Can Systems Explain Permissions Better? Understanding Users' Misperceptions under Smartphone Runtime Permission Model

(Supplementary Materials)

This supplementary material contains four parts: (1) permission group comprehension results (§I) (2) interview study questions (§II), (3) survey 1 instrument (§III), and (4) survey 2 instrument (§IV).

I. PERMISSION GROUP COMPREHENSION RESULTS

For full results of the permission group comprehension survey, please refer Table I and Table II.

II. INTERVIEW STUDY PROCEDURES AND INTERVIEW QUESTIONS

We provide the whole scripts and questions for interview study design as follows.

General phone usage and background.

- *What is your current Phone model and OS version?* We collected their current phone model and OS version. If the participant do not know what is the OS version, we help them find and record it. If the participant's Android OS version is less than 6.0, we will terminate the study.
- *How much time do you spend with your phone each day? How long have you been using the current operating system?*

Permission comprehension

- *Can you find the settings for permissions? If so, can you show it to us?* If the participant can not find, the interviewer will help the participants navigate to the centralized permission display.
- *How often do you use the permission settings? Will you check the app permissions regularly?* We did not follow up to ask if they check them regularly if they said they never used it before.
- *Can you explain what will an app be allowed to access, if you grant this permission? what can this app do with the resources?* We asked this question when the participants were viewing the centralized permission management display for both iOS and Android. We randomly picked 4-5 permission groups for each participant.

Permission experience

- *Have you find some permissions that you feel uncomfortable while using some app?* We ask if they have met uncomfortable permission requests and also provide specific details such as the permission group and app's name. We further asked why they find the permission requests uncomfortable

and what specific concerns that they have for permission grant.

Permission decision factors

- *Are there any cases that you are not sure about some permissions? Do you feel confident when you are making permission decisions? Why?* We further asked why they have such feelings and follow up on the next question.
- *What concerns do you have when you grant this permission? What information will be helpful for you to mitigate the concerns?*

App store attention

- *What do you usually look at before downloading apps in the app store? Why?* We show the participants the app store with corresponding iPhone or Android phone with the latest OS versions. We randomly open app as an example.
- *(Android only) Can you find the permission information for this app in the app store?*

Permission mechanism changes.(Android users only) We show the participants the prompt when downloading the "Camera FV-5 Lite" (an app built with install time permission model) on Android 9.0 with provided phone, and ask if the permissions will be granted after click "accept" and whether they will be prompted permission dialog in after they start using the apps. We further ask for reasons.

Permission rationale in dialog.(iOS users only) We show the screenshot of `Camera` permission request for "Prisma" (an app to stylize photos) on iPhone, and ask whether the rationale in the dialog is from the systems or the app developers. In the follow up, we also ask for reasons of why they have such perception and how they like this message.

III. SURVEY 1 INSTRUMENT

A. *Operating system*

Q 1. What is your current mobile phone's operating system?

◯iOS (For iPhones) ◯Android
Based on answer to this question, iOS respondents will answer Section III-B and III-D . Android respondents will answer Section III-C and III-E. The other sections remain the same.

B. *iOS Background*

Q 2. What are your current phone's model and iOS version? (e.g. iPhone 6s, iOS 12.1.3) (Note: You can find iOS version at Settings > General > About > Version.)

TABLE I: Permission group comprehension full results part 1. Table 6 in the original paper. ✓and ✗mark correct and incorrect responses respectively. - means the option is not provided for the OS platform. The options was shuffled and only four questions were randomly drawn for one respondent.
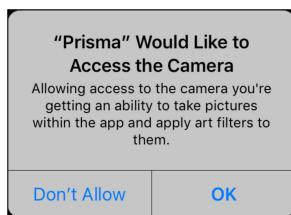
Permission Group	Options	Android		iOS	
Calendar Android: Allow [App]to access your calendar iOS: [App] would like to access your calendar	✓Save events to your calendar	44	62.9%	63	84.0%
	✓Read your calendar	61	87.1%	69	92.0%
	✗ Make phone calls	9	12.9%	0	0%
	✗ Send SMS	5	7.1%	1	1.3%
	✗ None of these	0	0%	0	0%
	I don't know	1	1.4%	0	0%
Contact Android: Allow [App] to access your contacts? iOS: [App] would like to access your contacts.	✓Read your contacts	65	90.3%	62	88.6%
	✓Save new contact to your phone	24	**33.3%**	29	**41.4%**
	✓Read your Google account email address	17	**23.6%**	-	
	✗ Read your location	6	8.3%	8	11.4%
	✗ Make phone calls	9	12.5%	6	8.3%
	✗ None of these	1	1.4%	1	1.4%
	I don't know	1	1.4%	0	0%
Camera Android: Allow [App] to take pictures and record videos? iOS: [App] would like to access the camera.	✓Take pictures and record videos	62	88.6%	65	90.3%
	✗ Read pictures and videos	29	**41.4%**	24	**33.3%**
	✗ Read your contact	3	4.3%	9	12.5%
	✗ Read your location	8	11.4%	6	8.3%
	✗ None of these	1	1.4%	1	1.4%
	I don't know	0	0%	1	1.4%
Microphone Android: Allow [App] to record audio? iOS: [App] would like to access the microphone.	✓Record your voice	55	88.7%	72	91.1%
	✓Record your voice when the app is in the b.g.	39	62.9%	42	53.2%
	✗ Access your calendar	4	6.45%	-	
	✗ Make a phone call	-		16	**20.2%**
	✗ Read your photos	5	8.1%	2	2.5%
	✗ None of these	2	3.2%	1	1.4%
	I don't know	0	0%	0	0%
Location Android: Allow [App] to access this device's location ? iOS: [App] would like to access your location. (*Always allow* is chosen)	✓Read your location	74	90.0%	-	
	✓Read your location when you're using the app	-		53	82.3%
	✓Read your location when the app is in the b.g.	-		53	82.3%
	✗ Make phone calls	11	13.4%	6	9.4%
	✗ Read your photos	8	9.8%	7	10.9%
	✗ None of these	2	2.4%	2	3.1%
	I don't know	1	1.2%	0	0%
Body Sensor Android: Allow [App] to access sensor data about your vital signs? iOS: [App] would like to access your motion & fitness activity.	✓Read your steps count	46	63.0%	48	78.7%
	✓Read your heart rate history	53	72.6%	-	
	✗ Read your fingerprints	22	**30.1%**	-	
	✗ Read your face ID	11	15.1%	-	
	✓Read the info. from sensors on your phone	-		45	73.8%
	✓Read your running history	-		45	73.4%
	✗ Read your contacts	-		2	3.2%
	✗ None of these	2	2.7%	0	0%
	I don't know	12	**16.4%**	4	6.6%

Q 3. How many years have you been using iPhone?

◯less than 3 years ◯3 - 7 years ◯more than 7 years

Q 4. Please read the following screen shot from iPhone.

| **"Prisma" Would Like to** |
| **Access the Camera** |
| Allowing access to the camera you're getting an ability to take pictures within the app and apply art filters to them. |
| Don't Allow   OK |

The explanation "Allowing access to the camera you're getting an ability to take pictures within the app and apply art filters to them" is from?

◯iOS or the system ◯App developer ◯I don't know

C. Android Background

Q 5. What is your current phone's make and model?(e.g. Samsung S9) _____

Q 6. What is your current Android version? (You can find this information under Settings > About Phone > Android Version)

◯Below 6.0 ◯6.0 - ◯7.0 - ◯8.0 - ◯9.0 -
If below 6.0 is selected, survey will end immediately.

**Q 7.** How many years have you been using Android?
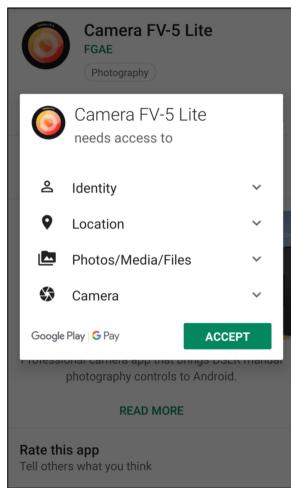
◯less than 3 years ◯3 - 7 years ◯more than 7 years

TABLE II: Permission group comprehension full results part 2. Table 6 in the original paper. ✓and ✗mark correct and incorrect responses respectively. - means the option is not provided for the OS platform. The options was shuffled and only four questions were randomly drawn for one respondent.

Permission Group	Options	Android		iOS	
Phone (Android only) Msg: Allow [App] to make and manage phone calls?	✓Get your phone number	32	**47.0%**		
	✓Get your phone unique ID (e.g. IMEI)	16	**23.5%**		
	✓Make phone call	54	79.4%		
	✓Answer phone call	45	66.2%	-	
	✓Know whether the phone is making phone calls	42	61.8%		
	◊ Read call history	36	52.9%		
	✗ Read your location	9	13.2%		
	✗ Read your calendar	4	5.9%		
	✗ None of these	1	1.5%		
	I don't know	3	4.4%		
Storage (Android only) Msg: Allow [App] to access photos, media, and files on your device?	✓Read this app's photos, media, and files	52	78.8%		
	✓Read other app's photos, media, and files	33	54.5%		
	✓Save new photos, media, and files	36	50.0%	-	
	✗ Read your location	4	6.1%		
	✗ Make phone calls	4	6.1%		
	✗ None of these	1	1.5%		
	I don't know	2	3.0%		
SMS (Android only) Msg: Allow [App] to send and view SMS messages?	✓Read your SMS messages	59	79.7%		
	✓Send SMS messages	64	84.6%		
	✗ Read your location	11	14.9%	-	
	✗ Make phone calls	7	9.5%		
	✗ None of these	10	10%		
	I don't know	2	2.7%		
Call Log (Android only) Msg: Allow [App] to access your phone call logs?	✓Read your call history	74	89.1%		
	✓Save new call record	31	**37.3%**		
	✗ Read your contacts	32	**38.5%**	-	
	✗ Get your phone number	25	**30.1%**		
	✗ None of these	1	1.2%		
	I don't know	4	4.8%		
Photo (iOS only) Msg: [App] would like to access your photos.	✓Read all photos on the device			66	94.3%
	◊ Delete photos on the device			13	18.6%
	✗ Read all files on the device	-		7	10.0%
	✗ Delete any files on the device			1	1.4%
	✗ None of these			2	2.9%
	I don't know			1	1.4%
Health (iOS only) Msg: [App] would like to access and update your health data in Steps. (A separate page with requested health data will be shown)	✓Read your steps count			48	70.6%
	✓Store your steps count			55	80.9%
	✗ Read your heart rate	-		33	**48.5%**
	✗ Read your workouts history			31	**45.6%**
	✗ None of these			1	1.5%
	I don't know			3	4.4%
Media (iOS only) Msg: [App] would like to access Apple music and your media library.	✓Play music in your media library			58	80.6%
	✓Edit your play list in apple music			37	51.4%
	✗ Take pictures and store videos	-		11	15.3%
	✗ Record your voice			6	8.3%
	✗ None of these			4	5.5%
	I don't know			5	7.0%
Bluetooth Sharing (iOS only) [App] would like to make data available to nearby Bluetooth	✓Scan the list of nearby bluetooth devices			45	65.2%
	✓Exchange data with connected bluetooth devices	-		58	84.1%
	✗ Read your messages devices even when you're not using the app.			2	2.9%
	✗ Make phone calls			2	2.9%
	✗ None of these			1	1.4%
	I don't know			2	2.9%

[*] *Read call history* moved to a new `Call Log` group since Android 9.0; *Delete photos on the device* will need extra confirmation.

Q 8. Read the following picture captured from app store (e.g. Google Play) when installing an app.
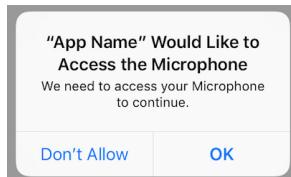

Answer the following questions.

(1) Will this app have access to the listed resources immediately? ◯Yes ◯No

(2) Can you change the permission settings for this app? ◯Yes ◯No

(3) Will this app ask again for these permissions when you are using this app? ◯Yes ◯No

D. iOS Comprehension

Four out of ten questions in this section will be randomly selected for each respondent. "I do not know" and "None of these" are exclusive from other choices.
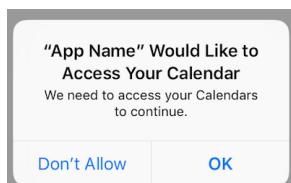
Q 9 (Microphone)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Record your voice when the app is in use ☐Make a phone call ☐Record your voice when the app is running in background ☐Read your photos ◯I do not know ◯None of these
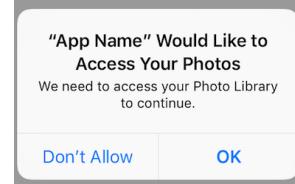
Q 10 (Calendar)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Send SMS ☐Read your calendar ☐Save events to your calendar ☐Make phone calls ◯I do not know ◯None of these
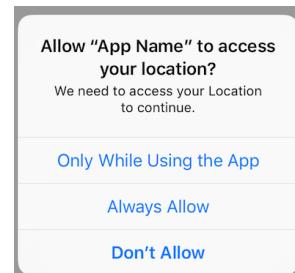
Q 11 (Photo)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Read all photos on the device ☐Read all files on the device ☐Delete photos on the device ☐Delete any files on the device ◯I do not know ◯None of these
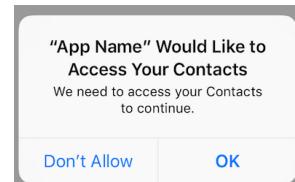
Q 12 (Location)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click Always Allow? (Choose ALL that apply)

☐Read your current location when you are using the app ☐Make phone calls ☐Read your current location when the app is running in background ☐Read your photos ◯I do not know ◯None of these
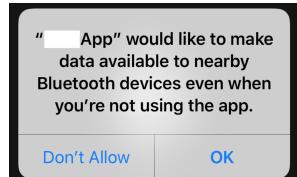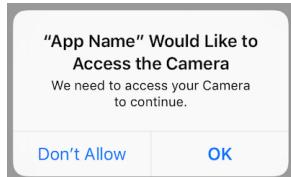
Q 13 (Contact)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Read your location ☐Read your contacts ☐Save new contact to your phone ☐Make phone calls ◯I do not know ◯None of these
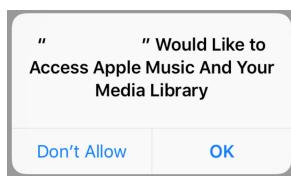
Q 14 (Camera)**.** When you are using an app and it prompts a dialog that says,

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Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Read your location ☐Take pictures and record videos ☐Read all pictures and videos ☐Read your contact ◯I do not know ◯None of these
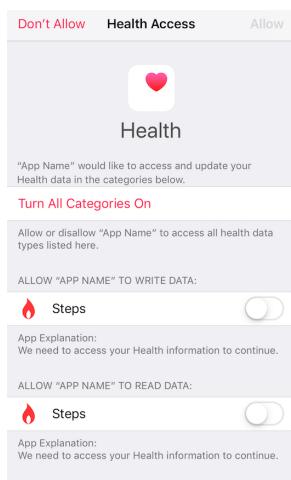
Q 15 (Media)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click OK? (Choose ALL that apply)

☐Record your voice ☐Play music in your media library ☐Edit your play list in apple music ☐Take pictures and store videos ◯I do not know ◯None of these

Q 16 (Health)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click Turn All Categories On? (Choose ALL that apply)
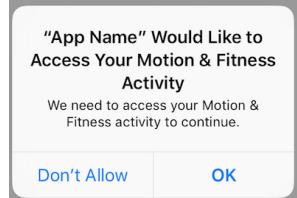
☐Read your steps count ☐Read your heart rate ☐Store your steps count ☐Read your workouts history ◯I do not know ◯None of these

Q 17 (Bluetooth)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click Ok? (Choose ALL that apply)

☐Scan the list of nearby bluetooth devices ☐Read your messages ☐Exchange data with connected bluetooth devices ☐Make phone calls ◯I do not know ◯None of these

**Q 18** (Motion)**.** When you are using an app and it prompts a dialog that says,
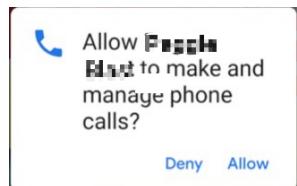
Which of the following will this app be allowed to do after you click Ok? (Choose ALL that apply)

☐Read your running history ☐Read the information from body sensors on your phone (e.g. gyroscopes) ☐Read your contacts ☐Read your steps count ◯I do not know ◯None of these

E. Android Comprehension

Four out of ten questions in this section will be randomly selected for each respondent. "I do not know" and "None of these" are exclusive from other choices.
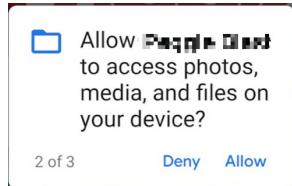
Q 19 (Phone)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click allow? (Choose all that apply.)

☐Get your phone number ☐Read your calendar ☐Get your phone unique ID (e.g. IMEI) ☐Make phone call ☐Read your location ☐Answer phone call ☐Know whether the phone is making a phone call ☐Read call history ◯I do not know ◯None of these
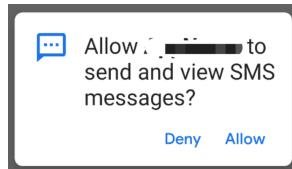
Q 20 (Storage)**.** When you are using an app and it prompts a dialog that says,

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Allow **People Duet** to access photos, media, and files on your device?

2 of 3   Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose all that apply.)

☐Make phone call ☐Read this app's photos, media, and files ☐Read other app's photos, media, and files ☐Save new photos, media, and files ☐Read your location ◯I do not know ◯None of these
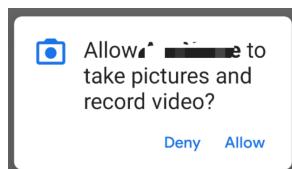
Q 21 (SMS)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to send and view SMS messages?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Read your location ☐Read your SMS messages ☐Make phone calls ☐Send SMS messages ◯I do not know ◯None of these
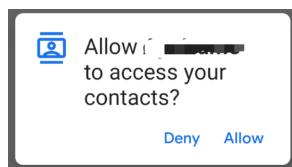
Q 22 (Camera)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to take pictures and record video?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Read your location ☐Read pictures and videos ☐Take pictures and record videos ☐Read your contact ◯I do not know ◯None of these
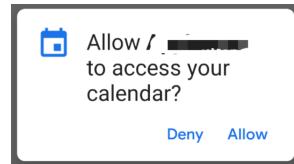
Q 23 (Contact)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to access your contacts?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Read your location ☐Read your contact list ☐Read your Google account email address ☐Make phone calls ☐Save new contact to your phone ◯I do not know ◯None of these
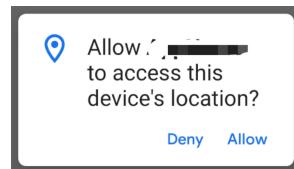
Q 24 (Calendar)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to access your calendar?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Make phone calls ☐Read your calendar ☐Send SMS ☐Save events to your calendar ◯I do not know ◯None of these
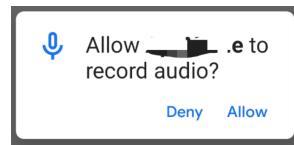
Q 25 (Location)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to access this device's location?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Make phone calls ☐Read your current location ☐Read your photos ◯I do not know ◯None of these
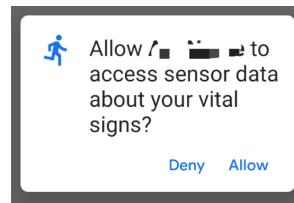
Q 26 (Microphone)**.** When you are using an app and it prompts a dialog that says,

Allow _____ .e to record audio?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Access your calendar ☐Record your voice ☐Record your voice when the app is in background ☐Read your photos ◯I do not know ◯None of these
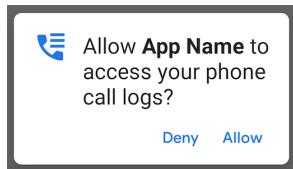
Q 27 (Sensor)**.** When you are using an app and it prompts a dialog that says,

Allow _____ to access sensor data about your vital signs?

Deny   Allow

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Read your fingerprints ☐Read your heart rate history ☐Read your step count ☐Read your face ID ◯I do not know ◯None of these

Q 28 (Call)**.** When you are using an app and it prompts a dialog that says,

Which of the following will this app be allowed to do after you click allow? (Choose ALL that apply)

☐Read your call history ☐Get your phone number ☐Get all your contacts ☐Save new call log ☐Get the phone number being dialed when you are making a phone call ◯I do not know ◯None of these

F. Experience

Q 29. How often do you meet permission prompts in apps that make you feel uncomfortable?

◯Never ◯Rarely ◯Sometimes ◯Frequently ◯Always

Q 30. Do you live on earth?

◯Yes ◯No
If No is selected, survey will end immediately.

Q 31. *Display if any of the last four from Q. 29 was selected.* Provide an example of meeting uncomfortable permissions in previous question. (e.g. An game app asks for external storage permission) _____

Q 32. *Display if any of the last four from Q. 29 was selected.* What do you do with the app if an app keeps asking for permissions that you do not feel comfortable with?

◯Allow the permission request ◯Deny the permission requests every time ◯Choose do not ask again in the permission dialog and deny it ◯Uninstall the app ◯I have met this before. ◯I don't understand this question ◯Other: _____

Q 33. *Display if the first of Q. 32 was selected.* If you choose to allow the permissions , what are the reasons?

◯I have to use that app for a specific purpose. ◯I trust the app's developer. ◯The app will crash without the requested permission. ◯I have get used to the app. ◯I do not care. ◯Other: _____

Q 34. This picture is captured from the app store (Google Play) on Android 9.0. How often do you read the app permissions list inside the app store (e.g. Google Play) before installing the app?

◯I have never seen this before in app store. ◯I don't know how to find the permission list in app store ◯Never ◯Seldom ◯About half of time ◯Usually ◯Always ◯Only for apps that I install for the first time

Q 35. *Display if any of last five from Q. 34 was selected.* Describe the detailed process to find application permission list in app store (e.g. Google Play). _____

G. Demographics

Q 36. What is your gender?

◯Female ◯Male

Q 37. How old are you?

◯18 - 24 years. ◯25 - 34 years. ◯34 - 45 years. ◯45 - 54 years. ◯54 - 64 years ◯64 years or older.

Q 38. What is the highest level of education that you completed?

◯Less than high school degree ◯High school degree or equivalent ◯Some college/Technical Certificate ◯Associates degree ◯Bachelor's degree ◯Master's degree ◯Doctorate degree ◯Other (Please specify): _____

Q 39. How would you rate your knowledge about mobile privacy and security?

◯No knowledge ◯Mildly knowledgeable ◯Moderately knowledgeable ◯Highly knowledgeable ◯Expert

Q 40. Are you majoring in, hold a degree in, or have held a job in any of the following fields: computer science; computer engineering; information technology; or a related field?

◯Yes ◯No

Q 41. Are you a native speaker?

◯Yes ◯No

Q 42. What is your current occupation field?

◯I currently do not have a job. ◯Student ◯I live on income from Amazon Mechanical Turk ◯Retail (e.g. salespeople, cashier) ◯Office clerks ◯Truck drivers ◯Restaurants (e.g. waiter, food prep) ◯Farmers ◯General Managers ◯Health Care (e.g. Nurses) ◯Business and Finance (e.g. Accounting, marketing) ◯Information Technology (e.g. Software Engineer) ◯Retired ◯Miscelaneous

Q 43 (Optional)**.** If you want to receive a summary of our research, please leave your email address.

_____

IV. Survey 2 Instrument

A. Operating System

Q 1. What is your current mobile phone's operating system?

◯iOS (For iPhones) ◯Android
Based on answer to this question, iOS respondents will answer Section IV-B. Android respondents will answer Section IV-C. The other sections remain the same.

B. iOS Background

Q 2. What are your current phone's model and iOS version? (e.g. iPhone 6s, iOS 12.1.3) (Note: You can find iOS version at Settings > General > About > Version.)

_____

Q 3. How many years have you been using iPhone?

○less than 3 years ○3 - 7 years ○more than 7 years

C. Android Background

Q 4. What is your current phone's make and model?(e.g. Samsung S9) _____

Q 5. What is your current Android version? (You can find this information under Settings > About Phone > Android Version)

○Below 6.0 ○6.0 - ○7.0 - ○8.0 - ○9.0 -
If below 6.0 is selected, survey will end immediately.

D. Scenario Experience

TABLE III: Factors and their messages displayed in the permission dialogs. `App` is the simulated app name and `Resource` is the permission group name that an app requests. The text in the brackets will be displayed only for positive messages.

Factors	Messages
Background access	`Resource` will [not] be accessed when you're not using the app.
Data transmission	`Resource` will [not] be transmitted and [or] stored by `App`.
Rating	The rating of `App` is 2.1 [4.8] rating in app store.
Review[1]	`App` has 13 [no] reviews related to `Resource` in app store.
Grant rate	10% [90%] of `App` users granted `Resource` access.
Brand reputation[2]	`App` has [not] been GDPR certified and [or] ISO 27001 certified.

Each respondent will answer three scenarios with positive framing or negative framing messages only for the same factor. All the messages for the decision factors are listed in Table III.
The order of the three scenarios is randomized.
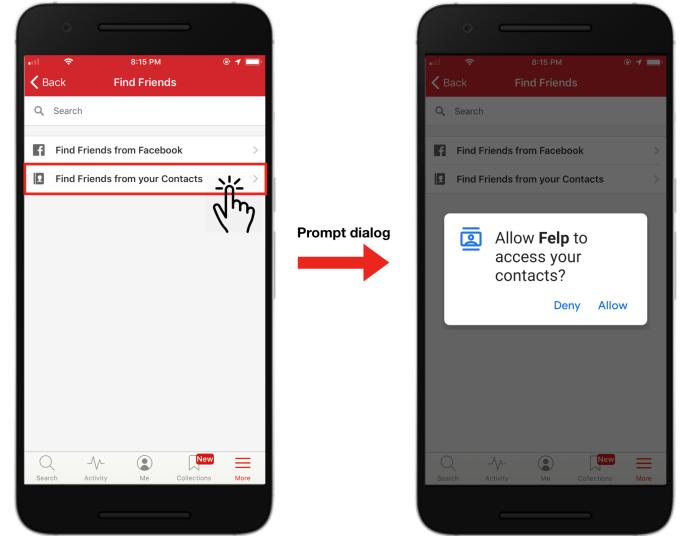
Scenario 1: Felp (Contact).
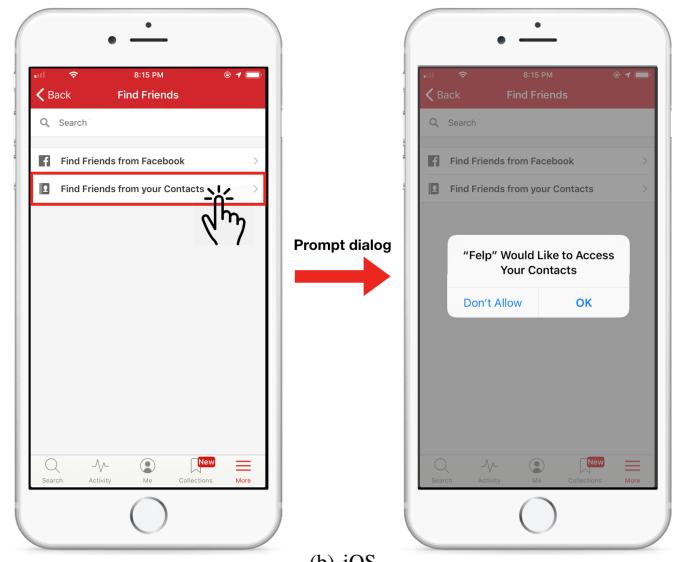
Q 6. You installed a restaurant rating and review app named Felp. Felp can help you find good restaurants around you, and read the menu and other users' reviews for the restaurant. [Insert figure with action illustration]

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[1]For the negative framing for *review* factor, we also display examples of negative reviews in the question descriptions. One example is "Why `App` needs my `Resource`? Intrusive and unnecessary permission invasion of privacy!".

[2]Since users may not be familiar with GDPR and ISO 27001, we include the short descriptions in the question text. GDPR certification means the company is transparent and honest in collecting and protecting users' personal data. Appropriate technical and organizational measures have been taken to achieve data protection; ISO 27001/2 certification means that the company has defined and put in place best-practice information security processes to prevent security risks such as cyber-attacks, hacks, data leaks or theft.

(a) Android

(b) iOS

Fig. 1: Control for Felp scenario. Figures will be shown based on the operating system. Users will make decisions without messages for decision factors first.

When you click the button in the screenshot, it will prompt a dialog and asks for contacts permission. Will you allow this permission request?
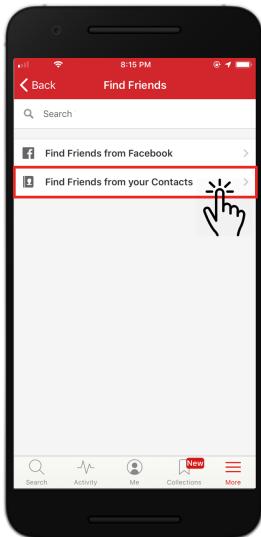
○Yes, I will allow. ○No, I will not.
*Page Break here. Respondents cannot go back.*

Q 7. *Suppose now, a trustworthy Phone company provides a service that the permission prompt dialogs are customized to incorporate more information, which is collected from all phone users of this company.*
In the following scenario, the Phone company provides you with the information that [Insert factor description].
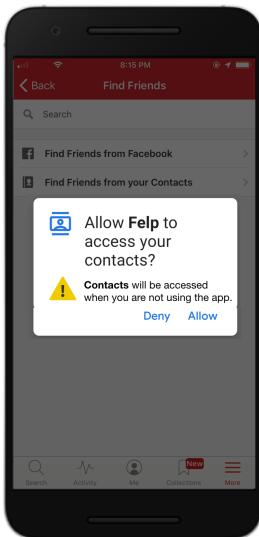
You installed a restaurant rating and review app named

Felp. Felp can help you find good restaurants around you, and read the menu and other users' reviews for the restaurant. (Insert screen picture of permission request with extra information with factor.)
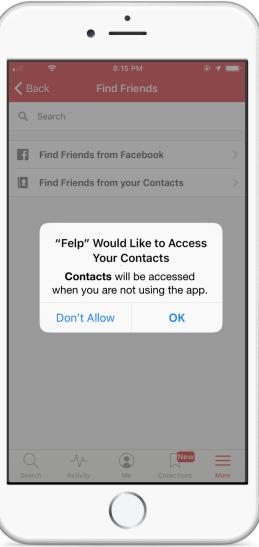
(a) Android

(b) iOS

Fig. 2: Figures will be shown based on the operating system. The text message for decision factor in the figure will be substituted based on the survey's decision factor as shown in Table III.

When you click the button in the screenshot, it asks for contact permission. According to the statistics provided by phone company, Felp [Insert factor description].
Will you allow this permission request?
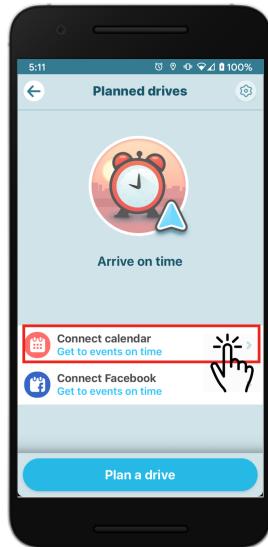
◯Yes, I will allow. ◯No, I will not.

Q 8. Explain your reasons (why you change or why you did not change your decision after reading the extra message).
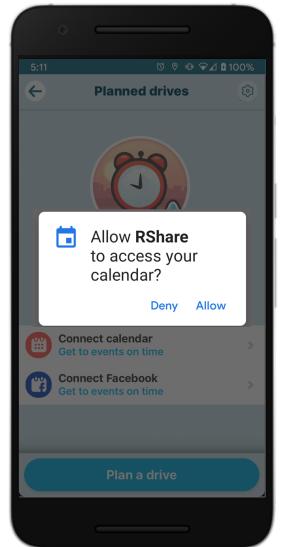
Page Break here. Respondents cannot go back.
Scenario 2: RShare (Calendar).
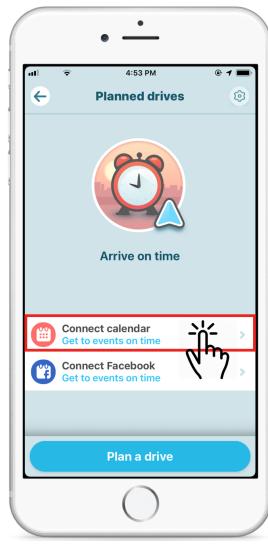
Q 9. In the following questions, you are considering the following scenario. You installed an app to find carpools named RShare. RShare can help you find a ride and carpool if you don't have a car. You can search for your destinations and find suitable ride. [Insert figure with action illustration]
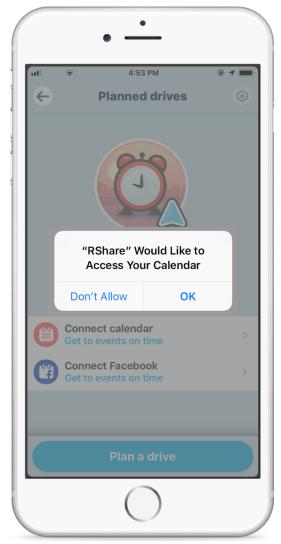
(a) Android

(b) iOS

Fig. 3: Control for RShare scenario. Figures will be shown based on the operating system. Users will make decisions without messages for decision factors first.

When you click the button in the screenshot, it asks for calendar permission. Will you allow this permission request?
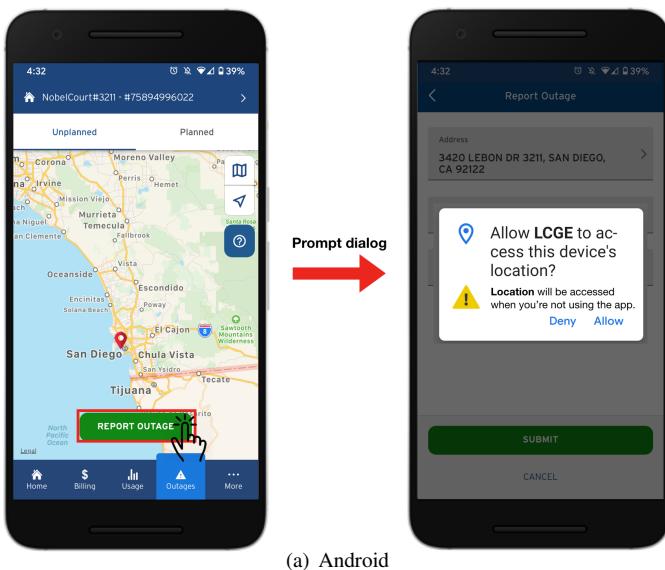
◯Yes, I will allow. ◯No, I will not.
Page Break here. Respondents cannot go back.

Q 10. *Suppose now, a trustworthy Phone company provides a service that the permission prompt dialogs are customized to incorporate more information, which is collected from all phone users of this company.*
In the following scenario, the Phone company provides you with the information that [Insert factor description].
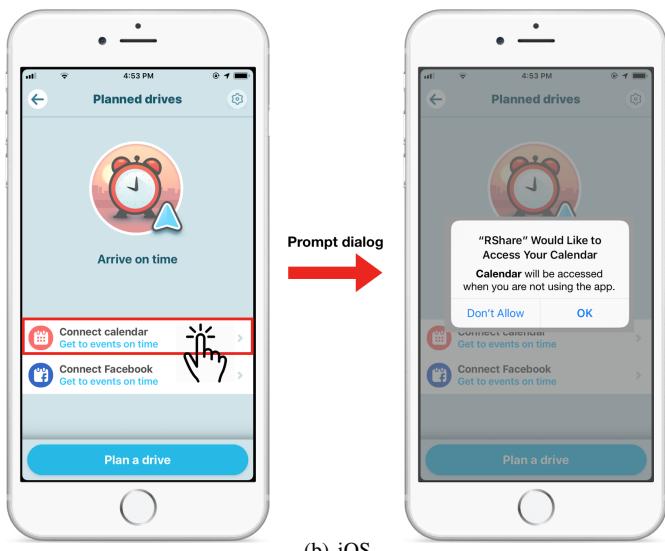
You installed an app to find carpools named RShare. RShare can help you find a ride and carpool if you don't have a car. You can search for your destinations and find suitable ride.
(Insert screen picture of permission request with extra information with factor.)


(a) Android

(b) iOS

Fig. 4: Figures will be shown based on the operating system. The text message for decision factor in the figure will be substituted based on the survey's decision factor as shown in Table III.

When you click the button in the screenshot, it asks for calendar permission. According to the statistics provided by phone company, RShare [Insert factor description].
Will you allow this permission request?

◯Yes, I will allow. ◯No, I will not.

Q 11. Explain your reasons (why you change or why you did not change your decision after reading the extra message).

_____

Scenario 3: LCGE (Local Gas& Energy) (Location).

Q 12. In the following questions, you are considering the following scenario. You installed a app to help you pay your electronic bills and utility fees named LCGE (LC Gas & Energy). LCGE can help you view your current energy usage and fees, make payments or schedule a payment on your mobile phone. [Insert figure for action illustration]

When you click the button in the screenshot, it asks for location permission. Will you allow this permission request?

◯Yes, I will allow. ◯No, I will not.
Page Break here. Respondents cannot go back.

Q 13. *Suppose now, a trustworthy Phone company provides a service that the permission prompt dialogs are customized to incorporate more information, which is collected from all phone users of this company.*
In the following scenario, the Phone company provides you with the information that [Insert factor description].

You installed a app to help you pay your electronic bills and utility fees named LCGE (LC Gas & Energy). LCGE can help you view your current energy usage and fees, make payments or schedule a payment on your mobile phone.
(Insert screen picture of permission request with extra information with factor.)

When you click the button in the screenshot, it asks for location permission. According to the statistics provided by phone company, LCGE [Insert factor description].
Will you allow this permission request?

◯Yes, I will allow. ◯No, I will not.
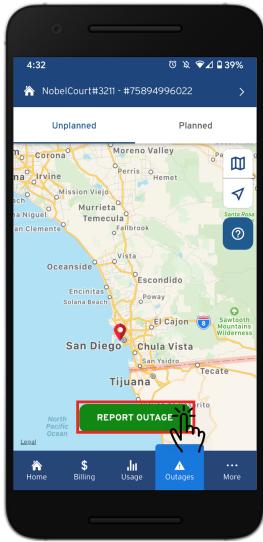
Q 14. Explain your reasons (why you change or why you did not change your decision after reading the extra message).

_____

Q 15. When you are making decisions in the previous questions,
how helpful is the information in the dialog: [Insert factor description]?
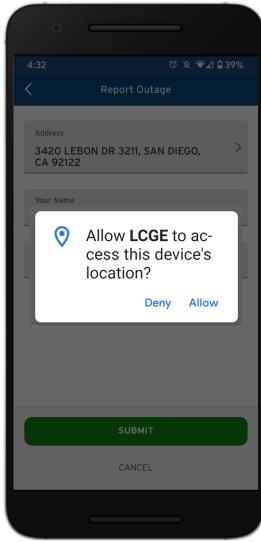
◯Very helpful ◯Somewhat helpful ◯Neural ◯Not helpful ◯Not helpful at all
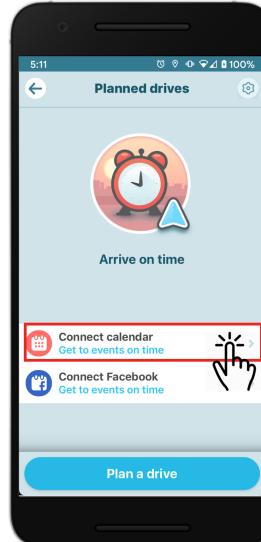
Q 16. Explain your reasons. _____
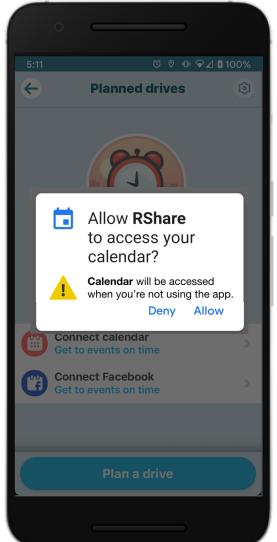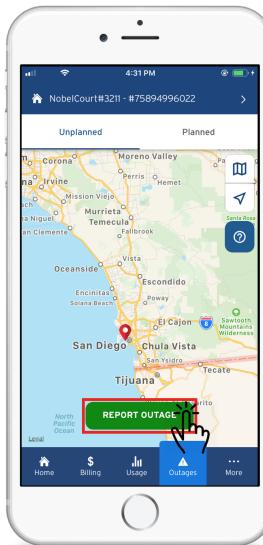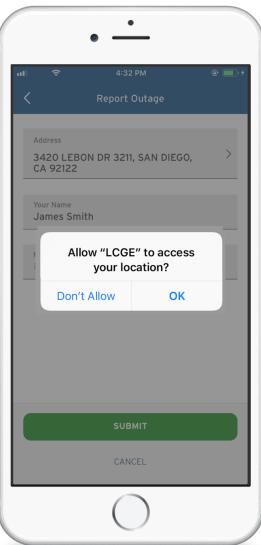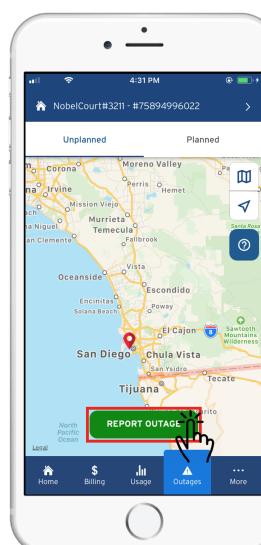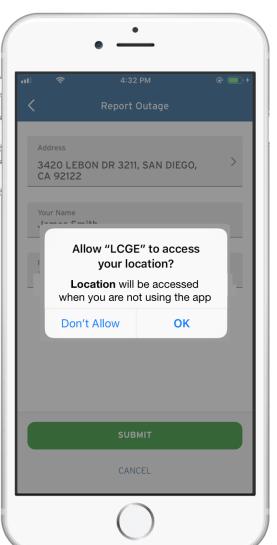
Fig. 5: Control for LCGE scenario. Figures will be shown based on the operating system. Users will make decisions without messages for decision factors first.

Fig. 6: Figures will be shown based on the operating system. The text message for decision factor in the figure will be substituted based on the survey's decision factor as shown in Table III.

E. Factors

Q 17. How often do you read app reviews before installing the app?

◯Never ◯Rarely ◯Sometimes ◯Frequently ◯Always ◯Only for apps that I install for the first time

Q 18. How many reviews will you check before installing the app?

◯I do not check ◯Only the reviews displayed by default ◯Less than or equal to 10 ◯More than 10

Q 19. How many reviews will you check before installing the app?

◯I do not check ◯Only the reviews displayed by default ◯Less than or equal to 10 ◯More than 10

Q 20. If you know a company has a good reputation for protecting users' privacy, will you be more likely to grant permissions to it?

◯Yes, I will be more likely to grant the permission ◯No, I will not be impacted by the company's reputation ◯I don't know.

F. Permission Comprehension

We reused the permission comprehension questions for survey 1 for the permission groups Contact, Calendar, and

`Location`. The order of the three questions is randomized.

G. *Demographics*

The demographics section in this survey is the same as Survey 1 demographics section §III-G.