

Fig. 1. Screenshots of a web browser requesting the permission. (The English translations are shown in speech bubbles.)

The following questionnaire used in the study of the paper "Browser Permission Mechanisms Demystified" to be presented at NDSS2023. For more information, please visit the official webpage <https://permium.seclab.jp/>.

## I. QUESTIONNAIRE USED IN SECTION VI

In this section, we show the questionnaire used in section V of the paper.

**Introduction :** When you answer the questions, assume that you are operating your own computer or smartphone. Also, assume that your computer or smartphone has hardware such as a camera or microphone connected to it. In each question, if the browsing mode is not specified, it is assumed that you are using your web browser in "Normal Browsing Modes" and not in "Private Browsing Modes." In the questions, "web browser" refers to the web browser that you normally use. In this survey, each section is independent, and the web browser status of other sections does not affect the web browser status of the next section. There will be no increase or decrease in reward based on the results of your selection.

### Questions about base knowledge.

**Q1.** Have you ever seen the permission request prompt shown in the Figure 1 while using a web browser? (regardless of permission type or mobile/desktop)

- Yes
- No
- I don't know.

**Q2.** Which web browsers do you use? (Multiple choice)

- Chrome
- Firefox
- Edge
- Brave
- Safari
- Other web browsers

**Q3.** Which devices do you use? (Multiple choice)

- Laptop or desktop computer with Windows installed

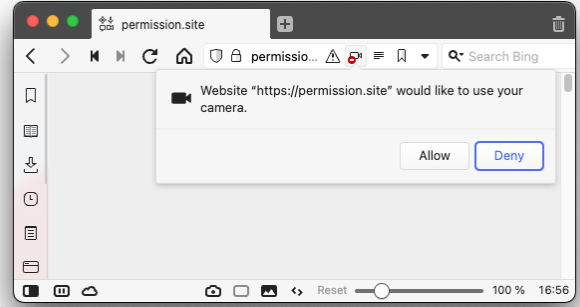


Fig. 2. Screenshot of a web browser requesting the camera permission. (Japanese prompts were used in the survey. The prompts are shown translated into English.)

- Laptop or desktop computer with Mac installed
- Android smartphone
- Android tablet
- iPhone
- iPad
- Other laptop or desktop computer
- Other smartphone
- Other tablet

**Q4.** Many web browsers have a "Private Browsing Mode" feature in addition to the "Normal Browsing Mode," which is designed to protect user privacy. The "Private Browsing Mode" is called differently by each web browser. (Chrome : Incognito mode, Incognito Window, Safari, Firefox : Private Browsing) In this study, these features are called "Private Browsing Mode" as a generic term.

**Q5.** Do you know "Private Browsing Mode" of web browsers?

- Yes
- No

**Q6.** Have you ever used the "Private Browsing Mode" of web browser?

- Yes
- No
- I don't know.

### Questions about U1.

**Q7.** You are browsing a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q8.** Please answer the following questions regarding what the website can do when "denied" is selected for camera permissions.

**Q9-(a).** The website can record camera footage.

- Yes
- No
- I don't know.

**Q9–(b).** The website can send camera footage to an external source.

- Yes
- No
- I don't know.

**Q10.** Please answer the following questions regarding what the website can do when “granted” is selected for camera permissions.

**Q11–(a).** The website can record camera footage.

- Yes
- No
- I don't know.

**Q11–(b).** The website can send camera footage to an external source.

- Yes
- No
- I don't know.

#### Questions about U2.

**Q12.** You are browsing a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q13.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser.

**Q14.** You launched the web browser and accessed the same website again. The website requested camera permission.

**Q15–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied”.

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q15–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted”.

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q16.** You are browsing a website using the “Private Browsing Mode” of a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q17.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser.

**Q18.** You launched the web browser and accessed the same website again in “Private Browsing Mode”. The website requested camera permission.

**Q19–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied”.

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q19–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted”.

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

#### Questions about U3.

**Q20.** In the questions, “a website” is defined as a website that you have not visited in the past.

**Q21.** You are browsing a website in “Normal browsing mode” of a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q22.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser.

**Q23.** You launched the web browser and accessed the same website again in “Private Browsing Mode.” The website requested camera permission.

**Q24–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied”.

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q24–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted”.

- The web browsers automatically allow.

- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q25.** In the questions, “a website” is defined as a website that you have not visited in the past.

**Q26.** You are browsing a website in “Private browsing mode” of a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q27.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser.

**Q28.** You launched the web browser and accessed the same website again in “Normal Browsing Mode”. The website requested camera permission.

**Q29–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied.”

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q29–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted.”

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

#### Questions about U4.

**Q30.** Web browsers provide a feature that allows users to erase data stored in the web browser, such as access history and website data. In this user study, this feature is called the “clear data mechanism.”

**Q31.** Have you ever known a “clear data mechanism” in web browsers?

- Yes
- No

**Q32.** Have you ever used a “clear data mechanism” in web browsers?

- Yes
- No
- I don't know.

**Q33.** You are browsing a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q34.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser. You left that website open and used the “clear data mechanism” in your web browser to erase the data stored in your web browser.

**Q35.** You returned to the website you had just left open. You reloaded the website. The website requested a camera permission.

**Q36–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied.”

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q36–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted.”

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q37.** You are browsing a website in “Private browsing mode” of a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q38.** ★ You have selected “denied” or “granted” for camera permissions, and then closed your web browser. You left that website open and used the “clear data mechanism” in your web browser to erase the data stored in your web browser.

**Q39.** You returned to the website you had just left open. You reloaded the website. The website requested a camera permission.

**Q40–(a).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “denied.”

- The web browsers automatically allow.
- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q40–(b).** Please answer how the web browser handles a re-requested permissions in case the choice of ★ is “granted.”

- The web browsers automatically allow.

- The web browsers automatically deny.
- The web browsers do not automatically grant or deny permissions. The permission request prompt pops up again, and the user chooses to allow or deny.
- I don't know.

**Q41.** You are using a web browser to browse a website. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q42.** Please answer the following questions regarding what the website can do when “denied” is selected for camera permissions.

**Q43–(a).** The website can record camera footage.

- Yes
- No
- I don't know.

#### Questions about U5.

**Q44.** In the questions, “a website” is defined as a website that you have not visited in the past.

**Q45.** You are browsing a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q46.** You closed the permission request prompt without selecting either the “allow” or “deny” button.

**Q47.** Please answer the following questions regarding what the website can do at this time.

**Q48.** The website can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don't know.

**Q49.** You continue to browse a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q50.** You closed the permission request prompt without selecting either the “allow” or “deny” button.

**Q51.** Please answer the following questions regarding what the website can do at this time.

**Q52.** The website can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don't know.

**Q53.** You continue to browse a website using a web browser. The website requests camera permission, and the permission request prompt pops up on your web browser. (see Figure 2).

**Q54.** You closed the permission request prompt without selecting either the “allow” or “deny” button.

**Q55.** Please answer the following questions regarding what the website can do at this time.

**Q56.** The website can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don't know.

**Q57.** Consider the situation described here, where the same website requests camera permissions multiple times, and you repeatedly close the permission request prompt. How do you think about the behavior of a web browser repeatedly displaying permission request prompts?

- Appropriate
- Somewhat appropriate
- Not really appropriate
- Not appropriate
- I don't know

**Q58.** Do you think that a mechanism should be implemented to prevent web browsers from displaying permission request prompts when the same website requests camera permissions multiple times?

- I strongly agree.
- Somewhat agree
- Somewhat disagree
- I strongly disagree.
- I don't know

**Q59.** Do you think a mechanism has already been implemented to prevent the web browser from displaying permission request prompts when the same website requests camera permissions multiple times?

- Yes
- No

**Q60.** As explained in this question, consider a situation in which the same website requests camera permissions multiple times, and you repeatedly close the permission request prompt. Do you think that the web browser should automatically deny the permission request by the website in this case?

- I strongly agree.
- Somewhat agree
- Somewhat disagree
- I strongly disagree.
- I don't know

#### Questions about U6.

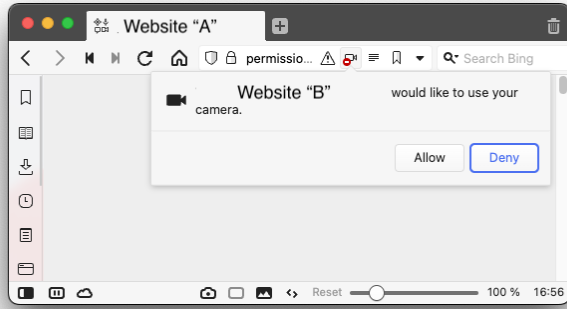


Fig. 3. Screenshot of a web browser requesting the camera permission. (Japanese prompts were used in the survey. The prompts are shown translated into English.)

**Q61.** In the questions, website “A” and “B” are defined as websites that you have not visited in the past.

**Q62.** You are browsing website “A”. As you continue browsing website “A,” website “B,” which is different from website “A,” requests camera permission. A permission request prompt from website “B,” appears on top of the content of website “A” (see Figure 3).

**Q63.** Please answer the following questions regarding what the website “A” and “B” can do when “denied” is selected for camera permissions.

**Q64-(a).** The website “A” can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don’t know.

**Q64-(b).** The website “B” can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don’t know.

**Q65.** Please answer the following questions regarding what the website “A” and “B” can do when “granted” is selected for camera permissions.

**Q66-(a).** The website “A” can get/use camera footage connected to your computer or smartphone.

- Yes
- No
- I don’t know.

**Q66-(b).** The website “B” can get/use camera footage connected to your computer or smartphone.

- Yes
- No

- I don’t know.

**Q67.** As explained above, the behavior in which permission request prompts from a website different from the one you are viewing are displayed on top of the website you are viewing is called “displaying permission request prompts on a different site” (see Figure 3).

**Q68.** How do you think about “displaying permission request prompts on a different site”?

- Appropriate
- Somewhat appropriate
- Not really appropriate
- Not appropriate
- I don’t know

**Q69.** Please describe the reason for your answer to the previous question Q68 (free writing).

**Q70.** Please describe your findings and thoughts about this user study. (free writing)

**Q71.** Please describe your findings and thoughts about the implementation or mechanisms related to web browsers and web site permissions. (free writing)

**Q72.** Please describe your findings and thoughts about the Private Browsing Mode. (free writing)

## II. QUESTIONNAIRE USED IN SECTION VII-B

In this section, we show the questionnaire used in Section VII-B of the paper.

### Questions about the conditions of the participants :

**Q1.** Are you accessing from an iPhone?

- Yes
- No

**Q2.** Do you use an iPhone on a regular basis?

- Yes
- No

**Q3.** Are you 18 years of age or older?

- Yes
- No

**Introduction :** This experiment consists of four surveys. Please read the description of each survey and answer the questions.

### Q4. Decision on which website requests permission.

**Explanation :** When using a web browser application such as Chrome for web browsing, requests for access permissions to various features such as camera and location information may occur. When permission is requested, the browser prompts the user to choose whether or not to grant or deny the permission. The following describes the situation in this survey.



Fig. 4. A screenshot of normal situation (The English translations are shown in speech bubbles.)

In this study, assume that you are browsing the website using the Chrome browser app on your iPhone. At that time, the following permission request prompt (Figure 4) appears on the screen of your smartphone. Please answer the questions listed below in relation to this situation.

From which website do you think you received this permission request? When the screen presented above is displayed on your own smartphone, from which website do you think you received this permission request? Please select one website that is the source of the permission request from the options listed. If you think the request is from a website other than listed in the options, please select "Other" and enter the name of the website.

- Restaurant Site
- Google Site
- Other (free-text entry)

#### Q5. Decision on which website requests permission.

**Explanation :** When using a web browser application such as Chrome for web browsing, requests for access permissions to various features such as camera and location information may occur. When permission is requested, the browser prompts the user to choose whether or not to grant or deny the permission. The following describes the situation in this survey.

In this study, assume that you are browsing the website using the Chrome browser app on your iPhone. At that time, the following permission request prompt (Figure 5) appears on the screen of your smartphone. Please answer the questions listed below in relation to this situation.



Fig. 5. A screenshot of attack situation (The English translations are shown in speech bubbles.)

From which website do you think you received this permission request? When the screen presented above is displayed on your own smartphone, from which website do you think you received this permission request? Please select one website that is the source of the permission request from the options listed. If you think the request is from a website other than listed in the options, please select "Other" and enter the name of the website.

- Restaurant Site
- Google Site
- Other (free-text entry)

#### Q6. Reasons for Decision

**Explanation :** When using a web browser application such as Chrome for web browsing, requests for access permissions to various features such as camera and location information may occur. When permission is requested, the browser prompts the user to choose whether or not to grant or deny the permission. The following describes the situation in this survey.

In this study, assume that you are browsing the website using the Chrome browser app on your iPhone. At that time, the following permission request prompt (Figure 6) appears on the screen of your smart phone. You need to select either "Deny/Allow" at the permission request prompt displayed. At this time, what information do you use as the reason for your "Deny/Allow" decision?

Please select all information that is the basis for your decision to "Deny/Allow." (Multiple choice) If you have a basis for decision other than the options, please select "Other" and enter the basis for your decision.



- Authoritativeness of the website
- Trustworthiness of the website
- Other (free-text entry)

Fig. 6. A screenshot of Google search results (The English translations are shown in speech bubbles.)

- Website from which permission is requested
- Necessity of permission
- Permission type
- Timing of permission prompt
- No basis for judgment as I always allow it.
- No basis for judgment as I always deny it.
- Other (free-text entry)

#### Q7. Reasons for Decision

**Explanation :** I ask this question to those who selected “Website from which permission is requested” in the previous question. Please click “Next” without selecting anything if you did not select “Website from which permission is requested” in the previous question. I would like to ask you about your decision after you know which websites request permission. What information about the website do you use to decide whether to grant or deny a permission request?

Please select all information that is the basis for your decision to “Deny/Allow.” (Multiple choice) If you have a basis for decision other than the options, please select “Other” and enter the basis for your decision.

- Features provided by the website
- Daily use or not
- Existence of a description of the purpose
- Appearance of the website
- Expertise of the website