Multiple-Password Interference in the GeoPass User Authentication Scheme

Mahdi Nasrullah Al-Ameen
Matthew Wright
Digital Map Based Authentication:

GeoPass

Your current zoom level is 16

Please select your geo location password to complete login...

Arlington, TX, United States
Digital Map Based Authentication Schemes:

- GeoPass*
  - 1 location
  - 97% login success rate
  - Median login time: 30 seconds
  - Theoretical password space: $2^{36.9}$

* published in SOUPS 2013
GeoPass: Research Issues

- Memorability for multiple location-passwords
- The impact of interference*
- The causes of interference
- Solution to interference effect

* Password interference occurs when users confuse the password of one account with that of another account.
Our Approach:

- Study-I: Understanding the causes and effects of Interference
- Finding a solution
- Study-II: Examining the efficacy of proposed solution
Study I: A Lab Study

- 18 participants

Procedure:
- 4 different websites: bank, email, movie, deal
- 3 sessions 1 week apart:
  i) Registration, ii) Login 1, iii) Login 2
Study I: Login Performance for Multiple Geopasses

<table>
<thead>
<tr>
<th>Session</th>
<th>Success Rate(%)</th>
<th>Number of Attempts</th>
<th>Login Time (sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Login 1</td>
<td>58</td>
<td>2.8</td>
<td>1</td>
</tr>
<tr>
<td>Login 2</td>
<td>67</td>
<td>3.1</td>
<td>1</td>
</tr>
</tbody>
</table>
## Interference Effects for Multiple Geopasses

<table>
<thead>
<tr>
<th>Session</th>
<th>Total Attempts</th>
<th>Success (%)</th>
<th>Unsuccessful Attempts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Accurate Interference</td>
</tr>
<tr>
<td>Login 1</td>
<td>282</td>
<td>14.9</td>
<td>5</td>
</tr>
<tr>
<td>Login 2</td>
<td>309</td>
<td>15.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Causes of Interference in GeoPass

- Confusion because of geographic distances between a pair of location-passwords?
Causes of Interference in GeoPass

No correlation is found between..

- Geographic distances (km) between the location-passwords of a pair of accounts.

AND

- Interference effect between those accounts.
Causes of Interference in GeoPass

So, we anticipate:

Users fail to correlate between a geopass and the account it is created for.
Possible Solution: *Mental Story*

- To create a meaningful correlation between a geopass and the account it is created for.
Possible Solution: *Mental Story*

Example from Study II:

- Location-password for Bank Account: *Bellagio Hotel at Las Vegas*

  Corresponding Mental Story:

  “Bank -> Money -> Las Vegas -> Bellagio”
Mental Story: More Examples from Study II

✔ Mental Story for a bank account’s geopass:

“I had an accident here. The accident could interrupt the financial security of a family.”

✔ Location-password for a deal account: Old Trafford, U.K.

Corresponding Mental Story:

“Manchester United makes[s] good deals to get skilled players in the club”
Study II: A Hybrid Study

- 37 participants

Procedure:
- 4 different websites: bank, email, movie, deal
- 3 sessions 1 week apart:
  i) Registration, ii) Login 1, iii) Login 2
## Study II: Login Performance for Multiple Geopasses

<table>
<thead>
<tr>
<th>Session</th>
<th>Success Rate(%)</th>
<th>Number of Attempts</th>
<th>Login Time (sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Login 1</td>
<td>98</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>Login 2</td>
<td>99</td>
<td>1.8</td>
<td>1</td>
</tr>
</tbody>
</table>
### Interference Effects for Multiple Geopasses

<table>
<thead>
<tr>
<th>Session</th>
<th>Total Attempts</th>
<th>Success (%)</th>
<th>Unsuccessful Attempts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Accurate Interference</td>
</tr>
<tr>
<td>Login 1</td>
<td>249</td>
<td>58.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Login 2</td>
<td>269</td>
<td>54.6</td>
<td>0</td>
</tr>
</tbody>
</table>
Summary of Findings

- **Multiple location-passwords**: Unsatisfactory memorability.

- **Interference effect**: A prominent reason for login failures.

- **Reason of Interference**: Users could not correlate their location-password with the account it is created for.

- **Mental story**: A possible solution to the interference issue in GeoPass.
Thank you

Questions?