Measuring the Effectiveness of Privacy Policies for Voice Assistant Applications

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Background

• An estimated 4.2 billion voice assistants are being used around the world in 2020
• VA platforms allow third-party developers to publish new voice-apps
• Provide privacy policies to notify users of their apps’ data practices and protect the privacy of online users

What is your name?
How old are you?
What is your phone number?
Voice Assistants

• Different requirements on privacy policy
  • Amazon Alexa
  • Google Assistant

Prior to submitting an app that collects personal data from end users, you are required to supply a privacy policy that will be displayed to end users on your app's product detail page.

Privacy Policy Guidance

The Policies for Actions on Google require all Actions to post a link to their privacy policy in the Directory. This guide explains Google's minimum expectations of what your privacy policy should include. It doesn't, however, address all possible use cases or issues. Your privacy policy, along with any in-Action disclosures, should comprehensively and accurately disclose all of your privacy practices. Your Action and privacy policy must also comply with all applicable laws and regulations, so you may need to include additional or different information based on the laws and regulations applicable to you or your Action.
Our work

• We analyzed 64,720 Amazon skills and 16,002 Google actions about their privacy policies

• We analyzed the privacy policy inconsistencies

• We also conducted a user study privacy policies and their persp
Impact

- We have reported all our findings to both Amazon and Google
- This work has also been reported by news media such as The Register
- Google recently awarded us a bug bounty for discovering these issues

*The Register* asked Amazon and Google to comment on the research.

“*We’ve been in touch with a researcher from Clemson University and appreciate their commitment to protecting consumers,*” a Google spokesperson said in an emailed statement. “*All Actions on Google are required to follow our developer policies, and we enforce against any Action that violates these policies.*

“We require developers of skills that collect personal information to provide a privacy policy, which we display on the skill’s detail page, and to collect and use that information in compliance with their privacy policy and applicable law,” an Amazon spokesperson said in an emailed statement.
Methodology

• Data collection
• Capture data practice
• Inconsistency checking
  • Inconsistent privacy policies
  • Missing privacy policies
High level issues

- Broken links and incorrect URLs
- Duplicate URLs
- Official voice-apps

<table>
<thead>
<tr>
<th></th>
<th>Alexa skills</th>
<th>Google actions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total #</td>
<td>Percentage</td>
</tr>
<tr>
<td>Without privacy policy</td>
<td>46,768</td>
<td>72%</td>
</tr>
<tr>
<td>Valid privacy policy URL</td>
<td>16,197</td>
<td>25%</td>
</tr>
<tr>
<td>Broken privacy policy URL</td>
<td>1,755</td>
<td>3%</td>
</tr>
</tbody>
</table>
High level issues

• Broken links and incorrect URLs
• Duplicate URLs
• Official voice-apps

![Bar chart showing percentage of duplicate privacy policy URLs for Alexa Skills and Google Actions]

<table>
<thead>
<tr>
<th>Platform</th>
<th>Duplicate privacy policy URLs</th>
<th>Total #</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon</td>
<td><a href="https://getstoryline.com/public/privacy.html">https://getstoryline.com/public/privacy.html</a></td>
<td>1,783</td>
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<tr>
<td></td>
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<td>5.6%</td>
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<td></td>
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<tr>
<td>Google</td>
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<td>1.0%</td>
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<td>55</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

Most common duplicate privacy policy URLs
High level issues

- Broken links and incorrect URLs
- Duplicate URLs
- Official voice-apps

Privacy policy provided by 6 Amazon official skills
Content analysis of privacy policies

- Zero data practice
- Inconsistent privacy policy
- Missing privacy policy
- Cross-platform inconsistency
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THANKS!

Please visit https://github.com/voice-assistant-research/voice-assistant for video demos and more information about our work.