Exploring the Usability of CAPTCHAS on Smartphones: Comparisons and Recommendations

Gerardo Reynaga, Sonia Chiasson and Paul C. van Oorschot
School of Computer Science
Carleton University
Ottawa, Canada
Introduction

• CAPTCHA
• Mobile devices have become a primary means of accessing online resources
• Limited usability work has been carried out to evaluate captchas for mobile device usage
• Captchas are primarily evaluated on their security

1) Bursztein and Bethard, WOOT ‘09. El Ahmad et.al. EUROSEC ‘10
Evaluated Captcha Schemes

• Character Recognition (CR), Image Recognition (IR), Moving Image Object Recognition (MIOR)

reCaptcha

NuCaptcha

Picatcha

Asirra
Evaluated Captcha Schemes

Gesture Emerging

Gesture reCaptcha

Asirra Slide

Please select all the cat photos. Slide images to the left and tap to select. There are 12 images.
User Study

Data Collection:
• Logs (performance)
• Questionnaires (perception & demographics)
• Observations

• Controlled environment
• 28 Participants
• Mixed experimental design
• Implementation: PHP, HTML5, CCS3 and JS
• Wizard of Oz gesture
User Study Results

- No inferential statistics, misleading given the WoZ and mixed design

- Outcomes
  - Success: NuCaptcha & Emergent at 98%; CR schemes > 90%
  - Most Errors: Asirra and Asirra Slides; Picatcha
  - Skips: few number of skips
### User Study – Times

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Mean Time (SD) in Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>reCaptcha</td>
<td>25.2 (17.50)</td>
</tr>
<tr>
<td>NuCaptcha</td>
<td><strong>8.5</strong> (2.92)</td>
</tr>
<tr>
<td>Asirra</td>
<td>29.2 (9.83)</td>
</tr>
<tr>
<td>Picatcha</td>
<td><strong>12.3</strong> (4.97)</td>
</tr>
<tr>
<td>Emerging</td>
<td>22.4 (6.46)</td>
</tr>
<tr>
<td>Gesture reCaptcha</td>
<td>55.3 (12.49)</td>
</tr>
<tr>
<td>Gesture Emerging</td>
<td>44.5 (12.65)</td>
</tr>
<tr>
<td>Asirra Slides</td>
<td>30.6 (12.98)</td>
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</table>
# User Study- Participant Opinion

## 1 Most Negative

<table>
<thead>
<tr>
<th>8.19</th>
<th>8.81</th>
<th>9.88</th>
<th>7.19</th>
<th>7.38</th>
<th>7.19</th>
<th>7.46</th>
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<td>9.8</td>
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<td>9.53</td>
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<td>8</td>
<td>6.43</td>
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</table>

## 10 Most Positive

- reCaptcha
- nuCaptcha
- Asirra
- Picatcha
- Emerging
- Gest. reCaptcha
- Gest. Emerging
- Asirra Slides

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User Study - Observations

• Phone handling
  – Placing the phone on the table when typing; holding when gesturing
  – From portrait to landscape

• Challenges and schemes
  – Image quality
User Study - Observations

• Distraction from main task
  – Game-like schemes were considered as distracting
  – Picatcha’s success message; Asirra “Adopt me”

• Gesture input
  – Unsure on how to gestures characters
Summary of Results

• Best outcome: NuCaptcha

• Best preferred: NuCaptcha

• Good overall outcomes: Emerging

• Most disliked: gesture schemes

• Virtual keyboard familiarity

• Participant preferred: CR schemes
Recommendations

• Design challenges
  – Design with one-task only focus
  – Use input mechanisms that are cross-platform

• Screen layout
  – Consider isolating the captcha
  – Minimize bandwidth usage
Future Work

• Limitations
  – Not a MTurk sample size, but we were able to observe and discuss
  – Using WoZ impacted the performance and perception
  – Emerging animated implementation was slow

• Future Work
  – A full gesture recognition implementation
  – Explore alternative input methods: sensors and multi-finger gestures
Conclusion

• The aim of this work was
  – to explore whether alternative input mechanisms help improve the usability of captchas on smartphones
  – evaluate the usability of the schemes

• Gesture input in web forms requires robust and reliable implementation of recognizers

• The disconnect between users’ preferences and their ability to correctly solve challenges

• The security is central to any scheme
Thank you

Questions?
Gerardo Reynaga
gerardor@scs.carleton.ca

Carleton University
Ottawa, Canada

[Links]
CHORUS Lab
http://chorus.scs.carleton.ca/wp/

Carleton Computer Security Lab
https://www.ccsl.carleton.ca/about/