A Usability Study of Five Two-Factor Authentication Methods

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Passwords: Everywhere, but...
Two-Factor Authentication

- Something you *know*
- Something you *have*
- Something you *are*
Five Two-Factor Authentication Methods

- SMS
- TOTP
- Pre-generated codes
- Push notifications
- U2F security keys
Something you have...
Goal:

Perform a comparative usability study of five 2FA methods
2FA banking studies

Security key setup
- Das [FC 2018]

Setup of four 2FA methods
- Acemyan [HFES 2018]

Day-to-day usability
- Krol [USEC 2015], Reynolds [S&P 2018]
Study Design

Compare five factors across a single application
  Reduce confounding factors
  Gather timing data
Examine setup and day-to-day usability independently
  Avoid bias
Two Parts

1. Two-week between-subjects usability study
2. Within-subjects laboratory setup study
Two Week Study Methodology

- 72 PARTICIPANTS (6 GROUPS OF 12)
- SIMULATED ONLINE BANKING WEBSITE
- 12 BANKING TASKS
Findings

Quantitative

Qualitative

https://media.giphy.com/media/xGlmlbMBsOcSc/giphy.gif
Timing
Timing
Qualitative Results
P25: “In my opinion, it may be a little obsessive for everything, but for banking it’s something that I actually do want some authentication. I almost wish that it was a requirement that the bank said, oh here set [two-factor authentication] up. Because now that I think about it, I don’t know how to set up 2FA with my bank. If it were an option I would definitely use 2FA.”
Availability of Second-factor Device

P42: “Honestly, once I’m home I kind of just set my phone down and forget where I put it sometimes, so that was a little bit hard . . . I needed to go find my phone and pull up the app.”
P8: “I mean, you hear a lot about stuff being broken into; I just don’t think I have anything that people would want to take from me, so I think that’s why I haven’t been very worried about it.”
Day-to-day Usability?

Hey, that's pretty good!

https://media.giphy.com/media/cN3TDDF02WCT6/giphy.gif
Limitations

- University population
- Simulated banking environment
- 2FA for every authentication attempt
Setup Study Methodology

30 participants
Setup each 2FA method
Used counterbalancing to account for ordering effects
Setup Study: Timing Data
Setup Study: SEQ Scores
Setup Failures

TOTP
  Scanning QR code
U2F
  Pop up permission
Setup

Usability?
Limitations

- University population
- Provider-specific setup implementation
- Unfamiliarity with provided phone
Conclusion

- Well-implemented 2FA methods may be set up and used without major difficulty.
- Home users may not always have access to second-factor device.
- Users differentiate between high and low value accounts.
- Time to authenticate decreases with familiarity (U2F, TOTP).
- Faster authentication does not necessarily mean higher usability.
Thank you