Ubiquitous and Mobile Computing

CS 528: The Effect of Developer-Specified Explanations for Permission Requests on Smartphone User Behavior

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Introduction/Motivation

- Permission request dialog on iOS.
- Optional explanation, purpose string.

- Allow or don’t allow, that is the question.
Introduction/Motivation

- User Behavior
  - 700 smartphone users
- How many apps with permission request dialog had purpose strings
  - 4000 apps
- Why developers would like to add purpose string or not
  - 30 developers
Related Work

- Threats
  - Malicious app
  - Unintentional access to personal data

- How to present request
  - iOS, WP: Runtime warning
    - Habituated to warnings
  - Android: Install-time warning
    - Few users read
Methodology: User Behavior

● Task 1:
  ● Screenshot of request with explanation

● Task 2:
  ● Screenshot of request without explanation

● Task 3:
  ● Request of a fake app, Party Planner, with purpose string of a pool of 14
Methodology: User Behavior

<table>
<thead>
<tr>
<th>Purpose String</th>
<th>Approval Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control:</strong> “Contact access is required for this app to work properly.”</td>
<td>52.5% of 59</td>
</tr>
<tr>
<td>“Let Party Planner use your contacts to autocomplete email addresses.”</td>
<td>70.2% of 47</td>
</tr>
<tr>
<td>“To find friends, we’ll need to upload your contacts to Party Planner. Don’t worry, we’re not storing them.”</td>
<td>69.5% of 59</td>
</tr>
<tr>
<td>“Party Planner would like to access your address book to show you the cheapest attractions by your contacts’ location. We won’t use your contact information for any other purposes.”</td>
<td>66.7% of 48</td>
</tr>
<tr>
<td>“Your contacts will be used to find your friends.”</td>
<td>65.5% of 58</td>
</tr>
<tr>
<td>“In order to find your friends, we need to send address book information to Party Planner’s servers.”</td>
<td>62.5% of 48</td>
</tr>
<tr>
<td>“Have more fun with your friends on Party Planner.”</td>
<td>58.7% of 46</td>
</tr>
<tr>
<td>“Easily search for and share event information with the people who matter most to you.”</td>
<td>57.5% of 40</td>
</tr>
<tr>
<td>“Your contacts will be uploaded to our secure server. This data is maintained securely and is not shared with another party.”</td>
<td>52.9% of 34</td>
</tr>
<tr>
<td>“Your contacts will be used to find your friends. They won’t leave your phone.”</td>
<td>51.5% of 33</td>
</tr>
<tr>
<td>“In order to find your friends, we need to send address book information to Party Planner’s servers using a secure connection.”</td>
<td>51.0% of 51</td>
</tr>
<tr>
<td>“Your contacts will be transmitted to our servers and used to find your friends.”</td>
<td>46.2% of 39</td>
</tr>
<tr>
<td>“Party Planner would like to access your address book to show you the cheapest attractions by your contacts’ location.”</td>
<td>45.5% of 55</td>
</tr>
<tr>
<td>“Party Planner would like to access your address book to show you the cheapest attractions by your contacts’ location and other purposes.”</td>
<td>38.8% of 49</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>56.8% of 666</td>
</tr>
</tbody>
</table>

Table 4. Pool of app purpose strings for the fictitious Party Planner app, as well as their associated approval rates. The first purpose string was used as a control condition because it conveys no information about why the app is requesting access.
Methodology: User Behavior

- **Question 1:**
  - Name of app? Previously used?

- **Question 2:**
  - Open-ended questions
    - What information would be accessed if “OK”?

- **Question 3:**
  - Rate the purpose strings of Party Planner from “strongly agree” to “strongly disagree”
Methodology: User Behavior

1. It helps me make a more effective decision about the sharing of my information.
2. It is useful.
3. It gives me more control over the sharing of my information.
4. It makes it easier to decide on the sharing of my information.
5. It allows me to quickly decide on whether to share my information.
6. It allows me to efficiently decide on whether to share my information.
7. It addresses my concerns over the sharing of my information.
8. I am satisfied with it.
9. It makes me more comfortable deciding on whether to share my information.
10. It is clear and easy to understand.
11. The language used is simple and natural.
12. I feel like it is necessary for me to make an effective decision about the sharing of my information.

Table 2. Each participant answered 12 questions on a 7-point Likert scale (“strongly agree” to “strongly disagree”). We took the average of these 12 responses to create a “satisfaction score.”
Result: User Behavior

- Purpose and Control
  - 568 participant approved 74% of request with purpose string and 66% of request without
  - Statistically significant by Wilcoxon Signed Rank
- People are more likely to allow request with a purpose string.
Result: User Behavior

- Choice of Text
  - Scores varied but no significant approval rate

- People are more likely to allow request with a purpose string but usually they don’t care or understand the content of the strings.
Methodology: Adoption

- 4,400 free apps from App Store
- Number of apps with purpose string
  - From app’s plaintext metadata file
- Number of apps with request
  - By static analysis on decrypted binaries
- Manual Testing
  - Manually find those numbers of 140 app to prove the accuracy
Result: Adoption

- Adoption rate
  - 80% of apps request access
  - Only 19% of them have purpose strings
  - Manual adoption rate is 17.5%

![Pie charts showing Request Adoption Rate and String Adoption Rate]
Methodology: Developer Opinions

- 30 iOS developers and two popular apps
  - Description of Vine and Scout
  - Whether the apps need permission request
  - If yes, write a purpose string for it
Result: Developer Opinions

● Developer Awareness
  ● 28 think permission request necessary, 17 claimed to be aware of purpose string, 7 did use purpose string
  ● No relationship with years of developing experience

● Developer Attitudes
  ● User benefit works

● Developers use few purpose strings due to lack of awareness and this is because Apple’s poor documentation of this feature
Conclusion

- Apple need to improve the document of purpose string to let developers be aware and use it.
- Developers can use purpose strings to let users know why.
- User need to read and make a trade-off between privacy and functionality.
References

References

References

- Mongolo. Rasticrac v3.0.1.