Are You Going to Answer That?
Measuring User Responses to Anti-Robocall Application Indicators

Imani N. Sherman, Jasmine D. Bowers, Keith McNamara Jr., Juan Gilbert, Jaime Ruiz, Patrick Traynor
Robocalls Can Be Annoying and Costly
Robocalls Can Be Annoying and Costly

- 4.7 billion robocalls, Jan 2020
- Scams
  - Tech Support
  - Callback
  - Social Security

Did she say my Social Security number expired?
How are Robocalls made?

STIR/SHAKEN
Why look at warning designs?

- Browsers
- Influence Decision Making
- User Independence
Goal

- Identify trends
- Determine user preference
- Test and evaluate warning designs

This work is NOT only about declining spam calls...

...but also about answering legitimate calls.
Survey Anti-Robocall Applications
Purpose: Collect current trends in robocall warning design

User Experience Collection
Purpose: Understand what users desire in robocall warnings

Warning Design User Study
Purpose: Show how users respond to currently used and user driven warning designs in best case scenario
Survey of Anti-Robocall Applications

Purpose - Collect current trends in robocall warning design
Methodology

• 10 anti-robocall apps
  • Search term: “Spam call Blocker”
  • Free
  • 4-star rating
  • Not affiliated with a telephone carrier
## Ten Selected Apps for Review

<table>
<thead>
<tr>
<th>Name</th>
<th>Call App (A1)</th>
<th>Call Blocker (A2)</th>
<th>Call Control (A3)</th>
<th>Caller ID &amp; Call Blocker (A4)</th>
<th>Clever Dialer (A5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stars:</td>
<td>4.6</td>
<td>4.6</td>
<td>4.4</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Installs:</td>
<td>100M+</td>
<td>10M+</td>
<td>5M+</td>
<td>5M+</td>
<td>1M+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>hiya (A6)</th>
<th>Mr.Number (A7)</th>
<th>Should I Answer? (A8)</th>
<th>Truecaller (A9)</th>
<th>Who’s Calling (A10)</th>
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</thead>
<tbody>
<tr>
<td>Stars:</td>
<td>4.5</td>
<td>4.2</td>
<td>4.7</td>
<td>4.5</td>
<td>4.4</td>
</tr>
<tr>
<td>Installs:</td>
<td>100M+</td>
<td>10M+</td>
<td>1M+</td>
<td>100M+</td>
<td>10M+</td>
</tr>
</tbody>
</table>

**Survey of Anti-Robocall Apps**
Wolgalter’s Design Guidelines

• Wording
• Layout & Placement
• Pictorial Symbols

Mr. Number
User Experience Collection

Purpose: Understand what users desire in robocall warnings through focus groups
Methodology

• Conducted 6, 60-minute focus groups and 3, 60-minute interviews

• 18 participants

• Participants discussed:
  • Robocall detection and response
  • Notification preferences
  • Desired Anti-robocall functionality
Notification Preference

• Background Color
• Icons
• Authenticated Caller ID
Warning Design User Study

Purpose: Show how users respond to currently used and user driven warning designs in best case scenario
Survey

- 34 participants
  - Age 20 to 32
  - None in the focus group

- Survey Contents
  - 5 warning designs
  - 6 phone numbers
Focus-AID
Phone Numbers

N1, N2: Two known numbers

N3: Unknown number, contact name was random city/state

N4: First 9 digits same as the participant’s first 9 digits

N5: Same area code as the participant

N6: Out of state loan company
Results

• Assessed how the following impacted participant Response:
  • Warning Design
  • Phone Number
  • Phone Number + Warning Design

• Response: the average number of times a participant answered a call.
Do robocall warnings affect users’ response to incoming calls from unknown numbers?

Yes

% of Answered Calls

<table>
<thead>
<tr>
<th>Unknown #</th>
<th>Control</th>
<th>Focus-Spam</th>
<th>Avail-Spam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Focus-Spam</td>
<td>35%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Avail-Spam</td>
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<td>5%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Do robocall warnings affect users’ response to incoming calls from known numbers?

Yes

<table>
<thead>
<tr>
<th>% of Answered Calls</th>
<th>Known #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>100%</td>
</tr>
<tr>
<td>Focus-AID</td>
<td>100%</td>
</tr>
<tr>
<td>Avail-CID</td>
<td>95%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>% of Answered Calls</th>
<th>Known #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>100%</td>
</tr>
<tr>
<td>Focus-Spam</td>
<td>65%</td>
</tr>
<tr>
<td>Avail-Spam</td>
<td>34%</td>
</tr>
</tbody>
</table>
Results

Will the Available and Focus design have significantly different effects on user response?

Yes, for known numbers.

<table>
<thead>
<tr>
<th></th>
<th>Known #</th>
<th>Unknown #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus-AID</td>
<td>100%</td>
<td>42%</td>
</tr>
<tr>
<td>Avail-CID</td>
<td>95%</td>
<td>34%</td>
</tr>
<tr>
<td>Focus-Spam</td>
<td>65%</td>
<td>5%</td>
</tr>
<tr>
<td>Avail-Spam</td>
<td>34%</td>
<td>3%</td>
</tr>
</tbody>
</table>
So what did we learn?
• Users were **more likely** to **answer** calls from **unknown** numbers accompanied with Authenticated Caller ID.

• Users were **less likely** to **answer** calls from **known** numbers accompanied by a **spam warning**.

• Warning designs work but are not perfect.
Thank you!

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Jasmine D. Bowers  Keith McNamara Jr.  Juan Gilbert  Jaime Ruiz  Patrick Traynor
Current Solutions

• Caller ID
• Black and Whitelisting
• Chatbots
• Audio Analysis
• Call Back Verification
• Provider based solutions: SHAKEN/STIR
• End-to-end solution: AuthentiCall
• Mobile Applications (Caller ID + Black and Whitelisting)
Robocalls Can Be Annoying and Costly

- 4.7 billion robocalls, Jan 2020
- "Tech Support"
- One-Ring Scam
- 50% of calls declined

CBS News, WWMT, West Michigan
Ten Selected Apps for Review

Survey of Anti-robocall Apps
Robocall Identification Method

• All apps use blacklist

• A3 uses its community and FCC, FTC and IRS complaint data

• A4 and A9 add customer contacts to whitelist
Wogalter’s Warning Design Guidelines


- Wording
- Layout & Placement
- Pictorial Symbols
- Auditory Warning
- Salience (Noticeability)
- Personal Factors (Demographics)
Notification Preference

• Background Color
  • Differ from normal call
  • Orange, Yellow
  • Red – mixed feelings

• Icons
  • Lock is confusing
  • Emojis unprofessional
  • X-mark and Check-mark

• Authenticated Caller ID
Stats Explained

• 34 participants between the age 20 and 32
• Survey: 5 warnings, 6 phone numbers, 30 combinations shown 6 times to each participant randomly
• RM ANOVA for reaction time
• ANOVA for Response
• No significant difference over rounds for time or response
### TABLE III. REPEATED MEASURES ANOVA RESULTS

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Df</th>
<th>F-value</th>
<th>p</th>
<th>F-value</th>
<th>p</th>
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<tbody>
<tr>
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<td>4,132</td>
<td>62.085</td>
<td>&lt; .001</td>
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<td>&lt; .001</td>
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<td>–</td>
<td>–</td>
<td>2.887</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>
Response Time

- Categories: Control, Available, Focus

Number:

- 1
- 2
- 3
- 4
- 5
- 6

Response Time:

- 2
- 4
- 6
### Comparison of % of Answered Calls

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Known #</th>
<th>Unknown #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>56.40%</td>
<td>100%</td>
<td>35%</td>
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<tr>
<td>Focus-AID</td>
<td>61%</td>
<td>100%</td>
<td>42%</td>
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<tr>
<td>Focus-Spam</td>
<td>25%</td>
<td>65%</td>
<td>5%</td>
</tr>
<tr>
<td>Avail-CID</td>
<td>55%</td>
<td>95%</td>
<td>34%</td>
</tr>
<tr>
<td>Avail-Spam</td>
<td>13%</td>
<td>34%</td>
<td>3%</td>
</tr>
<tr>
<td>%</td>
<td>N1</td>
<td>N2</td>
<td>N3</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Control</td>
<td>100%</td>
<td>99%</td>
<td>29%</td>
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<tr>
<td>Focus-AID</td>
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<td>Focus-Spam</td>
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<td>Avail-CID</td>
<td>94%</td>
<td>97%</td>
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<td>Avail-Spam</td>
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<td>2%</td>
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<table>
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<th>p-value</th>
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<tbody>
<tr>
<td>Focus-AID vs.</td>
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<td></td>
<td></td>
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<tr>
<td>Control</td>
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<tr>
<td>Focus-Spam</td>
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<td>.023</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
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<tr>
<td>Avail-CID</td>
<td>ns</td>
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<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Avail-Spam</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td>ns</td>
</tr>
</tbody>
</table>

| Focus-Spam vs.     |     |     |     |     |     |     |
| Control            | < .001| .014| < .001| ns  | < .001| ns  |
| Avail-CID          | ns  | .034| .ns  | .033| < .001| ns  |
| Avail-Spam         | ns  | .01 | ns  | ns  | ns  | ns  |

| Avail-CID vs.      |     |     |     |     |     |     |
| Control            | ns  | ns  | ns  | ns  | ns  | ns  |
| Avail-Spam         | < .001| < .001| < .001| < .001| < .001| ns  |

| Avail-Spam vs.     |     |     |     |     |     |     |
| Control            | < .001| < .001| < .001| < .001| < .001| ns  |
Limitations

• Participant Number
• Lab Study
• Lack of consequences
Goals:

1. How do robocall management applications warn users of robocalls now?
2. How do users handle robocalls?
3. What warning would they like to see?
4. How do users react to current warnings compared to the warnings they want to see?