all services. They showed that the mobile app version contained slightly more dark patterns than the browser version. Luguri et al. [7] reported that dark patterns effectively induce user behavior and that users have negative feelings toward forceful dark patterns but no emotional repulsion toward mild dark patterns. In other words, dark patterns that appear unguided at first glance are more likely to be accepted by users. Many dark patterns have been discovered and reported, but studies have yet to examine dark patterns related to the timing of choice display. This paper discusses the effect of delayed display of one of the multiple options on choice behavior.

Wilson et al. discussed the relationship between the position of choices and selection behavior [8]. They investigated the selection rate for four stockings arranged horizontally and found that the selection rates were 12%, 17%, 31%, and 40% from the left, indicating the existence of a right-sided bias. On the other hand, Valenzuela et al. [9] found that the choice in the center was more likely to be selected than the choices on either side of the display. We investigate the relationship between the display position of choices and the selection rate.

There is something called ‘pop-out’ among the human visual characteristics, and research has been conducted on pop-out and choice behavior. Pop-out is an optical property in which a stimulus can be perceived immediately when only one different stimulus is present among multiple stimuli of the same type. Hosoya et al. [10] focused on pop-outs and found that they effectively induced selection in signage-type vending machines when only COLD products were sold but were not so effective when HOT and COLD products were mixed. Maljkovic et al. [11] found that anticipating what will be popped out does not affect attention and that pop-outs must be consciously addressed. A delayed display of only one of the multiple choices could also be considered a variant of pop-outs. We hypothesized that *the delayed choice is more likely to be selected when one of the six choices is delayed*. This paper aims to investigate the effect of delayed display on selection behavior.

3 Methodology

3.1 Experimental Settings

As for the appropriate number of choices, too many would increase the burden of answering. However, if there are only a few options, this might cause experiment participants to select other choices before the delayed choice is displayed. Therefore, the number of choices in this experiment was set to six.

Danziger et al. [12] showed that the more decisions a person makes, the more stressed they feel and the less likely they are to make an accurate decision. Therefore, the number of questions was set to 15 to avoid fatigue caused by decision-making.

The questions asked the experiment participants about their favorite fruits, vegetables, etc. However, such questions could bias the choice toward a particular option depending on its popularity, so we selected options with the same degree of popularity and name recognition as far as possible.

To prevent the experiment participants from becoming accustomed to the delayed display, the delayed display of the choices was only used for five of the 15 questions. Also, we randomized the position of the delayed display and the order of the questions.

Three delay durations of 0.1, 0.2, and 0.3 seconds were set for the delayed display of the choices. The delay time was randomly selected from the three delay times when the delayed display was used. By comparing the selection behavior at each delay time, we investigated whether the effect of the delayed display on the selection behavior changed depending on the delay time.

3.2 System Overview and Experimental Procedures

The experimental system was created using Vue.js, a JavaScript framework. We first asked the experiment participants to access the experimental system page via a link from a page on Yahoo! Crowdsourcing [13]. When an experiment participant accessed the experiment page, the system generated a unique 16-digit alphanumeric and lower-case ID for each participant and presented a page explaining the experiment. On the

page describing the experiment participant was asked to check the checkboxes to confirm the experimental procedure and precautions. The precautions included using Google Chrome, Safari, or Firefox browsers and not pressing the back and reload buttons. In addition, on the page explaining the experiment, participants were asked to select their gender and age from a list before starting the investigation. The experiment could only be started if all the checkboxes were checked, and the page was accessed from a PC.

The sequence of one trial is shown in Fig. 2. When the user moved to the experiment screen, a question and a button were first displayed for each question. Clicking the button below the question displayed six choices. The participant selected one answer to the question from the displayed choices and clicked on it. For each trial, we obtained the user's unique ID, gender, age, current number of trials, selected time, choice content and its display position, delayed display position, delay time, and the date and time when the trial was completed.

After 15 trials of the experiment had been completed, an experiment completion screen was displayed with a common code for the experiment participant to select on Yahoo! Crowdsourcing [13] and a unique ID was generated for each experiment participant. By returning to the crowdsourcing screen, selecting that code and entering the unique ID, the experiment was completed.

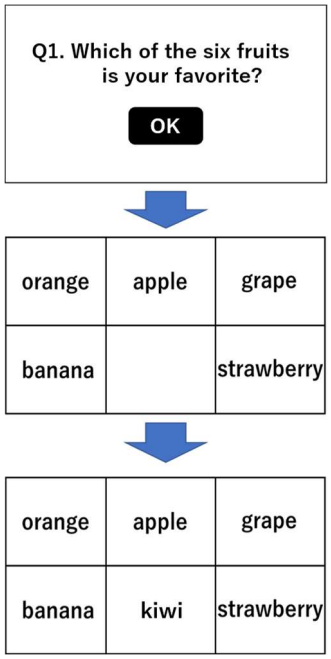

Fig. 2. An example of a delayed display of one of the choices.

4 Results

4.1 Data on Experiment Participants

The experiment was conducted twice using crowdsourcing, with 500 females and 500 males on July 7-8, 2022, and 500 females and 500 males on September 28-29, 2022. Because crowdsourcing experiments can cause some participants to respond inappropriately, we extracted inappropriate participants from the acquired data. In this experiment, problematic participants were removed by referring to the selection position, selected time, and the total number of trials. 89 participants (55 females and 34 males) responded inappropriately in the first experiment, and 101 (56 females and 45 males) responded inappropriately in the second experiment. The data from 1,810 participants (889 females and 921 males), excluding these inappropriate respondents, were included in the analysis.

4.2 Overall Results for Selection Rate of Delayed Choices and Selected Time

Since there were three delay times for the delayed display in this experiment, Table 1 shows the percentage of the delayed display selected for each delay time and the average chosen time when the delayed display was selected and not selected. The chance level of each choice was 16.67% because the number of options in this experiment was six.

Table 1 shows that for all data with delayed display, the selection rate for the delayed option was 16.92%, which is similar to the chance level. The selection rate of the delayed choice was slightly lower than the chance level when the delay time was 0.1 and 0.3 seconds. In comparison, the delayed choice was more likely to be selected when the delay time was 0.2 seconds. Regarding the selected time, when the delayed choice was chosen with a delay of 0.3 seconds, the selected time was more extended than in the other cases.

Table 1. Selection rate and selected time for delayed display alternatives for the entire body of data.

	Selectivity (%)	Average selected time (s)	
		Selected the delay target	Did not select the delay target
0.1	16.54	4.56	4.60
0.2	17.75	4.53	4.56
0.3	16.47	4.76	4.59
Average	16.92	4.61	4.58

4.3 Selected Time in Each Trial

The distribution of the selected time for each trial in the two experiments is shown in Fig. 3. We divided all data obtained in the two experiments into three groups: a group with a selected time of under three seconds (Group Short, N=7,947), a group with a selected time of over three and under five seconds (Group Middle, N=10,684), and a group with a selected time of over five seconds (Group Long, N=8,519) so that the number of data was as equal as possible.

Table 2 shows the average selected time and the selection rate of the delayed choices for each of the three data groups. Each group includes both delayed and non-delayed data.

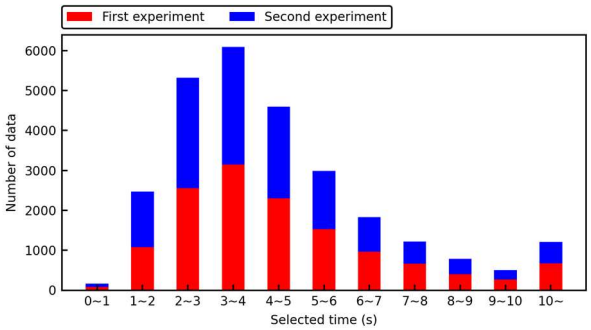

Fig. 3. Distribution of selected time in each trial.

Table 2. The amount of data and average selected time in each group, and selection rate of delayed alternatives displayed.

	Short	Middle	Long
Average selected time (s)	2.20	3.90	7.66
Selectivity (%)	17.10	16.41	17.41

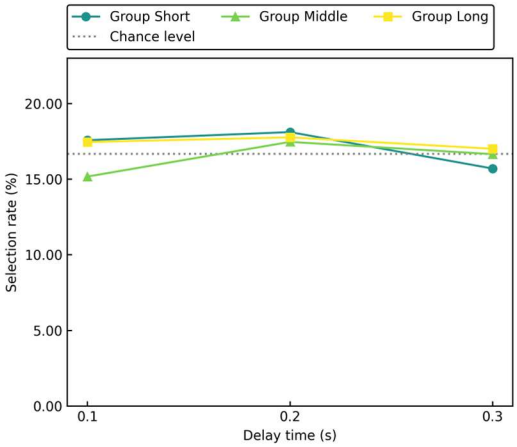

Fig. 4. Percentage of delayed choices in each group by delay time.

4.4 Percentage of Delayed Choices in Each Group

Table 2 shows that the selection rate of the delayed choice was similar to the chance level for all groups.

Next, Fig. 4 shows the selection rate of the delayed choice for each group for each delay time. When the delay time was 0.1 seconds, the delayed choice was slightly more likely to be selected in Group Short and Group Long, while the delayed choice was less likely to be chosen in Group Middle. When the delay time was 0.2 seconds, the selection rate was slightly above the chance level for all groups. When the delay time was 0.3 seconds, the selection rate of the delayed choice was slightly below the chance level for Group Short. For Group Long, the selection rate of the delayed choice stayed the same when the delay time was changed.

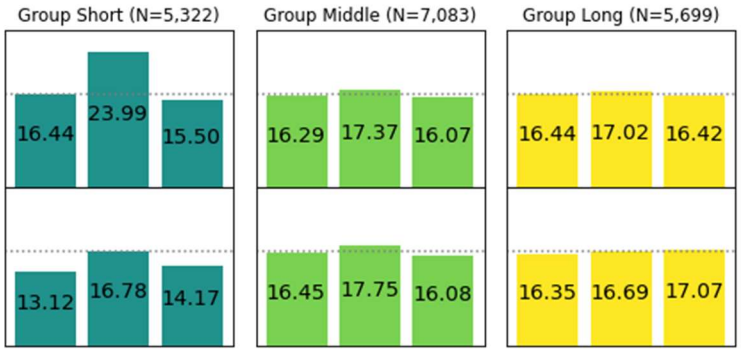

Fig. 5. Selection rate per position without delayed display.

Fig. 6. Selection rate per position with delayed display.

4.5 Relationship Between Position and Selection Rate in Each Group

As Wilson et al. [8] and Valenzuela et al. [9] pointed out, the selection's tendency depends on the choices' display position. Therefore, we also analyzed the relationship between the position of the options and the selection rate.

First, Fig. 5 shows the selection rate (%) for each position when the delayed display was not used. In Fig. 5, the selection rate is shown as a percentage of the total data without the delayed display, where 100 is the complete data without the delayed display for each group. In this experiment, three of the six choices were displayed at the top and bottom of the screen, respectively, and each bar graph corresponds to the position of the real choice. For Group Short, the top of the middle column was the most likely place to be chosen. For Group Middle and Group Long, there was almost no difference in the selection rate due to the difference in location.

Fig. 7. Selection rate per position at a delay time of 0.1 seconds.

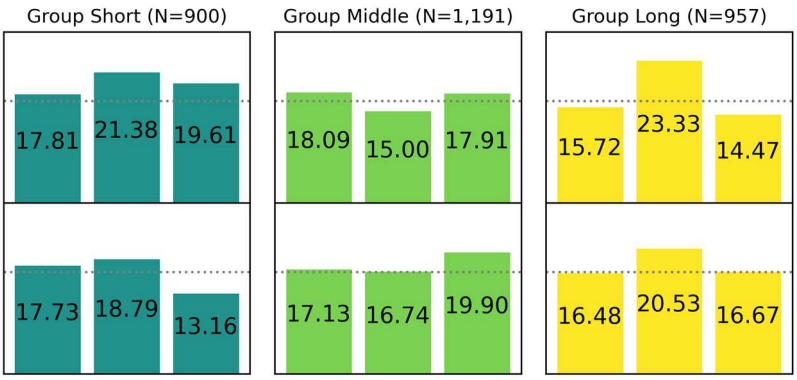

Fig. 8. Selection rate per position at a delay time of 0.2 seconds.

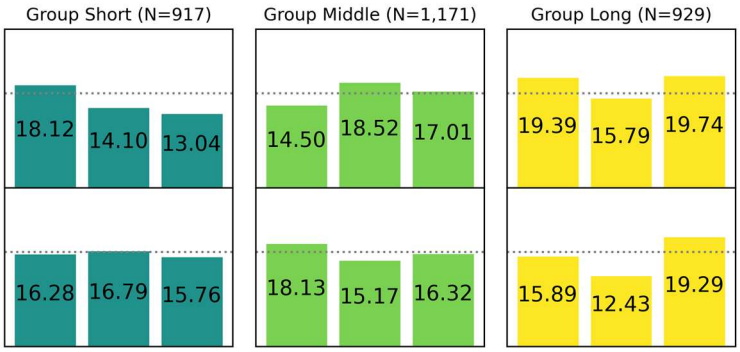

Fig. 9. Selection rate per position at a delay time of 0.3 seconds.

Next, Fig. 6 shows the percentage (%) of the delayed display selected for each position. In Fig. 6, the selection rate is shown as a percentage of the total data, with the delayed display at each position in each group. For Group Short, the delayed item was more likely to be chosen when the delayed display was on the top of the left column. For the other groups, there was no significant effect on selection.

Fig. 7 shows that when the delay time was 0.1 seconds, the delayed item was more likely to be selected when the delayed item was displayed at the top of the left column in Group Short. Still, it was less likely to be chosen at the bottom of the left column. In Group Middle, the delayed selection was less likely to be selected when the delayed selection is shown at the top of the left column. In Group Long, the delayed item was more likely to be chosen when the delayed item was displayed at the bottom of the left column but less likely to be selected at the top of the middle column.

Fig. 8 shows that when the delay time was 0.2 seconds, the delayed option was more likely to be selected when the delayed display was placed on the top of the middle column in Group Short. For Group Middle, the delayed choice was slightly more likely to be chosen when the delayed display was placed below the right column. Still, the difference between the positions was relatively small. For Group Long, the delayed choice was more likely to be chosen when the delayed choice was displayed in the middle column.

Fig. 9 shows that when the delay time was 0.3 seconds, no position was particularly likely to be selected for the selection rate of the delayed item in Group Short. The same was true for Group Middle. On the other hand, for Group Long, the delayed selection was more likely to be chosen when the delayed selection was displayed at the top of the right column. However, the delayed choice was less likely to be selected when the delayed selection was displayed at the bottom of the middle column.

5 Discussion

The overall selection rate of the delayed choice was 16.92%, which was not different from the chance level, and thus the hypothesis in this study was not supported. The results of the selection rate of the delayed choice in the three groups classified by the selected time showed no tendency to choose the delayed choice in any of the groups. These results suggest that delayed display of alternatives may increase the selection rate of delayed options or, conversely, may decrease it. Specifically, the selection rate increases when the delayed choice is displayed precisely when the user sees the delayed choice. On the other hand, if the choice is not displayed when the user sees the delayed choice, the selection rate is considered low.

Next, the results of the selection rate for each position without the delayed display showed that Group Short was more likely to choose the top of the middle column. This is thought to be because the experiment participants placed a button in the center of the screen that they clicked before moving to the selection page, so they tried to select the item without moving the mouse. On the other hand, the difference in the selection rate between the positions was slight for Group Middle and Group Long. This suggests that people who take time to select compare the contents of the choices regardless of the initial mouse position at the time of the screen transition. The results of the selection rate of the delayed choice for each position for each delay time showed that the delayed choice was more likely to be selected when the top-left choice was delayed by 0.1 seconds or when the top choice in the middle column was delayed by 0.2 seconds in Group Short. When the delayed display was not performed, the group was more likely to choose the top of the middle column, suggesting that the delayed display of the top-left option by 0.1 seconds could induce selection behavior for Group Short. In Group Middle, the delayed choice was slightly more likely to be selected only when the bottom right column was delayed by 0.2 seconds. When the delay time was 0.3 seconds, the selection rate of the delayed choice was about the same as the chance level. These results suggest that the delayed display of alternatives is unlikely to affect selection behavior for Group Middle. For Group Long, the delayed choice was more likely to be chosen when the bottom left column was delayed by 0.1 seconds, and the middle column was delayed by 0.2 seconds. This difference in the position at which the delayed item was more likely to be selected might be related to eye movement. Since eye movement was not captured in this experiment, we plan to investigate this in future experiments.

6 Conclusion

In this study, based on the idea that some user interfaces seem to be fair but induce selection, we hypothesized that *when only one choice is delayed in a multiple-choice environment, the choice is more likely to be selected*. In addition, we experimented with verifying whether the delayed choice is more likely to be selected when the user selects one answer from among six choices. The experimental results did not support the hypothesis that the delayed choice was more likely to be chosen. This could be due to

a significant selection bias toward some options and a lack of removal of inappropriate experiment participants. However, it is also possible that the delayed display of only one of the choices may work as an inducement or a non-inducement and that the effects may have canceled each other out. On the other hand, it was suggested that it might be possible to induce selection by changing the delay time and the position of the delayed display according to the length of the selected time. For example, when the selection time is short, the top-left delay at 0.1 seconds may induce the user to choose the item, while a bottom left delay of 0.1 seconds and a middle delay of 0.2 seconds may induce the user to select the item when the selection time is long.

We plan to reexamine the question and the content of the choices in future experiments. In addition, we plan to conduct a face-to-face investigation using an eye tracker to obtain the eye movements of the participant in order to clarify further the effect of delayed display of choices on selection behavior.

Acknowledgement

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