

Make a More Meaningful Interaction: Exploring the Framework of Cookie Notice

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Abstract

With the successive implementation of the acts on privacy protection in European Union (GDPR), UK (PECR), the United States (CCPA), Brazil (LGPD) and Canada (PIPEDA). More websites around the world will send cookie notifications to visitors when collecting their cookie data. Although China has also issued a cybersecurity law, the results of the top 300 most popular websites in China researched in this study were found that is not satisfactory. This paper invited more than two hundred volunteers to participate in two sets of experiments and a survey. More than 70% of users thought it is necessary to make a notification when webserver is collecting user's data. In this work, I compared two sets of notification designs, and recommended different position of notification for different web design situations. I found that users didn't make choices with the notification basically because they don't know how to make a suitable choices, and there are certain misunderstandings about the results of each choice. The research shows that the website provides users with detailed information about the content and purpose of the collected data is not only satisfies the user's right to know, but also encourages users to make a positive choice.

Keywords: privacy and security, cookie notice, user study

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1 Introduction

Today whether for operating or entertainment, we have to use the Internet at all times. When we are surfing the Internet, not only the mails, social messages, articles and something we wrote were recorded, but also the data like our hobbies and personal preferences we left indirectly and hardly noticed. A large number of companies, especially advertisement companies, have seen the potential value of the user's preferences as a long time that could help them to gain insight into the consumers and to provide deeply customized recommendation advertisements to each consumer.

Each web server will return a small piece of data and stored in the user's local physical memory or disk as a text-character string when the user browsing[7]. And the webserver will also read the local data while the user browsing next time. That small piece of data we called them Cookie.

The proposal of cookie brings a "memory" to the Hypertext Transfer Protocol (HTTP), which greatly improves the efficiency of the Internet and bring us more convenient functions. However, cookies are transmitted as an unencrypted text between server and user in HTTP, which also brings a new security risk. The most common vulnerabilities are Cross-Site Scripting (XSS), a typical web application vulnerability[3]. The XSS attack can steal cookies by setting up the execution of malicious scripts after crossing several websites but it is hard to prevent it[4][5]. Although the cookies generally do not store the high-sensitive personal privacy information like the user's real name, phone number, email address, or credit card information, there are still many users who do not want their behaviors and preferences can be read by advertisers.

The European Union's General Data Protection Regulation (GDPR) Act [35], which came into effect on May 25, 2018, made a significant change to the website. The Act proposes that users should have at least the right to know about cookie calls. Since then, about 62% of websites have displayed a banner of cookie consent notice[8]. January 1, 2020, the California Consumer Privacy Act (CCPA) [6]was also issued. The Cybersecurity Act of the People's Republic of China (CAPRC)[2], officially implemented on June 01, 2017, in China, also provide that the user's consent should be obtained before collecting their information.

In this research, I'll systematically explore the factors that may influence users' consent of cookies collection by setting two experiments and a survey. In section 3, a questionnaire survey website is designed, and volunteers are invited to participate voluntarily to collect the interaction information of participants' notification behavior without specifically mentioning the cookie notification bar. After that, the volunteers will be asked on the next page whether and why to interact with the cookie notification bar and other questions. In section 5, we analyze how to design the notification bar to

enable users to interact with the cookie notification more actively and make it more meaningful.

The target language environment of this experiment is Chinese, so the volunteers also mainly use Chinese as their mother language. Therefore, this research will analyze the design of the cookie notification bar and the interaction behavior with the Chinese language, and it will also show the difference with the experiments in the German environment conducted by Christine et. [1] to obtain more global results. This research will answer the following research questions through two experiments and a survey:

- (1) Whether the location of the cookie consent notification affects the user's choice
- (2) Whether the highlighted or unobvious cookie consent notification affects the user's choice
- (3) Whether the test of cookie consent notification with more details affects the user's choice

Between June and July 2020, more than 200 volunteers voluntarily participated in my experiment. I investigated whether volunteers were able to notice cookie notifications, their interactions, and the motivations they made for notifications. In the follow-up survey, I obtained the personal attributes of volunteers and further analyzed the relationship between attributes and their selection.

This paper compares and verifies the cookie notifications located in the top left and bottom left of the webpage in the Chinese environment. Volunteers are more aware of the cookie notifications at the bottom left of the page, similar to the conclusions in the German experiment. However, volunteers reported that the notification at the bottom left obscured part of the content, which caused them unwell. After that, we tested the position of the notification to the top of the page, pushing the whole webpage down and setting a highlighted background. It uses animation and highlighting to attract the user's attention without blocking any web content. Although the attention rate of volunteers is slightly lower than the position bottom left, the interaction rate is very close, so I think it is very competitive. The survey shows that half of the users prefer to be able to carefully choose the use of cookies on the site, but some users think that the detailed settings are too complicated. In conclusion, I recommend that websites with little content on the page or not sensitive to the page being blocked could set the cookie notification at the position bottom left, and others do not like to block any page content a pushing down notification with the highlight background may be better. The user hopes that the notification can provide certain choices, but too many choices increase the burden on the user, 2-3 choices may be a more helpful design.

In the survey, I asked each volunteer's usage habits of the Internet, their knowledge of cookies, and whether the cookie notification is necessary for their mind. Users who prefer a widely surfing of the Internet usually have more knowledge about cookies and

have a higher rate to notice the cookie notification. However, this is not directly related to their choice.

In my research, I found that almost all the Chinese websites do not have any notifications about cookies. Some websites even didn't mention that they will collect data. Only half of the websites have a privacy policy link in obscure locations. However, more than 70% of volunteers in my research propose that websites must remind users when collecting users' data.

To better balance the needs of users and commercial websites, I recommend that websites should send notifications to users when collecting data, and explaining these data in detail can bring more convenience to users at the same time, So that can enable users to make rational judgments to make a more meaningful interaction.

2 Background

The cookie consent notification often appears on websites, but what is the cookie, why they use cookies, and why the notification appeared?

2.1 cookie

A cookie is a small text created by the web server of the website that the user browses and stored in the user's local disk or memory through the browser. In common, the size of the cookie won't over 4kb. The behavior of users will be stored as a cookie when they are surfing the Internet. The website can obtain higher performance and provide tailored advertising recommendations for each user according to the analysis of the user's behavior preference. Besides, the cookies also stored some necessary data, and some websites may not provide services normally without this information.

the website will send and read a user's cookie when he is visiting the website. So if the user visits the same website again, the user will also be remembered by the website, which can avoid repeated operations such as frequently login. Sometimes the cookie information is not only created by the website itself, but from the third-party advertising column on the webpage, or even from a transparent element point.

The cookie is generally divided into two categories: temporary cookies and persistent cookies. The lifetime of temporary cookies are always limited, and it only exists in one browser usage time. In short, the temporary cookies will be cleared every time while the browser is closed. Persistent cookies are files that can be stored in the browser for a long time, and will only disappear if the user manually deletes them or automatically by the browser. Compared to temporary cookies, it is clear that persistent cookies have a higher security risk but it can more describe a user's behavior preferences.

In the current e-commerce website, these two cookies are widely used. For advertisers such as Google, they use cookies to understand what items do a user buys or browse the most and to place targeted advertisements. It will help them to avoid repeating the same advertisements and recommend YouTube videos, etc. [7]. The targeted advertising is also called Online Behavioral Advertising (OBA) [8], which promotes the development of the Internet advertising industry and brings obvious economic benefits. In 2019, the US digital advertising revenue is close to \$125B [9].

For a website operator, cookies can not only improve the usability of the website effectively but also configure personalized options such as webpage language or the font for users. The website can also use cookies to develop functions, for example, the cookie named "lbc" used by Google allows Google Documents to open multiple documents in one browser. Google Docs may not be used when blocking this cookie [7]. Small-sized websites rely on the revenue provided by advertisers could maintain free services to users, while also incentivizing websites to provide a better service.

The wide use of cookies has brought huge benefits to the Internet industry, but we also have to talk about its privacy issues. Using cookies on public computers does bring a lot of hidden dangers, such as forgetting to logout of someone's private account. However, more users may panic about the understanding of the Internet. A special example is when a user visits a website for the first time (through a search engine, etc.), and the recommended ads exactly appeared the item that the user just bought on another website. It may cause users to have a great distrust of the website. In the past few decades, a large number of exposed privacy leaks or black scandals have exacerbated user's suspicion. User preference information has a lot of potential commercial value, which makes it often regarded as a commodity, has a clear price, and traded between enterprises. This is also a reason why it is difficult for users to accept a cookie using.

2.2 Acts

The GDPR, which took effect in May 2018, made a significant impact. The GDPR mentioned that "the data subject has given consent to the processing of his or her personal data for one or more specific purposes", "a clear affirmative act" that is a "freely given, [purpose-]specific, informed and unambiguous indication of agreement to the processing of personal data." Martin's research shows that more than 63% of famous websites in the EU displayed a cookie consent reminder bar in October 2018 [8].

In China, the CAPRC [2] also stipulates that "website operators should express the rules, propose, method and scope for collecting and using the personal information, and they need to obtain the consent of the person being collected." "Without consent, personal information shall not be provided to others." However, the definition of personal information is "all kinds of information that can identify the personal identity of natural persons alone or in combination with other information." Could we explain

the behavior data of the user from the cookie can identify the owner? It also doesn't specify the use of cookies.

2.3 Cookie collection notice in China

To understand the current situation of Chinese websites collecting users' data and their right to know, I conducted a pre-investigation of the current websites in China. I first counted the top 375 websites (Appendix B) that have the most frequently visited by users in July 2020 based on the data provided by Alexa [36] in China. The ranking was based on the number of average daily visits and pageviews in the previous month Calculated. This research used JavaScript to write a Chromium script to automatically access and grab screenshots of all the homepages of the top 375 lists in July 2020 using an IP address located in the mainland of China. During the research, we noticed some of the top 375 most popular websites are subdomains of the same main website (for example, 3c.tmall.com is a subdomain of tmall.com) have the same site design. These subdomains under the same main domain are not statistically significant in my study, and finally, 85 similar domains URLs were deleted in the list. Additionally, a manual review we have to make for those 34 websites that returned "404 not found" pages may because they blocked my web spider. There is also a website that had ended its service at the time of the investigation. Finally, 290 effective data we have research in my study.

We manually observed the screenshots of these 290 websites one by one. At variance with Europe, none of the websites reminded users that they will collect cookies or other data because the CAPRA did not make specific regulations. In my results, only 35% of the websites provided a "Privacy Policy" link at the bottom of the page, which introduced the details and uses of data collected by the website. But after my sample survey, not all "privacy policy" allows users to decide their collection policy. There are two websites we did not notice any privacy-related sentences on the surface, but we found privacy settings hidden in the secondary menu after my manual review such as bing.com The possible reason is to keep their whole design. In the remaining 64% of the websites on the list, we did not find keywords such as "privacy", "cookie" or "data". However, we noticed that about 5% of the websites mentioned in the "Legal Notice", "Disclaimer", or "Service Agreement" links in the subsequent manual review that proposes their website would collect user personal data without any setting options. These statements generally state that they will not disclose user data at will and will not be held responsible for information leakage caused by hacker attacks. Unfortunately, we didn't see any possible links on the index page of the other website. The situation was hardly changed from 2007 [37].

The privacy policy links at the bottom of some webpages are always in a large amount of text with the same font that was so difficult to find as figure 1. A few websites will load new constant at the bottom of the page straightly so that the users can hardly read the bottom information. There are also websites that recommend their mobile apps in the bottom pop-ups, completely blocking the privacy policy link in the screenshot.

We observed third-party advertisements and did find cookie calls on the websites that did not provide privacy policy descriptions.

Overall, the Internet data collection policy of websites is not optimistic in China. Nearly 1/3 of the websites have no collection notice at all. It also has lots of problems with that websites have a notice, some of the notice using words such as “a law” to force users to accept the provision of data. Most websites placed the links at the bottom of the page, with very small fonts and in a large amount of information. Besides, some information flow websites will refresh the new information at the end of the page infinitely. These designs are harmful to users to notice privacy policy.

As the first research to survey the users' interaction with the cookie notification, I believe it makes a great practical significance.



figure 1 A sample of the privacy policy links at the bottom of webpage and in a amount of text with the same font. Privacy policy is in the red box.

2.4 Cookie Notice

Cookie notice often has different designs on different websites. Martin et al. [10] summarized different categories based on the situation in 2018. Some websites only notice users with a notification that they are using a cookie but do not provide any interactive options, more than half of the websites only provide a confirmation option, click the bottom “close” doesn’t mean that you do not agree to use cookies. Only a few sites offer binary, checkboxes, and vendor options.

Utz et al. first classified the design of the cookie consent notice [1]. They manually checked the 500 most popular websites of each EU country, a total of 6,000, and summarized eight variables of cookie consent notice: Position, Blocking, Choices, Text, Nudging & dark patterns, Formatting and Privacy links. They proposed that 58% of the notifications are at the bottom of the page, and 93% will neither prevent users from interacting with the page normally nor provide any choice (86%). Although almost all of the notifications provide a link to their privacy policies, only one-third of the notifications will mention the purpose of data collection and who can access the data in the text.

According to the experiment of [1], (1) the highest rate of interacting with the notification bar is coming out with the bottom left, but only 34%. (2) The interaction rate on the left is much higher than in other positions. (3) Instead, cookie consent notices

that provide more detailed options have a lower interaction rate than no options or binary options. (4) The interaction rate of mobile phones has even doubled to PC.

3 Methodology

Past studies [1][10][38] et al. have pointed out that most of the designs of the cookie consent notice may not meet the GDPR. At the same time, past studies have not proposed which design can positively influence users to make the correct choice. Therefore, this study mainly considers the following impact factors:

- (1) Could the text with more details of cookie consent notice increase user's trust?
- (2) The user may ignore or hardly notice the notice when browsing the websites. Could the highlighted text be used to simulate user interaction?
- (3) The impact of the user's knowledge of cookies on their choice.
- (4) The impact of user attributes on their choice.

This study did not experiment on a real commercial website: I was communicated with the vice president of Baidu Inc. that this experiment might bring new issues and may affect the user experience of the website. Either this experiment did not analyze the impact of the size of the notification bar on the user because of the affection by the screen resolution and browser size of the user, it is too difficult to make an effective analysis.

This study built an independent website for experimentation to avoid some new security risks and to reduce conflicts between users and commercial websites. We conducted two sets of comparative experiments and a user survey between June and July 2020, to understand the impact of different design parameters of the cookie notifications on Chinese user interaction: In the first experiment, I compared two locations—Top left and Bottom left that may have the most interactions. Experiment 2 tested whether highlighting the cookie notice bar without causing any main content on the webpage could change users' interaction.

3.1 Setup

Since different countries or regions have significantly different legal on cookie using, it is difficult for us to flexibly change various parameters on the cookie notification in a commercial website to conduct comparative experiments. And the commercial websites often have a certain design specification for the overall appearance of webpages, which will also limit us to make more experiments about the notification design.

In this research, I use the Amazon Web Services (AWS) EC2 [14] to build a website based on WordPress [15] specifically for the experiments. We have modified a plugin Complianz [16] from WordPress.org to make a lawful cookie consent and make a design of the consents in this study. This plugin widely supports cookie laws in various regions and provides design options in detail. In the experiment, the notification and my use of cookie still followed the current most widely used EU-cookie law GDPR and published the cookie privacy policy of this website according to the requirements [17]. Except for the necessary cookies to keep WordPress and the survey running, this research does not collect any other data.

As the first research in the Chinese environment, the URL of the experiment was posted on the top 3 of the most famous social networking sites (Weibo, QQ, and WeChat), I extensively invite volunteers to voluntarily participate in and finish the experiments and an anonymous survey. The submission from the same IP-address will prompt "Submission failed" to prevent the volunteer who' trying to answer multiple times.

To simulate a real web browsing environment for volunteers as possible, the experiment of cookie consent interaction is integrated into the survey. Before the experiment, I only informed volunteers that this survey was a questionnaire about privacy policies, and did not mention any about the cookie notification, figure 1,2.

The "stay time" when the user is surfing the website is a very important factor, leading to "no interaction" while it was too short. Therefore, to create a longer "stay time" for volunteers to make more reasonable choices, the survey in this experiment was divided into four pages. The first page and the second page only introduce the time required for the experiment and get some attributes of volunteers. Until the third page of the survey, they will be asked for the first time whether they have noticed the cookie notification and follow-up questions, (Appendix 1)[18].

Since some cookies are necessary for the function of the website and do not contain any personal privacy data, most websites do not provide the option like "refusing to use cookies" [1] [10]. It is also necessary to use the cookie to achieve some functions in this survey, so I provide two options: "accept all cookies" and "only necessary cookies" in my experiment. Neither option will obtain any personal information from volunteers since this study only uses functional cookies. And "no interaction" will be default as "only accept necessary cookies" at this time.

3.2 Experiment 1: Position

The purpose of Experiment 1 is to verify whether the location of the cookie notification could affect the user's choice. Utz et al. [1] conducted a lot of experiments on the six most common locations for cookie notifications in the German environment (top left, bottom left, top, bottom, top right, bottom right), and proposed that the interaction rate of top left and bottom left is much higher than other locations, but since

only two extremes of options (agree or reject) in the cookie consent were given, the influence of other factors on the interaction rate was not considered. The main purpose of this study is to push that users can make more valuable choices. Obviously, users should first be able to notice the notifications, so the two locations with the highest interaction rate are selected for verification in the first experiment, figure 2, 3. In the follow-up survey, I provided volunteers with four options: 1) I did not notice the notification bar at all, 2) I did not interact with the notification bar, 3) I chose “accept all cookie”, 4) I chose “only accept necessary cookie” and also asked the reason of their interaction.

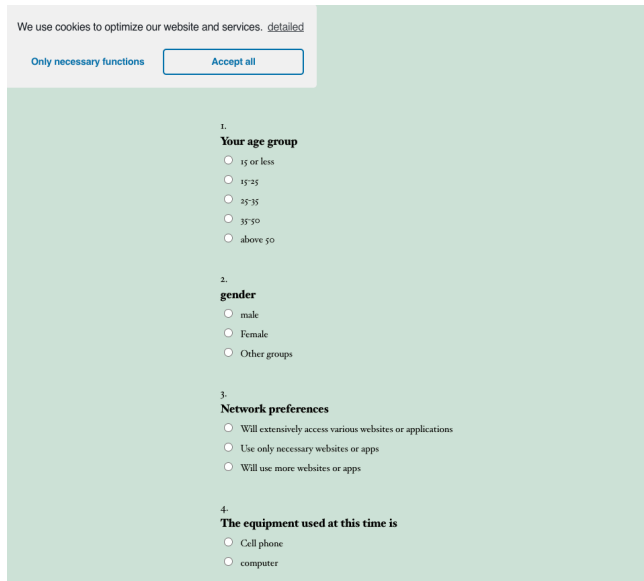


figure 2 a screenshot on PC



figure 2 b screenshot on mobile

figure 2 cookie notification at the position top left

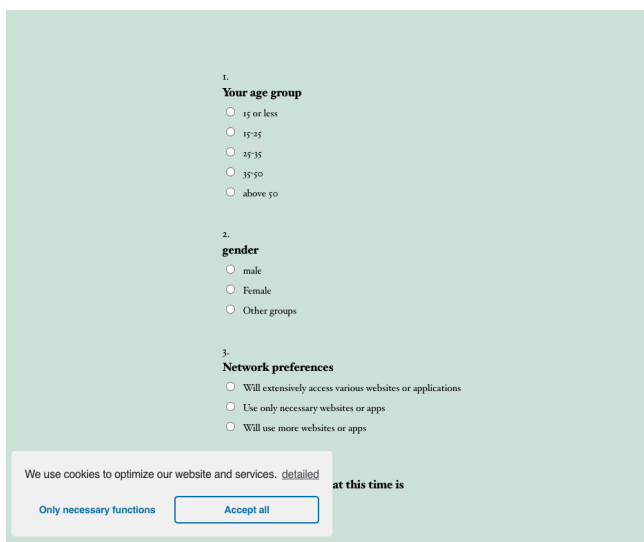


figure 3 a screenshot on PC

The cookie notification blocked the question 4



figure 3 b screenshot on mobile

The cookie notification blocked the button Next

figure 3 cookie notification at the position bottom left

3.3 Experiment 2: Highlight

Based on Experiment 1, we add a push-down notification and a push-down notification with a highlight background color.

Utz et al. proposed that a possible reason for the higher interaction rate in the two locations in Experiment 1 is that it blocks the user's focuses of the webpage more than other locations, that is because the Latin language is written from left to right, the left side contains more keywords. The Chinese language also has the same feature. However, the cookie notification bar that blocked the content of the webpage may disgust the users [11], which easily tends the user to make an emotional choice rather than a meaningful choice. In this experiment, I propose a new push-down notification, it pushes the entire webpage down with animation and appears at the top, as a comparison. To further attract the user's attention, a push-down notification with a highlighted background has been set up as shown in Figure 4, 5.

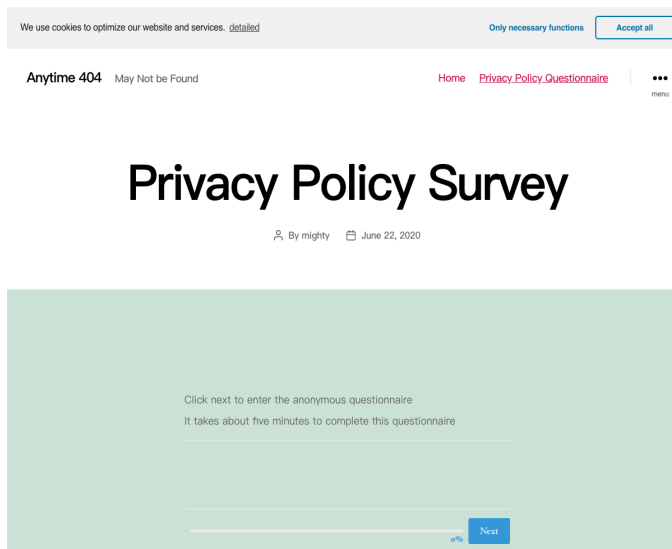


figure 4 a screenshot of PC



figure 4 b screenshot of mobile

figure 4 the cookie notification using the “push down” do not block any content of the webpage.

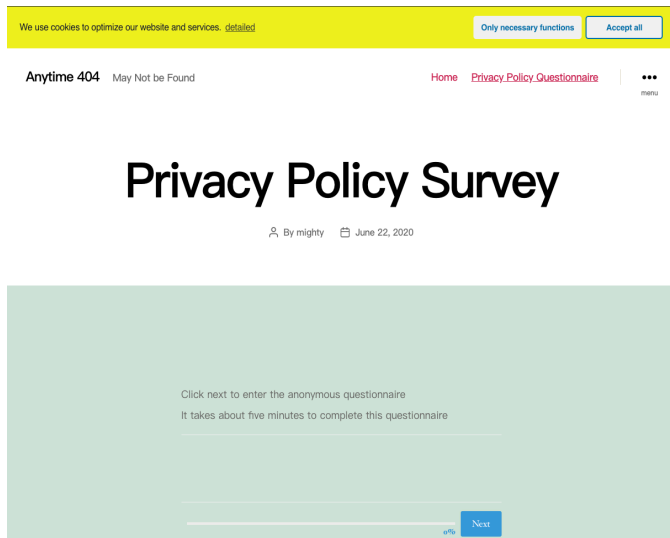


figure 5 a screenshot of PC



figure 5 b screenshot of mobile

figure 5 The cookie notification using “push down” and a heightened background may draw more attention.

3.4 Survey

I considered a survey that includes 13 questions and one free text (Appendix A). In the first part of the survey, it will collect the gender, age, and Internet usage preferences of volunteers. The keyword “cookie notification” will first mention in the second part as a question “Did you notice the cookie notification before this question?”. The following subsequent questions will focus on the specific reasons for users to make choices. For each selected reason, I preset several possible reasons, and provide volunteers with text boxes to describe personalized reasons.

For the reasons for “no interaction”, the preset options are

- 1) I don't know which choice to make/I don't know what happens after the choice.
- 2) There is no choice I wondered.
- 3) I don't care about the result of choice

For the reasons for choosing “accepted all”, the preset options are

- 1) Think it can better protect me from Internet privacy violations
- 2) Think I can get a better experience
- 3) Just habit
- 4) The notification bar blocked my viewing

For the reasons for choosing “only accepted necessary”, the preset options are

- 1) Do not want to provide too much personal data
- 2) Not sure about the result for choosing “accept all”

In the previous researches, it all mentioned that the design of the options and texts in cookie notifications will significantly change the user's behavior [1 2 27 43 50], so I have detailed the notifications' description texts in three degrees as three options, "We use cookies to optimize our website and services. Read more", "We collect including your behavior data to optimize our website and services" and provide checkboxes that allow a fine-grained choice of usage as figure 13.

Finally, I surveyed volunteers' understanding degree of " web cookies" and their sensitivity to personal privacy.

4 Results

4.1 Datasets

During the period from June 19 to July 9, 2020, this experiment website has visited a total of 1004 times, of which 213 volunteers participated in the experiment. At last, two volunteers withdrew from the experiment halfway, a survey that only took 6 seconds was considered invalid, finally recovered 210 pieces of valid data.

Among the 210 datasets, only 7.62% of the volunteers use computers to participate in the experiment, and 92.38% of the volunteers use the mobile phones to participate in the experiment generally conformed to China Internet Network Information Center (CNNIC) [12] which report that 99.3% of Chinese netizens use mobile phones to access the Internet and 43.7% use a laptop to surf the Internet. Overall, males accounted for 51.90%, and females accounted for 47.14% (figure 6), which was also basically consistent with the gender males 5.1:4.9 females reported by the National Bureau of Statistics of China [13]. Figure 7 shows the number of volunteers by age group. The average time for volunteers to complete the whole experiment was 2 minutes 59 seconds, about 72.38% of surveys exceeded 2 minutes. Surprisingly, 37.62% of the volunteers in this survey have some or more knowledge of cookies, which is much higher than the researchers' estimates.

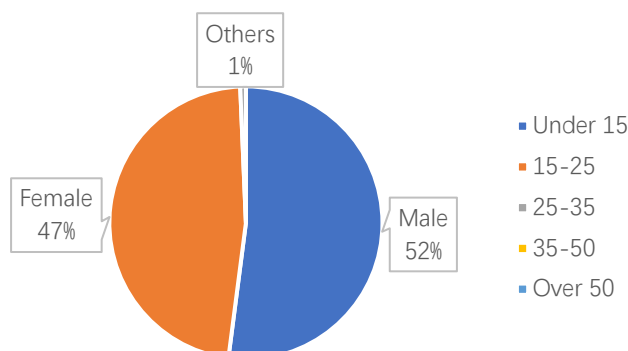


figure 6 radio of gender

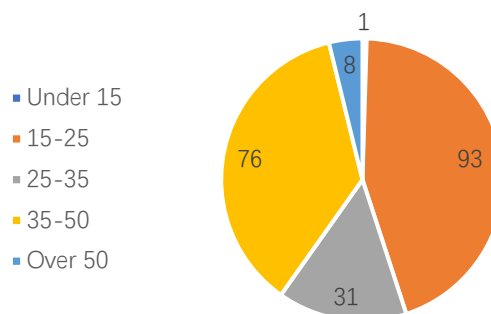


figure 7 radio and number of age group

4.2 Experiment 1

4.2.1 Attention rate, interaction rate, and choice

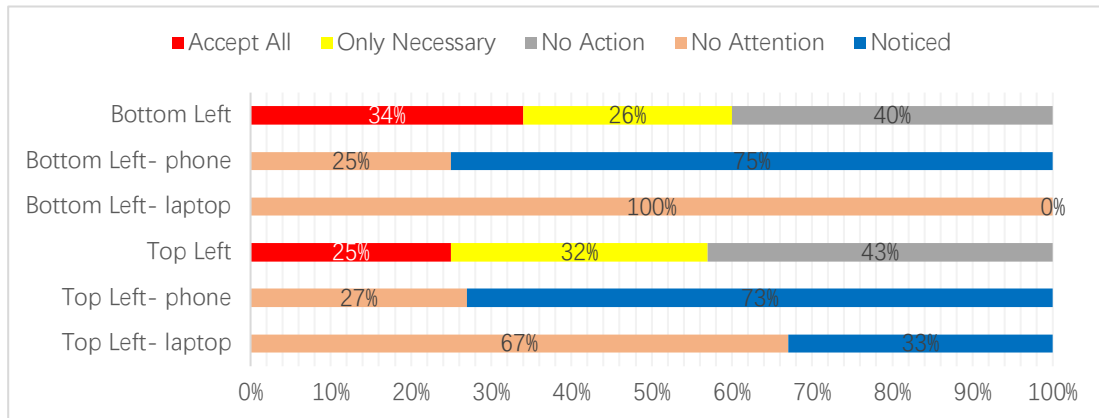


figure 8 Interaction rate and choice in exp.1

The limited sample size of the computer terminal obtained in this experiment is not statistically significant, so it is not used as the main comparison data in the follows. Figure 8 shows the user's attention rate, interaction rate, and their choices when the cookie notification is located on the “top left” and “bottom left”. Overall, the attention rate of the two locations on the mobile phone is basically the same, and the proportion of selecting "no interaction" is also approximately the same. The interaction rate probability at the bottom left is slightly higher. The notification in the bottom left position has a significantly higher click rate than the upper. “Only accept the necessary” is lower than the top left position.

4.2.2 Analysis

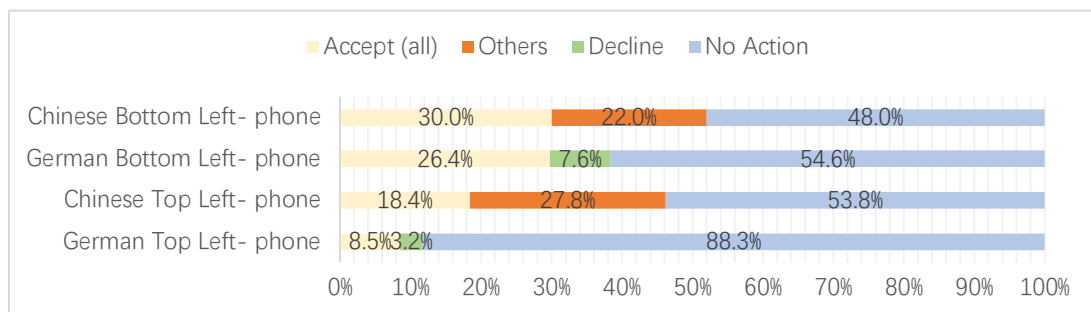


figure 9 Interaction rate compare with [1]

In the comparison between the two groups, it can be clearly found that the bottom left position has more satisfactory performance than the top position and the bottom position has a higher attention rate and a higher interaction rate. The proportion of “accept all” reached 34%. One possible reason is that after the user normally reads the upper texts of the website, the demand for the web page is reduced, and will trust more with the website. At this time, seeing the cookie notice bar at the bottom of the webpage could stimulate new reading interest and leading more active select. 29.4% and 37.5% of volunteers in the bottom left and top left positions of the motivation to choose "accept

all" think that the notice bar hinders their normal browsing. I purpose that the notice bar at the bottom left could prove a better experience than the top left position. Since my survey website does not have complicated web content, the percentage of thinking it is blocking a normal browsing may increase to some extent.

One possible reason for the higher interaction rate of this experiment compared to the German environment (figure 9) is that I provide a more relaxed intermediate option than the binary option of agree-reject --- “only accept necessary”, the compromise effect in psychology may be able to verify this factor. Another possible reason is that [1] is an experiment conducted on a shopping website. The shopping website may has a higher security risk than the website in this experiment. The elements on the page are also more complex and may confuse users.

4.3 Experiment 2

4.3.1 Attention rate, interaction rate, and choice

In Figure 10, I compared the attention rate of the two design schemes of the two groups. The attention rate of the push-down notice is the same as that of the top left, are 73%, which is slightly lower than the position bottom left. The push-down notice bar with a highlight background is only 66%, lower than the other three designs. The attention rate of the notification on the computer is less than half of the mobile phone. Although the push-down cookie consent with a highlight background does not improve the attention rate, it has an 11% higher interaction rate than the sample push-down.

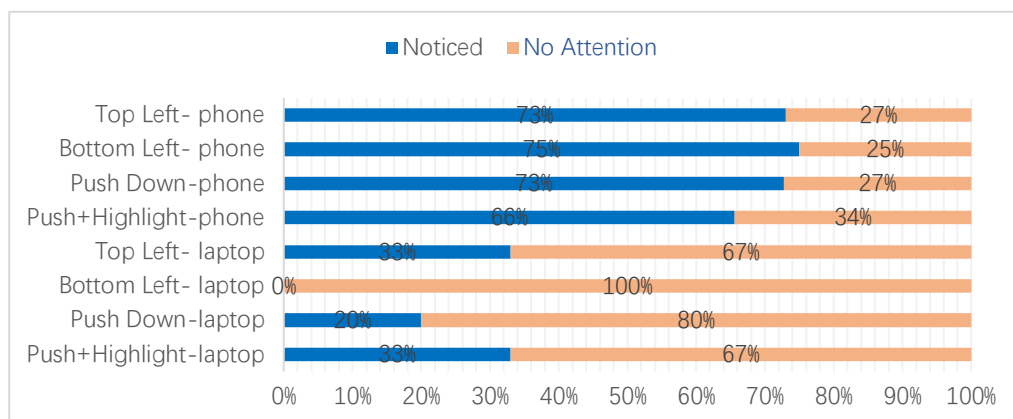


figure 10 Attention rate compared with 4 designs in Exp.1 and Exp.2

4.3.2 Analysis

After communicating with volunteers, I found that when the user quickly scrolled the screen, the push-down notice was fleeting. The user can see the notice bar only after clicking on the webpage and waiting for a second. The highlight push-down notice bar may attract users' attention for a longer period, thus becoming a possible factor for increasing the interaction rate.

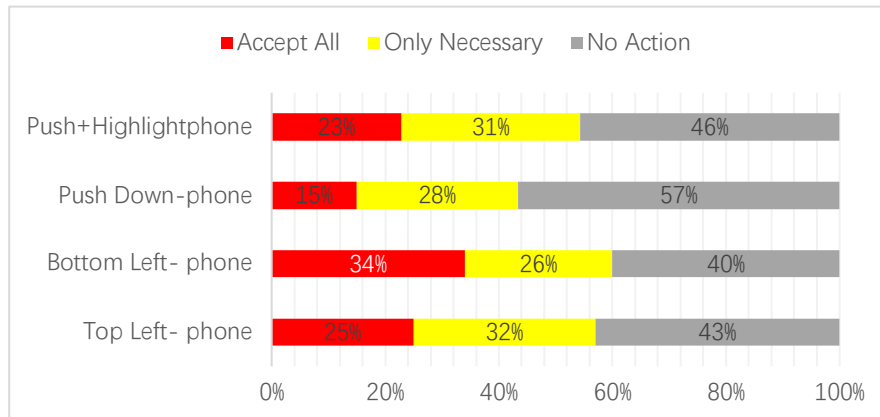


figure 11 Interaction rate and choice compared with 4 designs in exp.2 and exp.2

Based on the above two groups of data (figure 11), I believe that the following two designs may be more able to prompt users to make more positive and meaningful choices: , and the highlighting or designing bottom left notice bar.

4.4 Survey

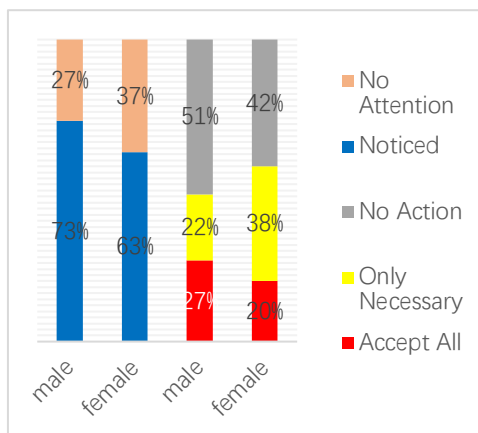


figure 12 Interaction and choice divide in genders

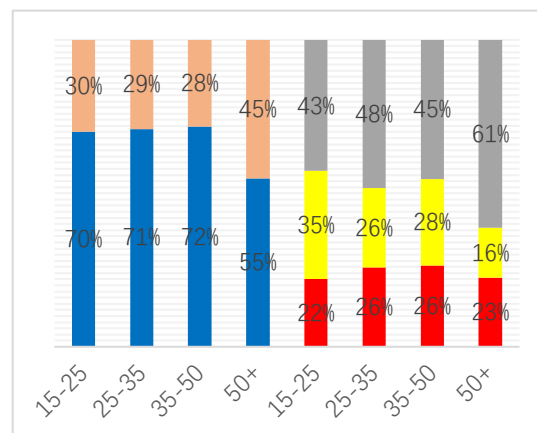


figure 13 Interaction and choice divide in age groups

4.4.1 Possible influencing factors

- i) gender; ii) age; iii) the using habits of Internet; iv) knowledge of cookie

I have drawn many interesting inferences by analyzing the relationship between volunteer attributes and corresponding choices. Males are 10% more likely to notice the cookie notice bar than female (figure 12). The number of volunteers over the age of 50 noticed the cookie notifications have a greatly drop may because of their decreased vision (figure 13). However, up to 51.4% of meals know a few or more about cookies, and only 21.2% of females. 73% of the volunteers who use the Internet extensively could notice the notice bar, 67% of the volunteers with moderate usage frequency could notice, and only 64% of the volunteers who only visited the necessary websites or applications noticed the bar (figure 14).

However, I have noticed that the frequency of Internet use by users is positively related to their knowledge of cookies. It may be proposed that users who know more about cookies or the Internet may be more likely to notice the notice bar of the website. Unfortunately, the factors of gender and age didn't pass the $\chi^2 - test, (p > 0.05)$, so these are not important factors that influencing users' choices.

4.4.2 Detail texts

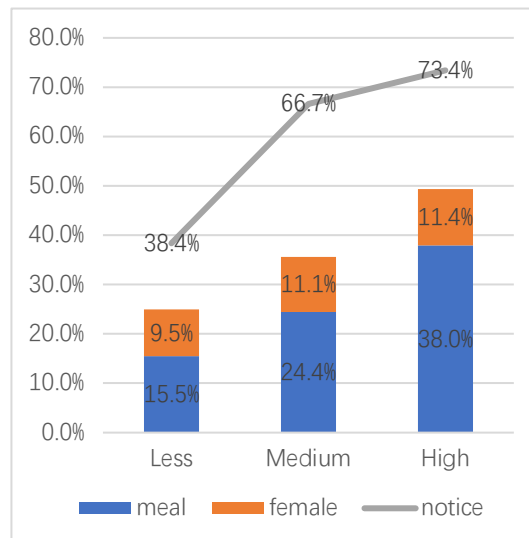


figure 14 The x-axis is the range of network usage, the bar chart show the rate of users have some knowledge about cookie divide in genders. The gray line diagram shows the attention rate.

In the survey, I provide three kinds of notice box, as shown in figure 6, designs according to the degree of detailed description of the texts. From using the most basic “cookie”, replacing “cookie” with “behavior data”, and providing a fine-grained choice of uses for “data” (figure 15). More than half of the participants prefer to select the fine-grained checkbox bar. Surprisingly, the users who choose “behavior data” are even less than the text “cookie”. The answer of survey shows that most of the volunteers who choose “cookies” even don't know any about cookies, I didn't receive any reasons for this choice. It may be that they do not want to choose a complicated checkbox, nor do they want to see the text “behavior data”.

In this part, I received some interesting replies: "I hope it could be more easier to understand", "There are too many texts in checkboxes, the other two are ambiguous, I don't want to choose any of them", "What kind of data is collected?" Get users' data, make better service to users, checkbox is easier to accept."

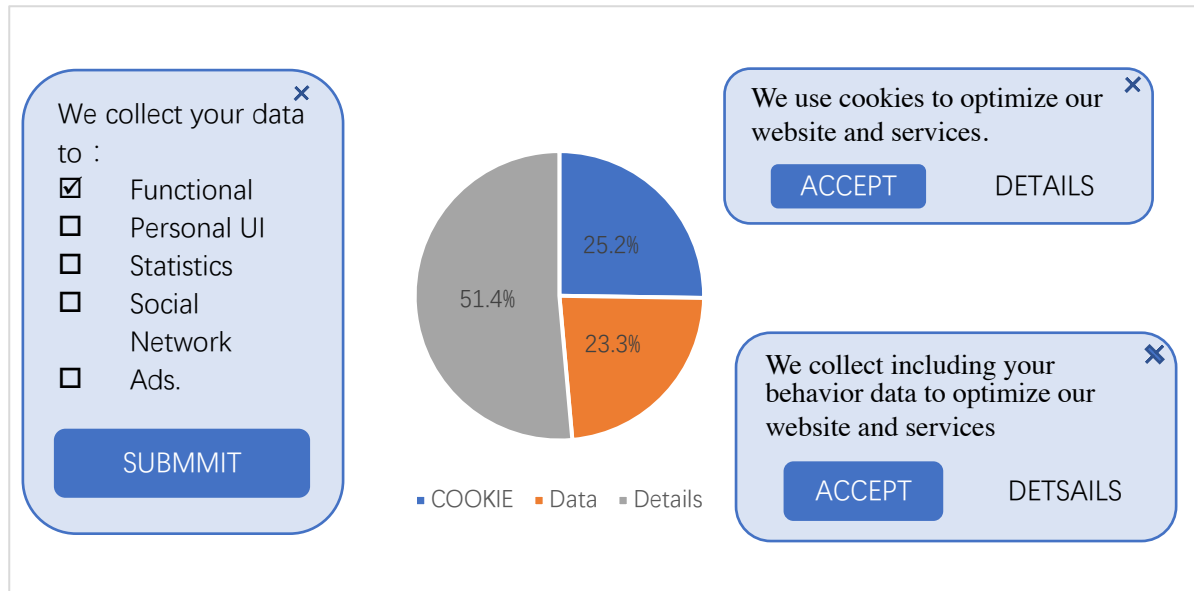


figure 15 the ratio of 3 degrees of detailed text

4.4.3 Necessary Survey

In previous research, [32] it was suggested that the use of cookie notifications by a large number of websites would bring more troubles to users, resulting in many users installing cookie notification blocking plugins. But most blocking plugins will not provide users with more valuable choices, even may bring new security risks, which is completely incompatible with the purpose of this study. In the experiment, I posted a question, whether the cookie notice is necessary. 5.7% of the volunteers did not care about this, 70.5% of the volunteers thought that notification was still necessary, and the other of users thought that I do not need a notice, as long as the web servers provided detailed modification functions for those who care about personal data in the settings interface.

4.4.4 Free textbox

I received a total of 29 free answers in 210 surveys, many of which can bring new inspiration to our future works. Some statements are very fierce, hoping that commercial institutions or organizations can strengthen management and punishment measures: "Public institutions and commercial organizations collect a lot of personal data, but the obligation to protect the data is far from enough, even I consumers have to protect ourselves."; "Compared with the benefits of the black market, the punishment for companies to abuse user data is too mild."

There are also volunteers who are very pessimistic about privacy protection: "Big data is so powerful that personal privacy will no longer exist."; "It doesn't matter, personal information has long been leaked".

Several volunteers mentioned that when using some applications, they have to agree to many permissions, and even if they don't agree, they can't use the application.

Finally, I would like to thank the volunteers who corrected the mistakes and made some suggestions for this experiment.

5 Discussion

This research analyzed the interaction differences brought by cookie notifications of different designs through two sets of experiments and a survey. Although it can get better user attention and interaction rate while the notifications are set in the top left and bottom left positions, the comparative analysis of Chapter 4.2 shows that the position of the bottom left not only blocks the content of the website less than that of the top left but also brings a higher rate of total consent interaction. Therefore, setting the notification to the position bottom left of the web page may prompt users to make more positive and meaningful choices.

When the webpage is full of interest points, placing the cookie notice in the bottom left may block more content, which is not conducive to enhancing the user experience. In experiment 2, we tested two push-down notifications that also have a high interaction rate and will not have any effect on the content of the page. Pushdown notifications use an animation even a highlighted background to attract user attention, have a substantially increased of the interaction rate than a simple notification at the top position.

When setting up the survey of detailed texts, I found that there is no proper Chinese translation for cookies at this stage, and the term cookie itself is not intuitive enough. Moreover, it is difficult to accurately describe with short sentences in various language environments. Users may hardly understand the meaning so that it is impossible to make a valuable choice for cookie notification. In this survey, 22 volunteers thought they knew the cookie completely, but five of them still chose the option "Don't know the result" of choosing "accept all". 81.4% of volunteers believe that the website will collect personal data after choosing "accept all". It may reveal that most volunteers do not actually know about cookies. At present, there is no clear definition of personal privacy data. When it is clear that better services can be obtained, users are often willing to provide more private data. Considering that about half of the users do not interact with the notification till noticed and are unsure of the consequences of not interacting, we specifically added the default notice.

I observe that some users are unwilling to accept the checkboxes that are too many choices, so it is recommended to set the options to 2-3.

E.g "We collect website service data and anonymous behavior data using to this way.
Learn more about our [privacy policy](#) "

Function (without personal data)

- Customization
- Market

[SUBMMIT \(Default after ...\)](#)

[PREFERENCE](#)

limitations. This experiment was taken on an independent website, which has fewer security risks than complex commercial websites, and the experiment was conducted anonymously throughout. Therefore, in this experiment, I had a higher interaction rate than other experiments. Our volunteers may differ from a wide range of Internet visitors because only 210 valid data were collected. But the results from past researches have also been verified in the qualitative research of my experiment. There may be differences caused by the culture from this experiment running in the Chinese environment.

The limitation of the user attributes from the social platform which shared the URL will also cause a certain deviation to the experimental results. Due to the complete reliance on the voluntary participation of volunteers, the proportion of users who are interested in the Internet or privacy may be higher than the actual proportion.

5.1 Research Ethics

My experiment is entirely based on the voluntary participation of each volunteer, and each volunteer could withdraw at any time during the survey. The experiments and survey in this research do neither collect any personal information from any volunteer nor have any third-party services. I can ensure that no volunteers and their privacy will be deceived or compromised. Although there are no strict regulations in the Asian region where the experiment is located, this experiment still complied with the relevant GDPR regulations throughout the research. The experimental data is stored in the personal AWS server. After the research is completed, the server data will be formatted and the unidentified questionnaire data will be transferred to the researcher's computer.

6 Related works

How to protect personal privacy data on the Internet has always been valued by researchers. Especially, various countries or regions are actively improving relevant laws and regulations in recent years, which has greatly promoted the development of privacy protection. There is a special type of user's personal data, cookies, that have attracted the interest of many researchers.

It undoubtedly provides an economic foundation for free Internet services of the widely used of cookies [24] [26], and it also brings more convenient functions, the functions most common is a cookie-based authentication system [19] [20]... Lots of researchers have focused on exploring the security of the cookie using just because

cookies may contain the feature that can verify the unique identity of users. For the reasons of compatibility or performance, some websites still using an unencrypted protocol HTTP. Suphannee et al. proposed that through the flaw of the cookie, user's browsing history, search history and even the user's name, location, and mail address may be leaked [21]; Panagiotis et al. found that cookies may still record the user's browsing history when using anonymous tools such as Tor [22].

To ensure the transparency of the data collection and use, the acts of many regions or countries, mainly of GDPR, have put forward requirements for network service providers [35]. The researches [1] [10] [27-30][38] statistics on the situation of cookie notifications on global websites. Even in Europe, there are still many websites that do not have a notification bar or the notification bar does not comply with the GDPR regulations. The results are the same. Similar to the findings of my study, these researches rarely see notices related to privacy policies on Chinese websites. Iskander et al. tracked the use of cookies by 2,000 famous websites including Europe, the United States, and China [28]. It proposed that GDPR is mainly for the processing of personal information, but lack an explanation of cookies and the technical guidelines. And the main source of income of most current websites is the advertising revenue from these cookies, (the advertising loss caused by users rejecting cookies is even more than the possible penalty by GDPR [31]). The current cookie privacy policy is far from the proponents' vision.

[30] researched the operation of the website after the user interacted with the "cookie notification" and found that 141 websites regarded the non-interaction as "accept". Even if the user explicitly chose to exit, there were still 27 websites stored as "accept". More than half of the websites have such violations. The results of [10] show that the third-party services on the website either lack the function of "without using cookies" or require major changes to the website to meet the regulations. [28] After observing the rejection of the cookie collection request, only returning a static text webpage also confirmed this view. It observed in the paper [28] that returns only static text pages after rejecting cookie collection requests also confirm this point.

Past researchers have made efforts of the design on the cookie notice bar in the Latin language environment. A qualitative study [32] was made on the text of cookie notifications proposed that the text will not significantly affect whether users agree to collect the cookies. Instead, the cookie notice bar is considered a threat to their privacy. The user's decision depends more on the trust of the website. [10] [28] categorize the options given in the notice bar; [1] [27] synthesize the relationship between these design attributes "position, text, link, selection scheme, highlight " of notification bar and users interaction. [33] [34] Investigate some tools that provide detailed "cookie usage settings", but such tools often cost additional learning to users.

7 Summary

The past research has been conducted mainly in the regions of the United States, Canada, the United Kingdom, and the European Union that have implemented personal data collection regulations at present. The language environment and educational background of network visitors of the area were using Chinese is different from the above areas. Therefore, I conducted targeted experiments and surveys. Firstly, I investigated the existing privacy policy notification solutions of Chinese websites. Then I studied the tendency and reasons for Chinese users' interaction with the "cookie notification" and understand the expected design of the users. At last, I try to give the recommended scheme for cookie design, to enable users to make more meaningful choices and achieve a win-win situation for users and network service providers instead of Inducing users to accept or reject the notice.

There may have a few other valuable solutions to encourage users to make more valuable choices in my opinion. For users, the survey results show that Chinese netizens currently have limited knowledge of cookies, so the web servers could randomly recommend related popular science articles in daily browsing and introduce what better services they bring after obtaining cookies. Users are often aware of the dangers of privacy leakage but do not understand the benefits after providing data. For network service providers, they should focus on cultivating user's trust, continuously improve their own security level, and use technology to avoid risks. The key is to be able to gradually improve the legal.

Future works: Expand the scope of the experiments. The current experimental data is very limited and is built on a dedicated survey website. More accurate data can be obtained by making larger experiments in natural websites; Taking a regularly experiment to investigate the changing of user interaction with cookies notification; Track the use of personal data such as cookies by the website to verify whether the privacy policy provided by the website is complete or the authenticity of privacy settings.

Better handling of private data. For example, it proposes a model that can disrupt the relevance of cookies from the same user and fragment personal data.

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Appendix A Survey

Page 1

Q1 age group

A. Under 15 B. 15-25 C. 25-35 D. 35-50 E. Over 50

Q2 gender

A. male B. female C. other

Q3 network preferences

A. widely used B. normal C. only necessary websites

Q4 device

A. smartphone B. computer

Q5 Did you notice the privacy policy reminder box on the page before answering this question?

yes

no

Q6 Did you interact with the privacy policy reminder box

Yes, accept all

Yes, only accept the necessary cookie

Q7 Reasons for **no interaction** (multiple choices) (skip this question if interact)

I don't know what choice to make/ what happens

No choice I want

Don't care

Q8 Which of the following options meets your motivation to select **accept all** (multiple choices)

can better protect privacy

get a better experience

A habit

Block the webpage

Q9 Which of the following options meets your motivation to choose to **only accept the necessary** (multiple choices)

Do not want to provide too much personal data

Not sure about the result of accept all

Q10 What do you think will happen if you choose **accept all** (multiple choices)

Personal information will be collected

Website content will change

Advertising content will change

do not know

Q11 What do you think will happen if you **don't make any choices?** (Multiple choice)

cookie will not be collected

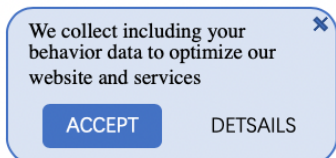
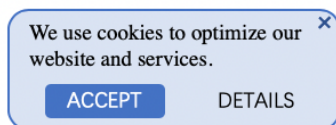
= accept all

= only accept necessary

Have limited access

Don' know

Q11 Which of the following three reminders do you prefer? (Optional reason)



We collect your data ×
to :
 Functional
 Personal UI
 Statistics
 Social
Network
 Ads.

Page 3

Q12 When you visit a website or application, what information do you think will be collected?

My browsing history

my location

My IP address

The device I use when accessing

my name

My contact information (email or phone)

Will not collect any of my information

Q13 Have you ever set privacy settings on a website or app?

Yes

Noticed, but didn't set

Never noticed / don't care

Q14 Do you know what COOKIE means on the Internet

do not know

Have seen, but don't know

Understand the approximate meaning

Fully understand

Q15 Do you think it is necessary for websites to send notifications when collecting information?

No, I don't need

Not necessary, but should be provided in settings

It's necessary

Free text

Appendix B

List of top 375 popular websites in China (July 2020)

tmall.com	jianshu.com	runoob.com	fairwhale.tmall.com
baidu.com	amazon.cn	scotfield.tmall.com	cnbeta.com
qq.com	myhome.tmall.com	ku.tmall.com	earthmusic.tmall.com
sohu.com	bing.com	qdn.cn	91jm.com
login.tmall.com	cnnic.cn	wt.tmall.com	nanxie.tmall.com
taobao.com	gmw.cn	shouji.tmall.com	zol.com.cn
360.cn	aimer.tmall.com	jeanswest.tmall.com	house365.com
jd.com	err.tmall.com	threegun.tmall.com	babyschool.com.cn
pages.tmall.com	crabsecret.tmall.com	nvxie.tmall.com	chinayigui.com
sina.com.cn	miao.tmall.com	anta.tmall.com	umeng.com
weibo.com	gap.tmall.com	kolonsport.tmall.com	huamu.cn
xinhuanet.com	lee.tmall.com	lining.tmall.com	zhcw.com
csdn.net	spao.tmall.com	lafuma.tmall.com	chinafloor.cn
alipay.com	youtube.com	nike.tmall.com	chinachugui.com
zhanqi.tv	jiameng.com	maniform.tmall.com	chinamenwang.com
google.com.hk	neiyi.tmall.com	basichouse.tmall.com	cnzz.com
panda.tv	81.cn	hollisterco.tmall.com	winshang.com
china.com.cn	sonhoo.com	kq36.com	youku.com
tianya.cn	huaban.com	baby.tmall.com	weixinyuanuan.com
huanqiu.com	haofang.net	gucn.tmall.com	chinanetrunk.com
sogou.com	youdao.com	new3c.tmall.com	pcbaby.com.cn
yy.com	58.com	it.tmall.com	gongchang.com
babytree.com	douban.com	langsha.tmall.com	morningpost.com.cn
17ok.com	chinaz.com	smm.cn	huim.com
detail.tmall.com	360.com	jia.tmall.com	258.com
mama.cn	efu.com.cn	imis.tmall.com	9384.com
jrj.com.cn	youth.cn	septwolves.tmall.com	eee114.com
google.cn	toutiao.com	haoyer.com	chinaweiyu.com
1688.com	haosou.com	semir.tmall.com	vvvdj.com
soso.com	ih5.cn	triumph.tmall.com	v2ex.com
so.com	mfisp.com	newbalance.tmall.com	home77.com
bilibili.com	focus.cn	calvinklein.tmall.com	weihai.com
yao.tmall.com	yixiin.com	watch.tmall.com	jia400.com
hao123.com	gusuwang.com	bershka.tmall.com	to8to.com
gome.com.cn	ibicn.com	discoveryexpedition.tmall.com	douyu.com
cnblogs.com	liansuo.com	all.com	chaduo.com
6.cn	ekaie.com	marksandspencer.tmall.com	w3school.com.cn
aliyun.com	dyson.tmall.com	com	xabbs.com
rednet.cn	iyiou.com	esprit.tmall.com	chinadaily.com.cn
zhihu.com	mseav.com	lachapelle.tmall.com	cofeed.com
163.com	bzw315.com	tonlion.tmall.com	china.net
iqiyi.com	tecent.com	peacebird.tmall.com	jb51.net
eastday.com	360doc.com	qiannaimei.tmall.com	eastmoney.com
3c.tmall.com	fun48.com	book.tmall.com	rencaijob.com
google.com	xialin.com	jackjones.tmall.com	creditchina.gov.cn
nvzhuang.tmall.com	cpic.com.cn	dickies.tmall.com	spzs.com
subject.tmall.com	bag.tmall.com	topshop.tmall.com	wordpress.com
uniqlo.tmall.com	nanzhuang.tmall.com	gainreel.tmall.com	99114.com
food.tmall.com	car.tmall.com	forever21.tmall.com	segmentfault.com
nianhuo.tmall.com	cabbeen.tmall.com	oschina.net	3dmgame.com
51sole.com	urfs.tmall.com	dai.tmall.com	iliangcang.com
list.tmall.com	honeys.tmall.com	it168.com	azhhan.com
51.la	sports.tmall.com	eland.tmall.com	gamersky.com

baike.com	cfsbcn.com	oeeee.com	appgame.com
chinaz.com	tudou.com	5dcar.com	mojifen.com
newsmth.net	126.com	wangzhuanz.com	bbwhf.com
www.gov.cn	jzjncy.com	jjwxc.net	worktile.com
zhibo8.cc	52pojie.cn	chooseauto.com.cn	ccidnet.com
alimama.com	wjdiy.cn	ali213.net	66cruises.com
znds.com	wto168.net	xuannaer.com	fanlibang.com
zxxk.com	meituan.com	kdslife.com	chinaswitch.com
zhaopin.com	chinabm.cn	smzdm.com	hea.cn
dianping.com	cdstm.cn	80073.com	modernweekly.com
jnu.edu.cn	gh0089.com	lamabang.com	yinyuetai.com
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sf-express.com	zbgw.cc	mgtv.com	ywart.com
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