Research on interactive design of multilingual e-commerce platform based on eye tracker

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Abstract. In "interactive design", designers usually rely on personal experience and understanding to work. The design interface has strong subjectivity, and it is difficult to match the intention of users. Based on the basic experiments of eye movements, this study collected and analyzed the pages of the search engine for a multilingual e-commerce platform through the indicators such as the duration of the objects being watched, the number of objects to be followed, and the sequence of objects to be looked at. After the experiment, we found that the first movement of the eyeball was still focused on the upper left corner of the page. During the browsing process, the subjects were used to the order from top to bottom and from left to right. So when we design the page, we should keep this style and respect the user's habits. After analyzing the data, we found that the simple design made a good impression on the subjects, so we should keep the simple style in the page design, avoid filling every inch of space, otherwise it will cause the burden of visual memory. The data analysis also showed that the use of controls, prompt wording, color settings and page style are consistent, which can make users easily speculate about various functions and increase the user's preference.

1. Introduction
The role of interaction design in e-commerce platform has always been greatly valued. In the traditional interaction design, designers complete the preliminary design by subjective reasoning, summarize the existing problems through user experience, questionnaire survey, interview and other forms, and then modify, improve and finalize according to the problems. There are some defects in the objectivity of this process, because users' instant feelings and psychological feelings can't be expressed by questionnaires or interviews, so the final results will affect the accuracy of the data. With the help of eye tracker, the whole process of human-computer interaction can be recorded in real time, and more real data can be obtained from psychology and physiological movement track of eyeball for analysis and research.
In the design of the "One Belt and One Road" multilingual e-commerce platform "sootc" page, we use eye tracking system to collect the true feelings and how the participants use it in the interaction process and further improve the data with questionnaires and conversations, which will provide important data support for the designers.

2. Experimental method

2.1 Introduction to experimental instruments
Eye tracker is an important instrument in basic research of psychology. It can be used to record the characteristics of eye movement track in the processing of visual information, and widely used in the research of gaze, visual perception, reading and other fields. In this experiment, the main feature parameters of gaze are extracted and analyzed.

Figure 1. Workflow of high speed and high sampling eye tracker.

The high-speed and high sampling eye movement instrument (Figure 1) from the Key Laboratory of the National People's Committee of the people's Republic of China and the Ministry of education of the Chinese national language and character information technology of Northwest University for nationalities was selected as the experimental instrument, because the laboratory has rich experience in eye movement data collection and processing.

2.2 Experimental method
First, we design several common templates to experiment with the current popular e-commerce page. We collect and analyze the data from the duration of fixation, the times of fixation and the sequence of fixation.

2.3 Experimental indicators

2.3.1 Duration of looking at the target. Fixation time is an important index of eye movement data. It is found that the interpretation of this data is controversial in current references. Generally speaking, when we like something, we often describe our interest in it by keeping our eyes fixed. Therefore, in eye movement experiments, fixation time can be used to indicate the interest of the subjects in the test. However, some researchers think that long fixation time may also be due to the difficulty of the target object, which the subjects cannot understand, so the fixation time is longer.

2.3.2 Times of looking at the target. The number of times to gaze at a target refers to the number of times to gaze at the same target in a certain period of time. The measurement of this data is mainly based on the saccade and eye movement. The number of times to gaze at the target is a sign of the importance of region division, which is a vital indicator in the study of e-commerce interface. The more times the subjects' gaze, the higher attention they pay to this region.

2.3.3 Sequence of looking at the target. There are two indicators of fixation order, one is visual placement. By examining the order of visual placement, we can see the subjects' attention and interest.
in visual selection. The second is the visual track. By recording the conversion of fixation points in each area and connecting the fixation point sequence, we can clearly see the visual track of the subjects. This index helps us to study the distribution of important positions.

2.4 Identity of subjects
Because this experiment is limited by multilingualism, the age, education and occupation of the subjects will affect the final results of the experiment, so we selected 20 college students from Northwest University for nationalities, half male and half female, to complete the experiment. According to the requirements, all subjects must be proficient in Chinese or Tibetan or Uyghur and English. It is also required that the naked or corrected visual acuity is above 1.0, no framed or hidden glasses are worn in the experimental stage, and no eye diseases are found.

3. Experimental results and analysis

3.1 Experiment design
Through the analysis of the current mainstream e-commerce platform page structure by the design team, we set the following forms of page structure in combination with our own multi language characteristics: the "□" shaped structure, the "C" shaped structure, the "T" shaped structure and the "response" structure of free transformation. The four basic structures are represented by sample 1, sample 2, sample 3 and sample 4 respectively (Figure 2). Sample 1 is "full encirclement structure", that is, the upper part is the menu, the middle part is the banner, on the left and right sides is the information, and the bottom part is the advertising space recommendation. Sample 2 is a "C" shaped structure, that is, the menu is on the left, forming a semi surrounding structure with banner, which is also a popular structure of e-commerce in China. Sample 3 is a T-shaped structure, with the pull-down menu on the top, banner on the bottom, and advertising space recommendation on the bottom. Sample 4 is a "response" structure, which is popular in shopping websites in Europe and America and it can adapt to changes in browsers.

Finally, we divide the four samples into different regions for later data statistics and analysis. The top basic information, logo and search box of sample 1, sample 2 and sample 4 are divided into zone 1, the pull-down menu is zone 2, the banner and left and right sides are zone 3, and the advertising space

![Sample 1: “□” structure](image-url)
![Sample 2: C-shaped structure](image-url)
![Sample 3: “T” structure](image-url)
![Sample 4: “response” structure](image-url)

Figure 2. Frame structures used in the test.
is recommended to be zone 4. The top of sample 3 is zone 1, the vertical menu is zone 2, banner is zone 3, and the recommended advertising space is zone 4.

3.2 Experiment process

After the subjects are prepared according to the sequence, we call out the experimental procedure, stipulate that the browsing time of each interface is controlled by the subjects themselves, and set that each page is browsed in 30 seconds, remind the subjects to switch to the next page, pause for 0.1 second in the middle, and the screen is gray when the pause is made. The experiment stipulates that all experiment contents should be browsed as much as possible within 2 minutes. If there are subjects who want to finish the experiment in advance, they can finish the experiment procedure, or if the time is up and the subjects have not browsed the experiment contents, they will be reminded to finish as soon as possible, but the delay time should not exceed 20 seconds.

Samples 1-4 were randomly disordered during the experiment and the subjects could not see the labelling symbols of the regions so as to avoid the influence of the habitual selection caused by the sequence on the test data.

![Figure 3. The effect of the object's gaze on sample 4.](image)

In the experiment, we randomly grab the visual track map of one subject (Figure 3). The left computer screen is the main operator's screen, and the right computer screen is the subject's screen.

3.3 Analysis of experimental results

3.3.1 Fixation time. It can be seen from table 1 that the average fixation time of sample 1 is 16.6 seconds, that of sample 2 is 20.2 seconds, that of sample 3 is 19.4 seconds, and that of sample 4 is 24.9 seconds. The subjects stay in sample 4 for a long time, but there are not too many elements difficult to identify and large pieces of text in sample 4, so we judge that the subjects have a relatively high degree of interest in sample 4, which is also confirmed in the questionnaire survey. Sample 4 is a "response" structure, which mainly considers that the length of different language descriptions of the same word in the process of multi-language switching will be different, which will lead to wrong lines, incomplete display, superposition and other situations affecting the appearance, so it is very important to leave the page blank properly.

| Serial number | sample 1 | sample 2 | sample 3 | sample 4 |
|---------------|----------|----------|----------|----------|
| 1             | 16       | 18       | 18       | 19       |
| 2             | 13       | 19       | 13       | 15       |
| 3             | 12       | 15       | 17       | 21       |
| 4             | 14       | 22       | 22       | 28       |
| 5             | 11       | 17       | 27       | 33       |
According to the fixation time of each region from sample 1 to sample 4, sample 4 has the longest fixation time and sample 1 has the shortest fixation time. According to the region division, the fixation time of zone 1 and zone 3 of all the samples was similar, while that of zone 4 was the largest. When analyzing sample 4 from fixation time, subjects' attention was compared, especially the 4-area time of sample 4 was up to 11.8 seconds. Therefore, the analysis from the time length data is basically in line with our initial design concept.

Table 2. Statistical chart of fixation time of 4 areas in sample 1-4 Unit: Second.

|       | Area 1 | Area 2 | Area 3 | Area 4 | Total |
|-------|--------|--------|--------|--------|-------|
| sample 1 | 3.1    | 2.2    | 6.1    | 5.2    | 16.6  |
| sample 2 | 4.4    | 4.9    | 4      | 6.8    | 20.1  |
| sample 3 | 3.5    | 3.2    | 4.5    | 8.1    | 19.3  |
| sample 4 | 3.7    | 4.6    | 4.8    | 11.8   | 24.9  |
| Average | 3.6    | 3.7    | 4.8    | 7.9    |       |

Although time is an important indicator to measure the subjects' understanding of the target object, there is a certain relationship between the subjects' understanding of the elements. According to the questionnaire survey after the experiment, some subjects have a cognitive process for some elements, so it may take a long time. For example, the sign of Zone 1 is an abstract pattern, which needs a certain time in the recognition process. The fixation time on the search box is shorter, because the design of the search box is simple and easy to understand, so the time is shorter. From the above data, it is in line with our initial design concept.

In our experiments, we found that the duration of gaze can also be reflected in the difficulty of extracting information. For example, each subject has to browse at least two language versions. When they encounter difficult sentences and patterns, they stay for a long time. When they encounter special elements of interest, they may also affect the duration. Therefore, the information extracted only from the fixation duration can’t fully meet the requirements of the experimental results. There is also a process in which the subjects are emotional when browsing the page, which will also affect the accuracy of the data. If this complex psychological cognitive process is only analyzed by the fixation time, it is one-sided to summarize the experimental results, so it needs to be combined with other index data for comparative analysis.

3.3.2 Times of looking at the target. Table 3 shows the statistics of fixation times of four samples and different regions. We found that sample 3 and sample 4 had more fixation times in the three and four regions of all samples. From the data of the number of times of looking at the target, banner still
occupies the first place. Because banner has a large area and is in the golden section of the whole page, such results also meet our expectations. After that is the location of the first area marker and search box. The number of times of fixation at this location is not much, and 80% of them are looking at the marker. According to the questionnaire, because the elements of the marker are complex and need a cognitive process, there are many times of fixation. And the search box is relatively simple and clear, so it is easy to accept, and the number of fixation is relatively small. The menu is a pull-down structure, so the subjects jump back and forth in several categories after clicking to enter, indicating that the subjects are not very interested in the plain text area, so the area proportion of the plain text area should not be considered in the design process. From the perspective of the number of fixation times of advertising recommended location, the subjects have a high degree of interest in this area, which is also in line with our expected design effect.

| Area 1 | Area 2 | Area 3 | Area 4 | Total |
|--------|--------|--------|--------|-------|
| sample 1 | 4      | 3      | 8      | 3     | 4.5   |
| sample 2 | 6      | 6      | 5      | 7     | 5.5   |
| sample 3 | 5      | 6      | 7      | 8     | 6.3   |
| sample 4 | 6      | 7      | 8      | 9     | 7.3   |
| Average | 5.3    | 5.5    | 7.0    | 6.8   |

3.3.3 Sequence of looking at the target. The analysis of samples 1-4 from the fixation visual track is consistent with the habits of the subjects, and the subjects are basically in the habit of browsing from top to bottom, from left to right. But Uyghur is from right to left. Although five Uyghur test students show the inverted "F" shape in the test process, they are still used to browsing from left to right, which shows that there are more pages from left to right at ordinary times, forming a habitual "F" order.

According to the browsing order of the four areas in the sample, banner is the first to be browsed, followed by the elements of Area 1, then the recommended advertising space of Area 4, and finally the directory of Area 2. However, the visual landing point is also on the catalog, in fact, it is the recommended advertising space. From the data of visual placement, we can find that the subjects are interested in menu and advertising recommendation. From the visual track data, the most active element conversion is in Area 4, followed by Area 1, because there are more elements in Area 1, and the subjects are very interested in the top text button.

4. Experimental results

Through the analysis of experimental data, we found that the first movement of the eyeball focused on the upper left corner of the page, and the subjects were used to browsing the page from top to bottom and from left to right. So in page design, we should pay attention to these key areas to ensure that we can pass on the most important information to the visitors. Therefore, when designing the interactive interface, we should try to follow this format.

We can also see from the experiment that we should try our best to avoid large text piles. Research shows that average page readers don't spend time reading large chunks of text, no matter how important they are. Therefore, these large texts must be divided into several small paragraphs to highlight the important points. It is better to add pictures or videos to improve users’ attention. From the data of sample 4, the viewers are relatively receptive to the principle of simplicity. While providing enough information, the interface design should be as simple and clear as possible. In the interface design, we should pay attention to blank space. If we fill every inch of space, it will cause the burden of vision and memory of the viewer. So in the process of design, we should keep the scale of information of each screen.

When the user browses the product information, whether it is the use of controls, the wording of prompt information, or the design of color or window layout style, it is necessary to be consistent, so
that the user can use it to establish an accurate mental model. When they are familiar with an interface, they can switch it to another interface to easily speculate various functions, getting a unified feeling and adding friendliness.

5. Conclusion
At present, there are many hardware devices about eye movement. Because each device manufacturer uses different concepts and parameters, there are many methods but lack of unified standards, which brings many difficulties to the research of eye movement. Most of the instruments involved in this paper have been used in reading, advertising psychology and other fields, but the application of multi-language user shopping website interface is still rare, and the corresponding research literature is relatively small.

In the process of the experiment, each subject's psychological changes will affect the results of the experiment, because some subjects can't concentrate or are too nervous by the influence of the environment to complete the test objectives. Therefore, the collected data can’t fully display the actual situation of the subjects, resulting in the corresponding errors in the later data analysis. Before the experiment, visual proofreading for each subject is a very tedious process. Most of the time in the whole experiment is in the preliminary work, so in the future experiment we should try to simplify this tedious work procedure to get more real data.

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