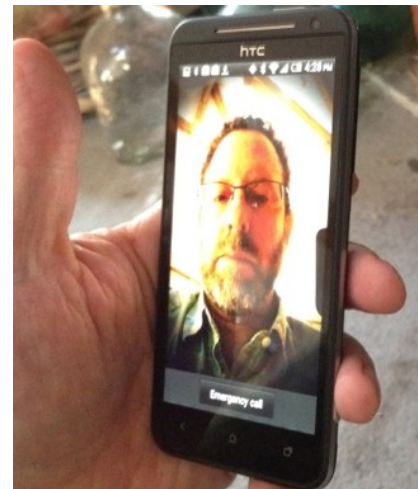
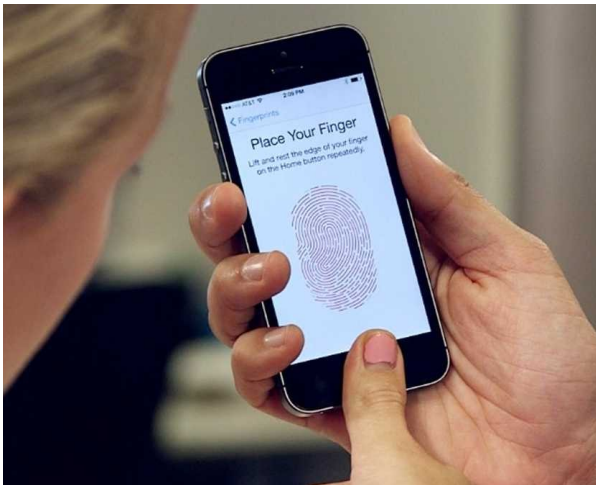


Biometric Authentication on iPhone and Android: Usability, Perceptions, and Influences on Adoption

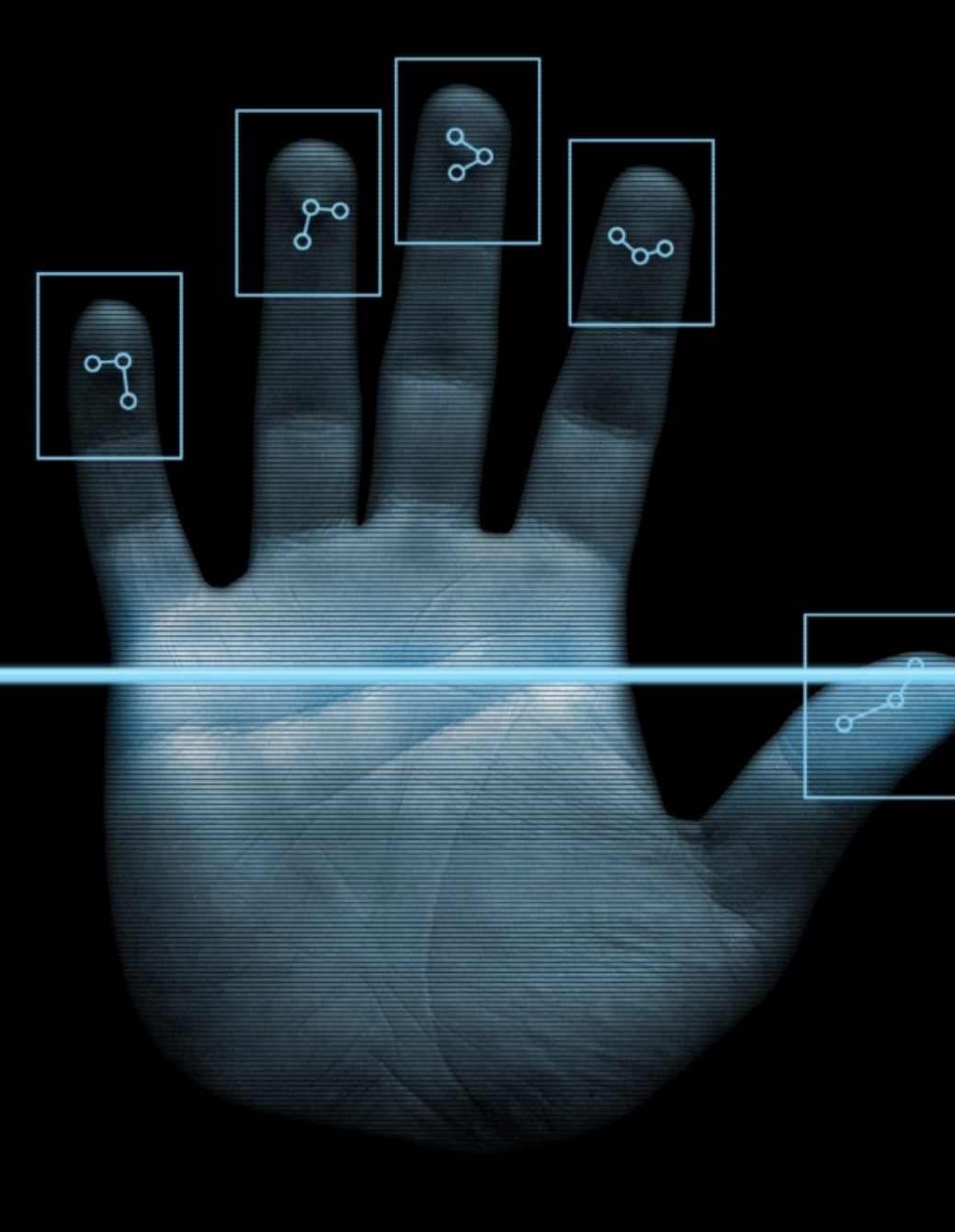


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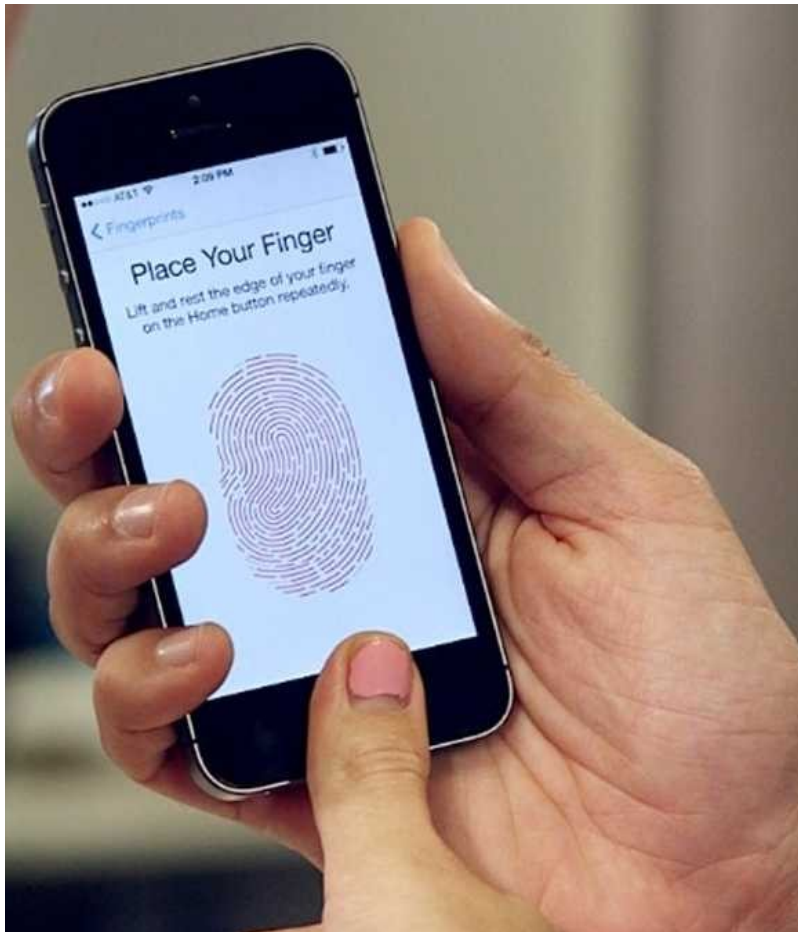
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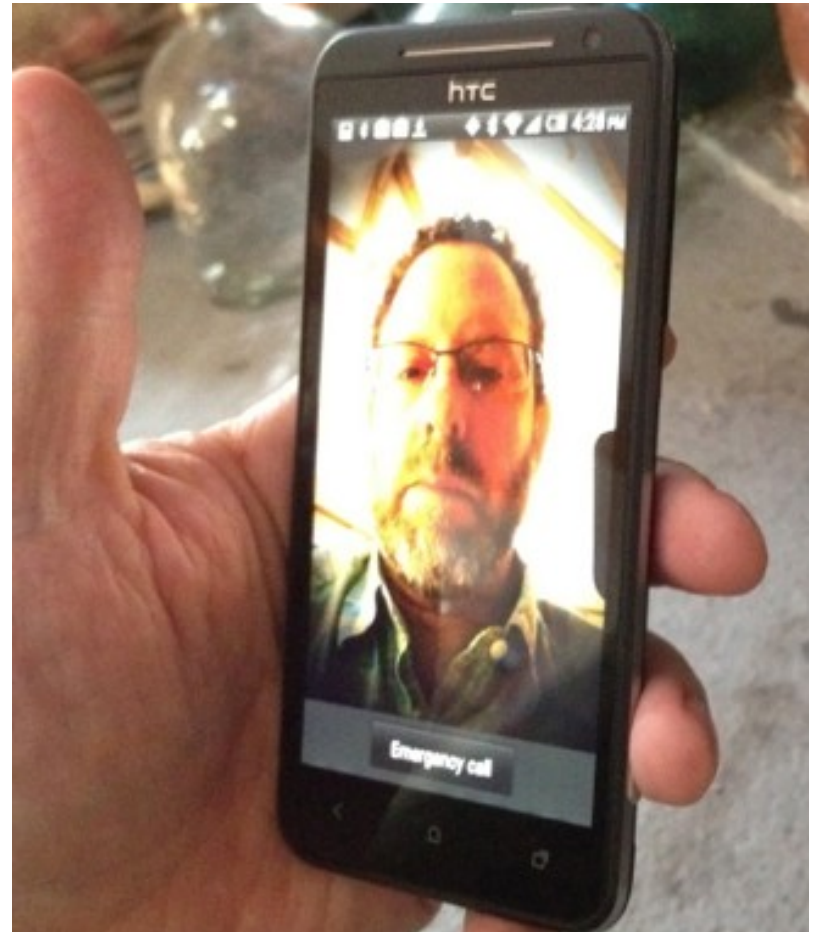




iPhone 5S Touch ID



Android 4.0 Face Unlock



**How usable are these
biometric systems?**

**What are users'
experiences using
these systems in the
real world?**

**Have people adopted
these systems?
Why/why not?**

Overview

- Study 1: **Lab study**
 - Face unlock, fingerprint unlock, and PINs
 - How usable is each system in common usage scenarios?
 - Comparative ranking
- Study 2: **Online survey**
 - Investigate adoption decisions
 - Understand real-world usability experiences and perceptions

Lab study methodology

- 10-participant, within-subjects usability study
- Four mechanisms: iPhone fingerprint unlock, iPhone PIN, Android face unlock, Android PIN
- 1) Demographic survey
- 2) Registration phase for each system
- 3) Usability in 5 scenarios
- Likert-scale usability questions
- We provided iPhone 5S & Samsung Galaxy S4
- Recruited on Craigslist and with flyers
- Compensated \$10 for ~ 1 hour

Five lab study scenarios

- Sitting (baseline)



Five lab study scenarios

- Sitting in a dark room



Five lab study scenarios

- Sitting with wet hands (moisturizer)



Five lab study scenarios

- Walking



Five lab study scenarios

- Walking carrying a bag in one hand



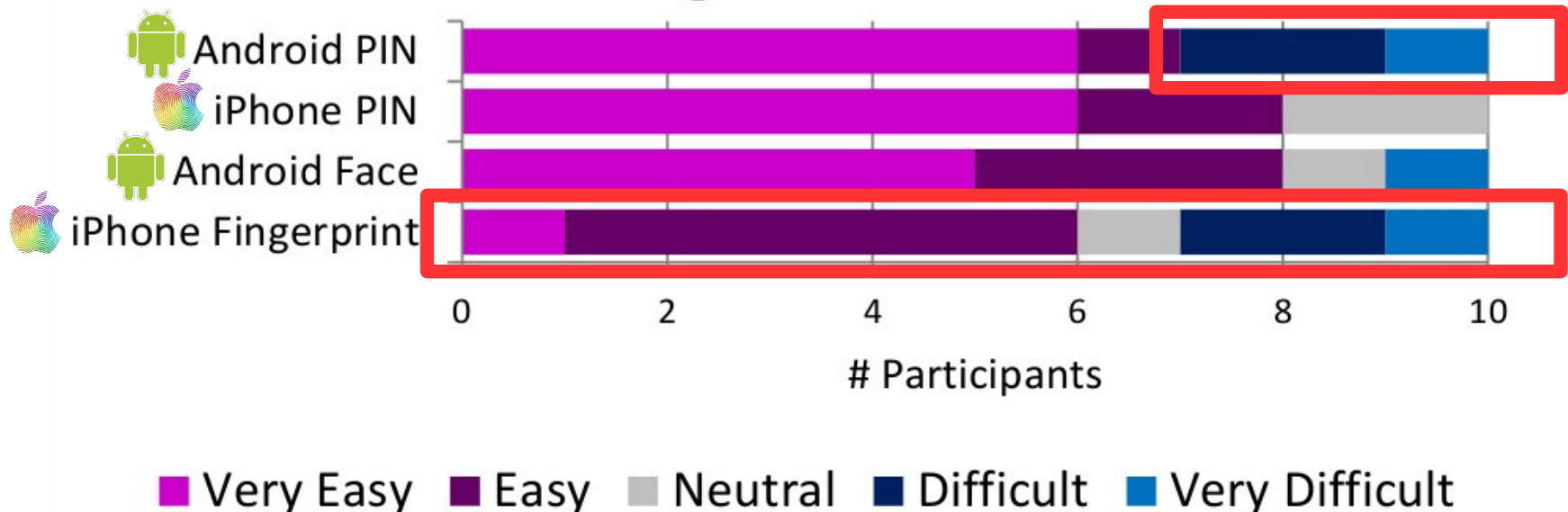
Lab study participants

- 10 participants (8 male, 2 female)
- Relatively young (2 over 30)
- 4 regular iPhone users; 6 regular Android users
- 2 had used Fingerprint Unlock; 2 had used Face Unlock


Lab study results

- Preconceived notions:
 - Biometrics secure and easy to learn
 - Biometrics inconvenient and uncool
- Registration process was relatively easy

Registration

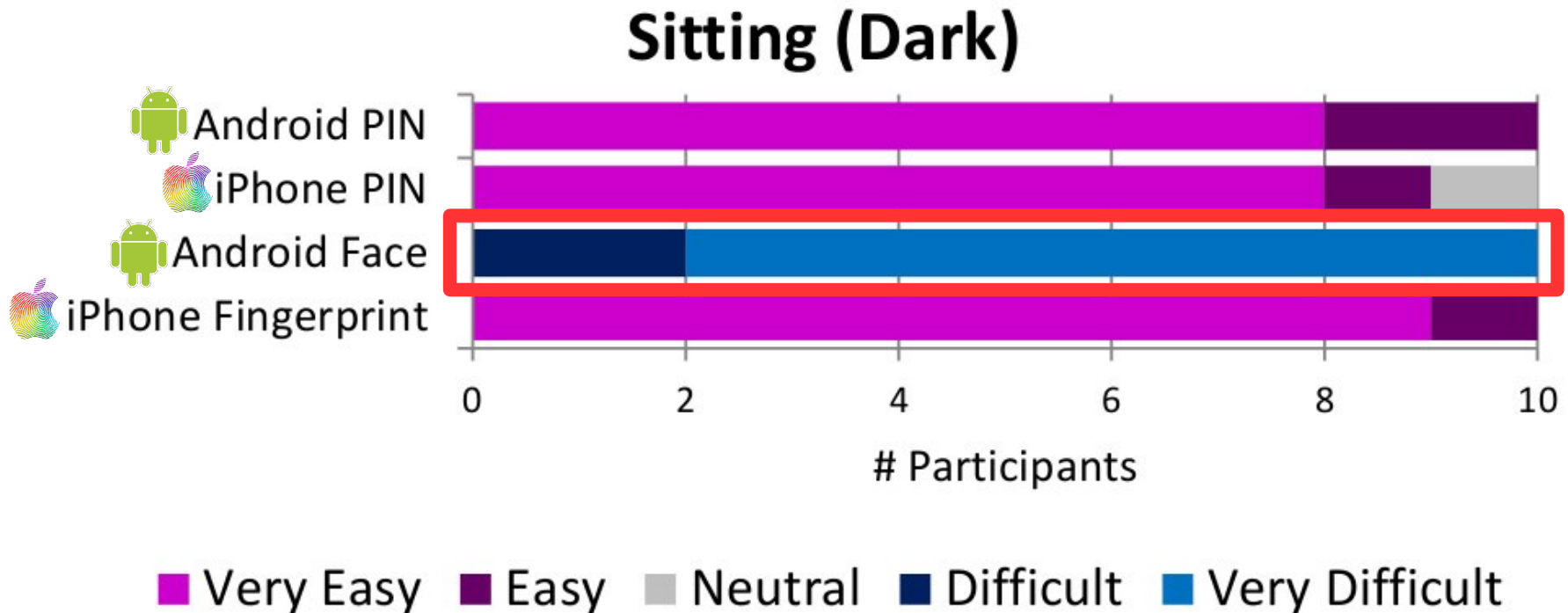


Lab study results

- Participants found all schemes usable in all situations **except for** Face Unlock in the dark
 - 90%+ of participants per group said authenticating while sitting was easy
 -  – Two iPhone participants found Fingerprint Unlock difficult with moisturizer
 - 80%+ found authenticating while walking (with/without bag) easy

Lab study results

- Participants found all schemes usable in all situations **except for** Face Unlock in the dark



Comparative ranking

- Participants tended to like both phones' PINs



– iPhone PIN does not require hitting enter

- Participants had polarized opinions of Fingerprint Unlock



– 6 rated it #1 / 4

– 4 rated it #4 / 4

Usability issues

- iPhone Fingerprint Unlock registration unclear
 - “The image they were showing me didn’t make sense to me, so I was like I’m not sure which way. I’m supposed to be like turning my finger. So that was kind of difficult”






Usability issues

- Android Face Unlock doesn't show what screen looks like when authenticating
 - One participant left the phone on the table
- Participant required to fail at Face Unlock before falling back to PIN

Survey methodology

- Online survey of owners of compatible phones
 - iPhone 5S or Android 4.0+
 - Verification questions about menus
- Android = Face Unlock questions, iPhone = Fingerprint Unlock questions
- Focus on perceived usefulness and ease of use, as well as adoption decisions
- Recruited on Mturk
 - Compensated \$1.00 for ~9 minutes
- Questions branched based on {current user, former user, non-user}

Survey participants

- Initially recruited 100 Android and 100 iPhone
 -  – 1 current and 15 former Face Unlock users
 - Reopened for current/former users of Face Unlock (63 more)
- Android: 163 respondents (109 pass validation)
 -  – 47 female, 61 male, 1 decline to state
 - Relatively young (54% age 20-29)
- iPhone: 101 respondents (89 pass validation)
 -  – 35 female, 54 male
 - Relatively young (55% age 20-29)

Android results



- Few people with compatible phones seem to use Face Unlock
- Current users feel that Face Unlock has increased convenience and security vs. PIN
 - “...it ensures ONLY I can unlock it unless someone knows my pin code as well- which hopefully no one does”
- Former users felt it less convenient
- Former users found it unreliable (in the dark)
- Non-users expected hassle and low security

iPhone results



- Many people with compatible phones seem to use Fingerprint Unlock
- Both current and former users feel that Fingerprint Unlock is more secure than PIN
- Current users find it more convenient than PIN, whereas former users do not
- Some non-users did not trust Apple with their biometric data

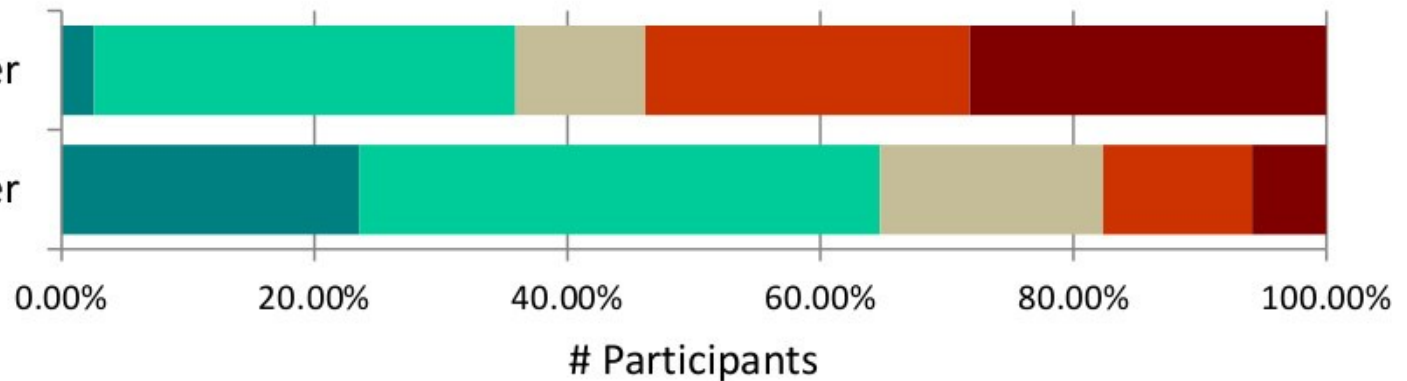
Convenience

Convenience of Face Unlock vs. PIN



Former User

Current User



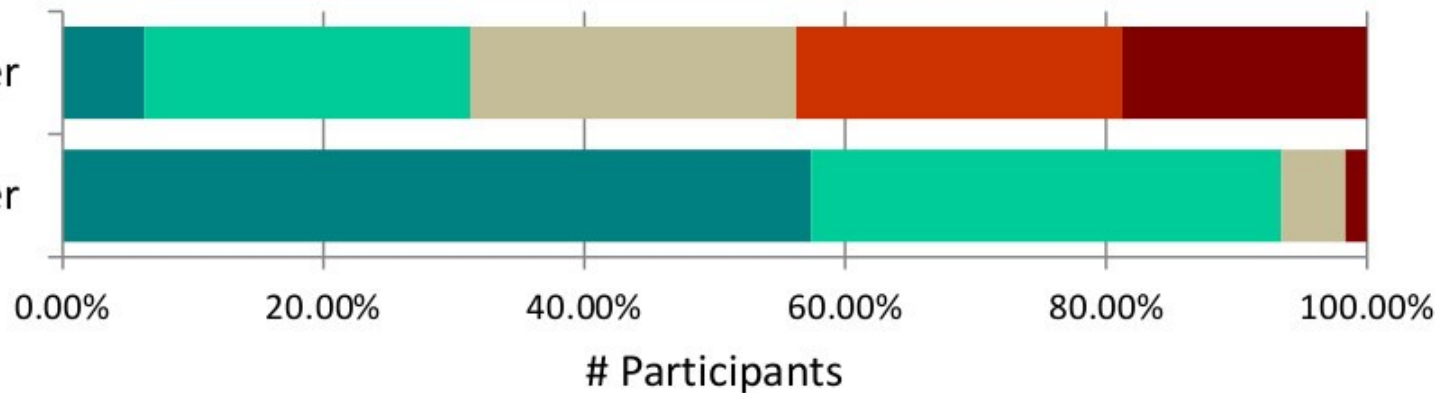
■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

Convenience of Fingerprint Unlock vs. PIN



Former User

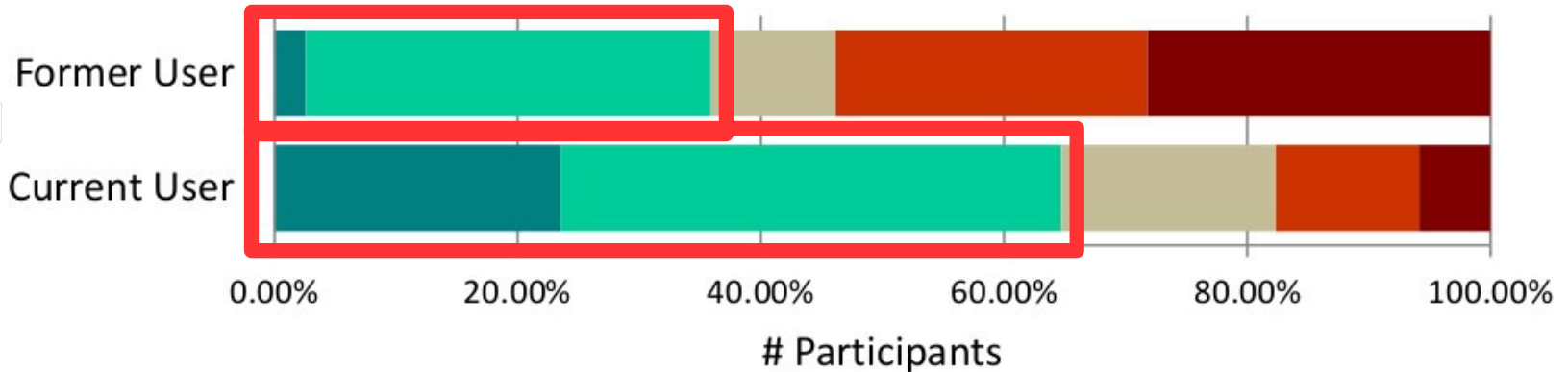
Current User



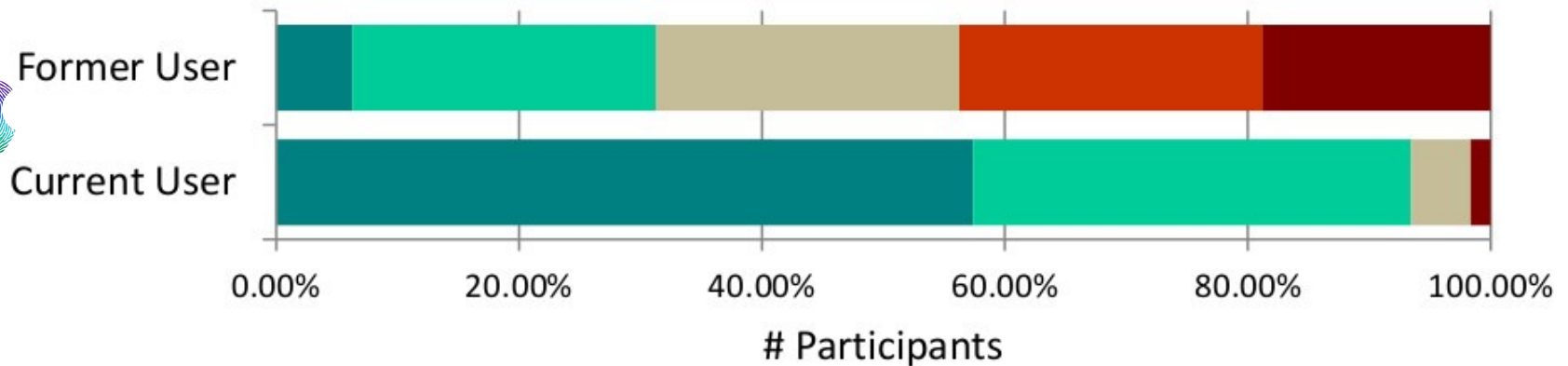
■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

Convenience

Convenience of Face Unlock vs. PIN



Convenience of Fingerprint Unlock vs. PIN



Legend: A lot more (dark teal), A little more (light teal), Equally (tan), A little less (orange), A lot less (dark red)

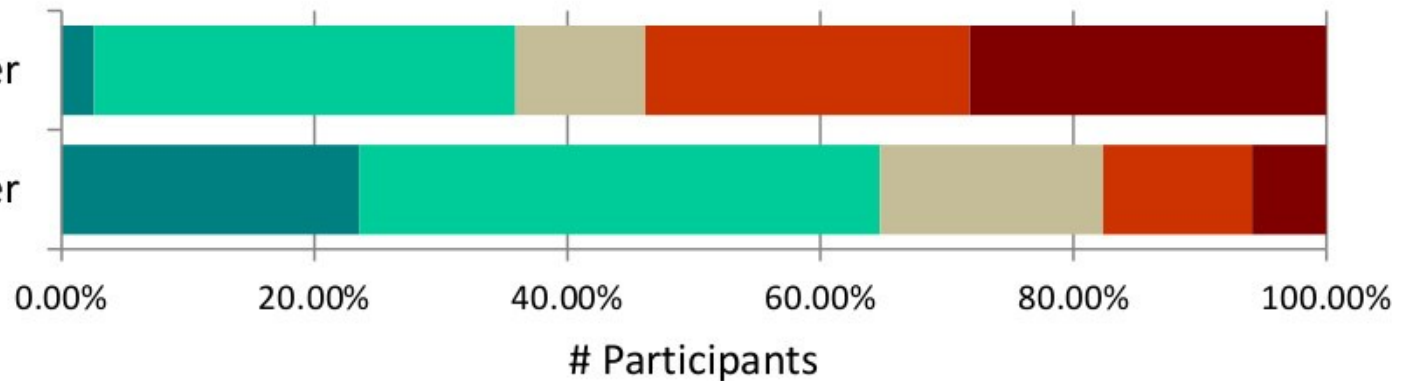
Convenience

Convenience of Face Unlock vs. PIN



Former User

Current User



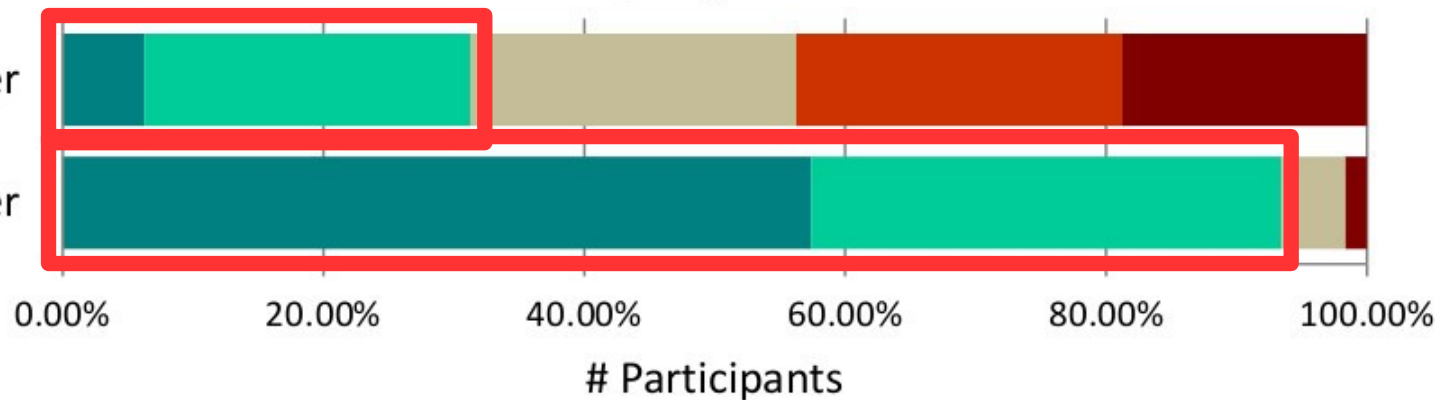
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Convenience of Fingerprint Unlock vs. PIN



Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

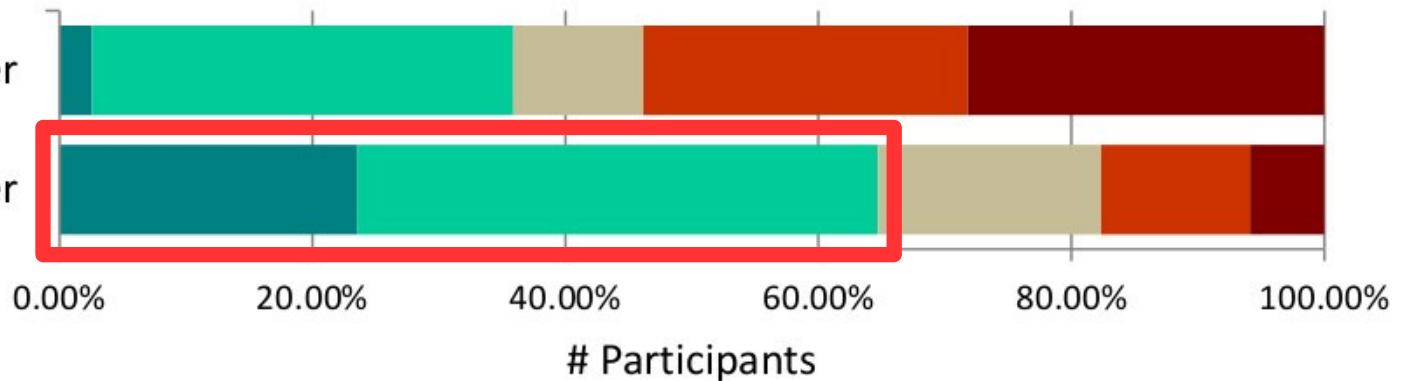
Convenience

Convenience of Face Unlock vs. PIN



Former User

Current User



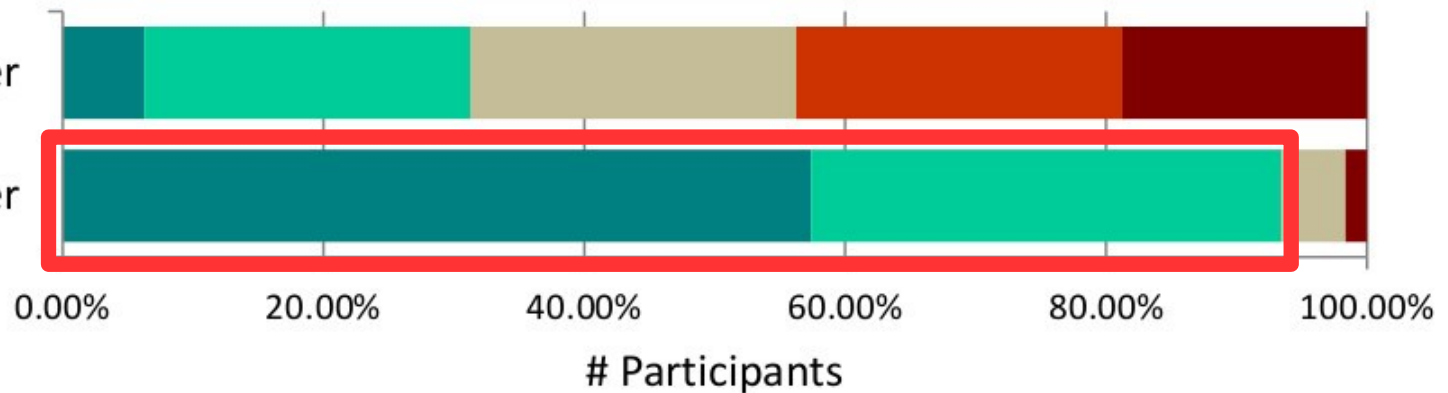
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Convenience of Fingerprint Unlock vs. PIN



Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

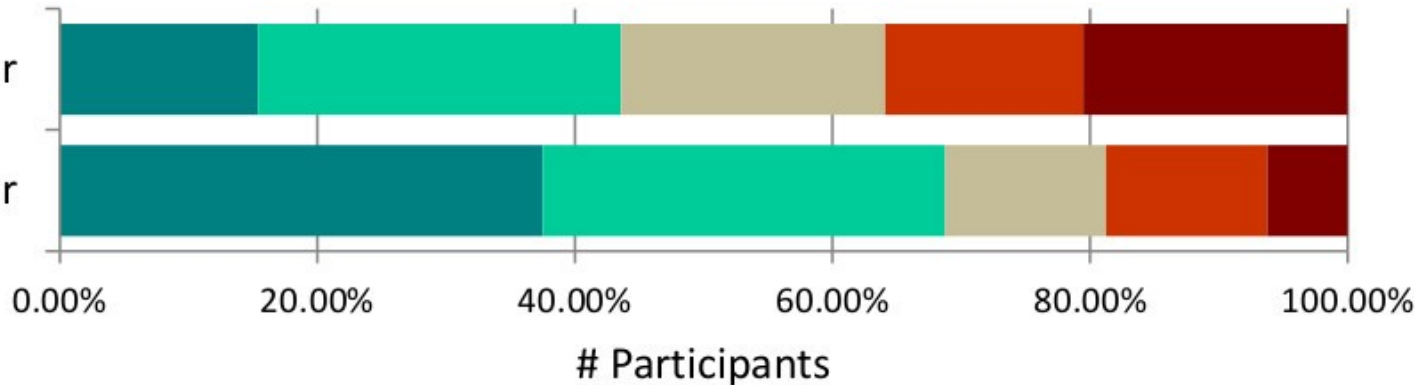
Security

Security of Face Unlock vs. PIN



Former User

Current User



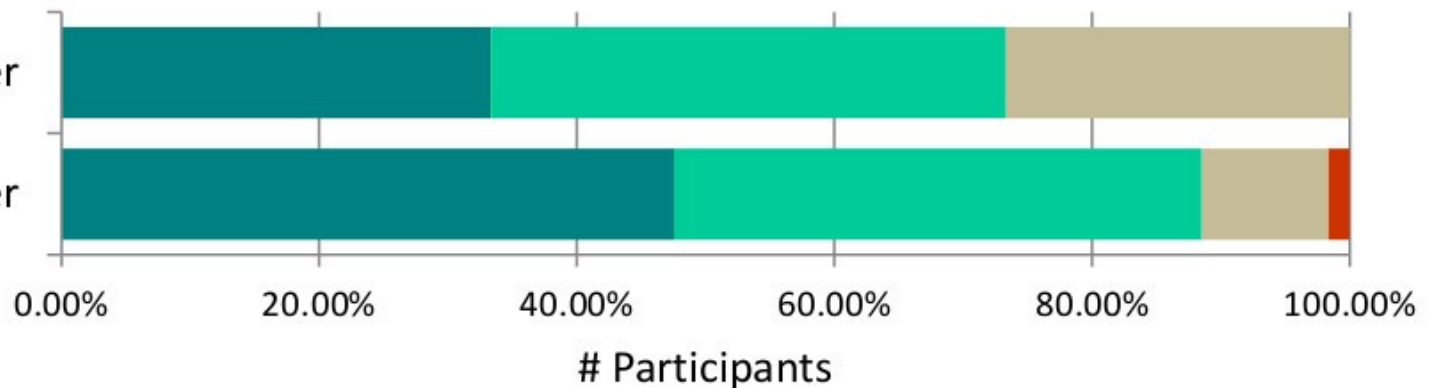
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Security of Fingerprint Unlock vs. PIN



Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

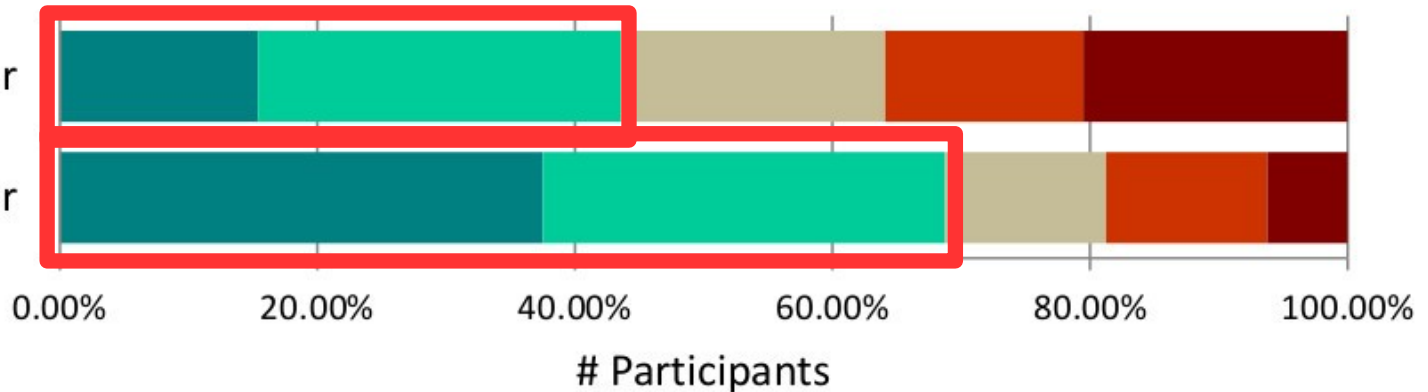
Security

Security of Face Unlock vs. PIN



Former User

Current User



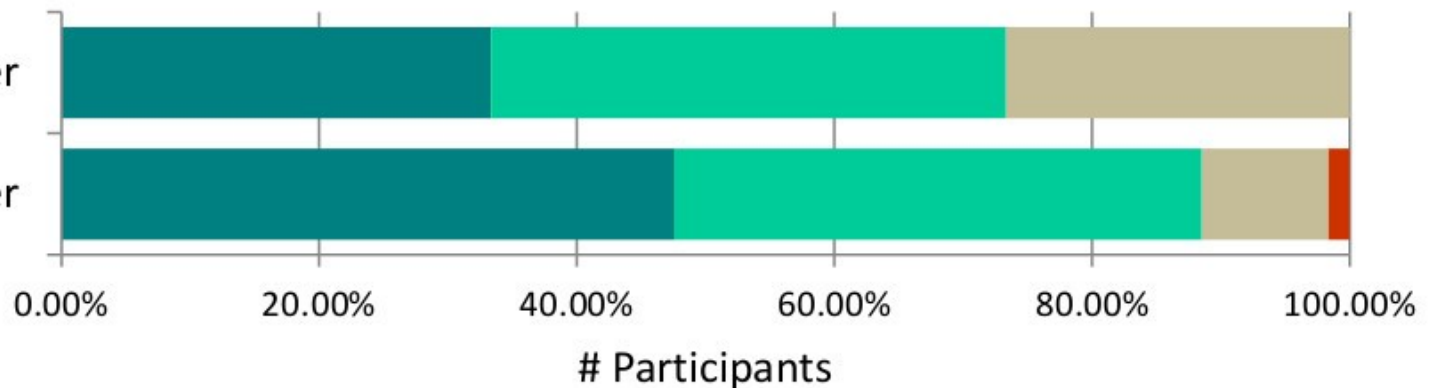
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Security of Fingerprint Unlock vs. PIN



Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

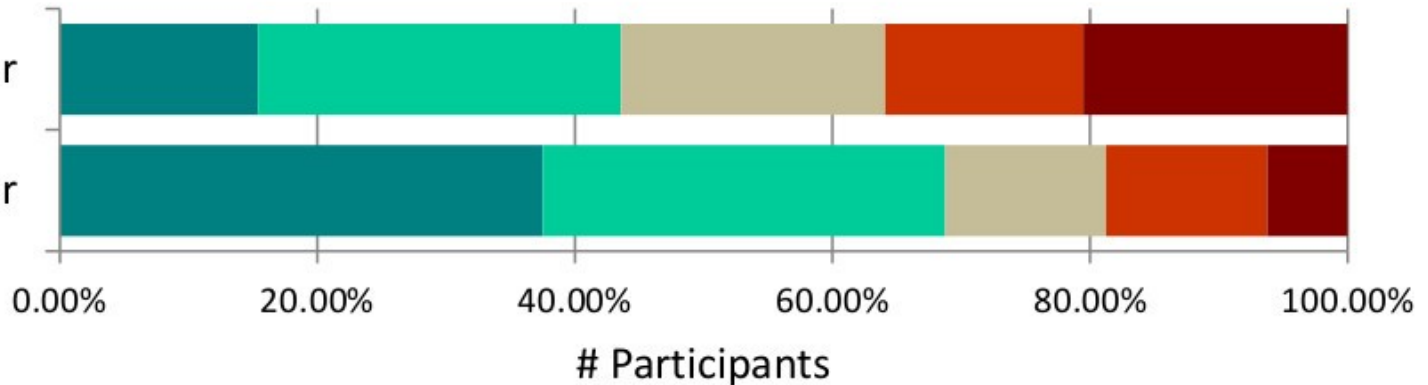
Security

Security of Face Unlock vs. PIN



Former User

Current User



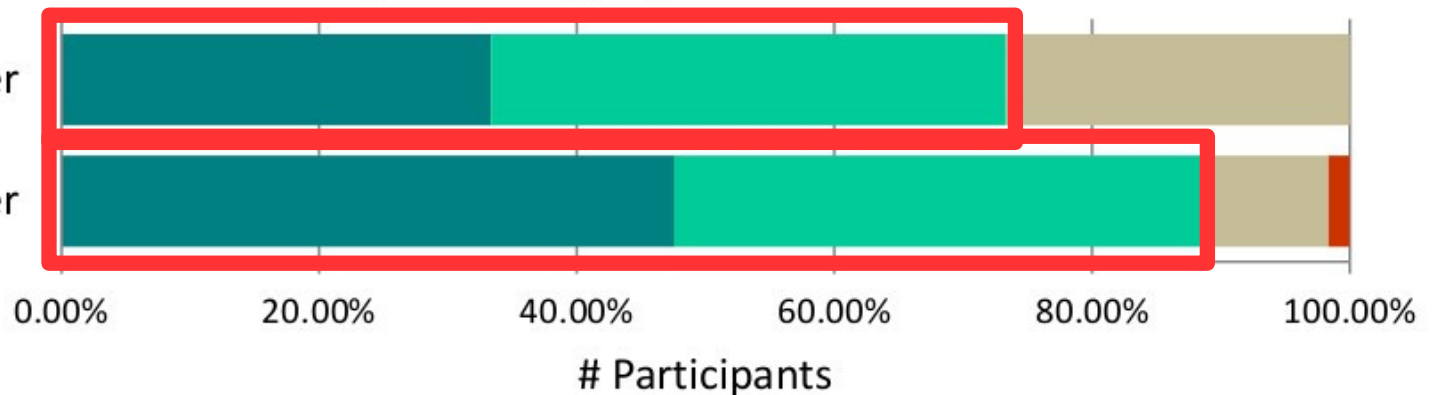
■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

Security of Fingerprint Unlock vs. PIN



Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

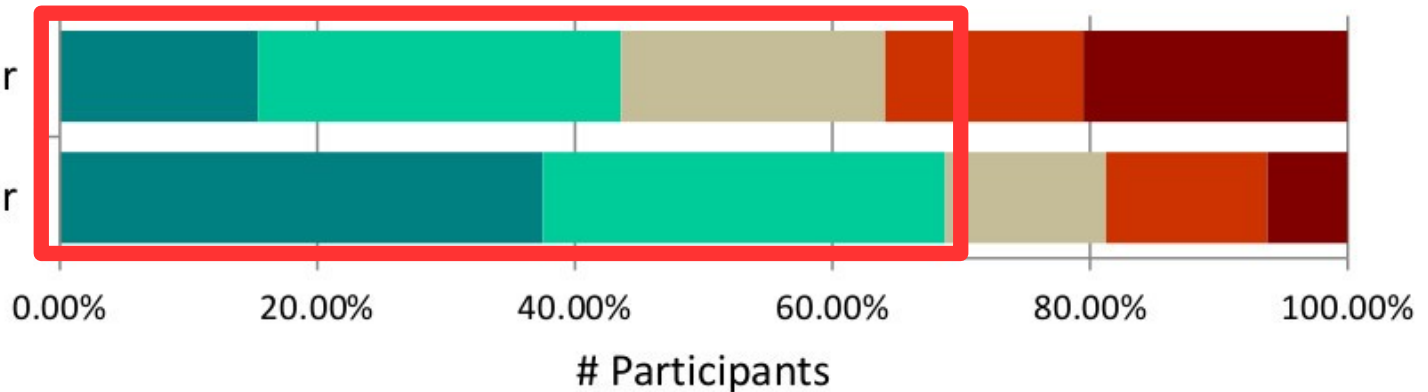
Security

Security of Face Unlock vs. PIN



Former User

Current User



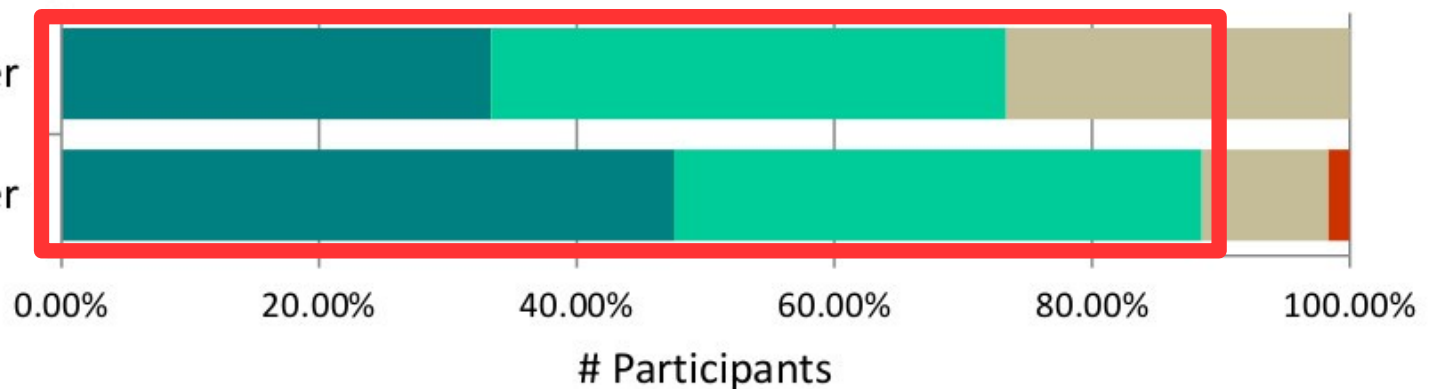
■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

Security of Fingerprint Unlock vs. PIN







Former User

Current User



■ A lot more ■ A little more ■ Equally ■ A little less ■ A lot less

Usability Issues

-  Authenticating in the dark difficult for many Android Face Unlock users
-  Authenticating with wet or dirty hands difficult for many iPhone Fingerprint Unlock users
-  Authenticating with Face Unlock perceived as uncool due to “selfie” perception
-  iPhone Fingerprint Unlock noted as particularly convenient while driving an automobile

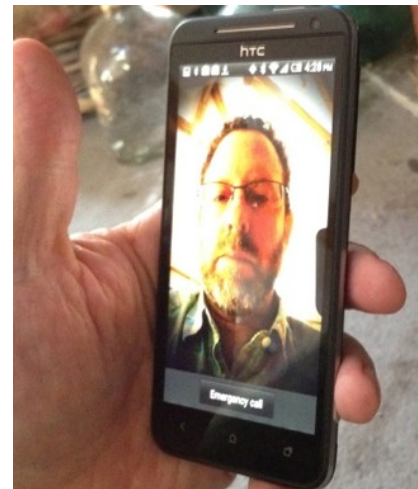
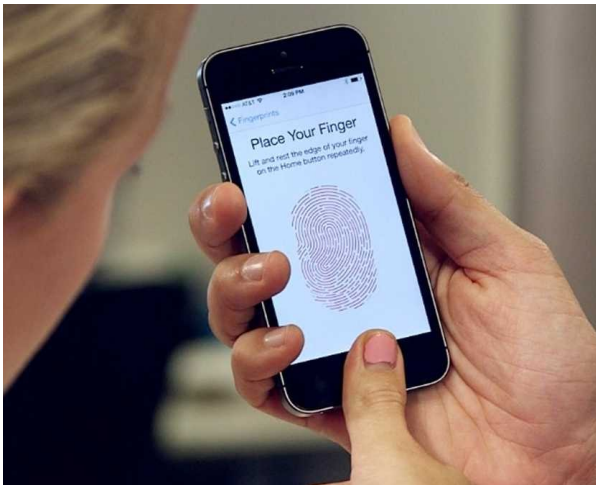
Limitations

- Small-scale lab study with convenience sample
- Online survey was observational
 - Android and iPhone populations are not statistically comparable
 - Convenience sample

Conclusions

- Mix of successes and failures
- Fingerprint unlock far more promising for large-scale adoption
- Users' perceptions of security contrasted with manufacturers' statements
 - Users perhaps overly optimistic
- Low-hanging fruit among usability issues

Biometric Authentication on iPhone and Android: Usability, Perceptions, and Influences on Adoption



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