

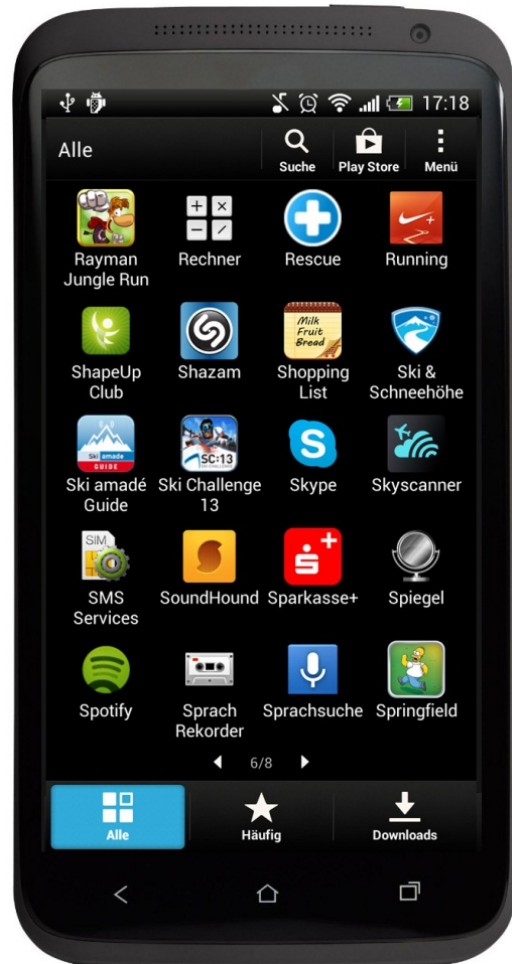


Using Graphics and Gestures to Improve Knowledge-based Authentication for Mobile Devices

Emanuel von Zezschwitz

Emanuel.von.zezschwitz@ifi.lmu.de

Motivation



- Pictures, Videos
- Online Banking
- Online Shopping
- E-Mail, Messaging
- Business Data

Authentication on Mobile Devices

PIN



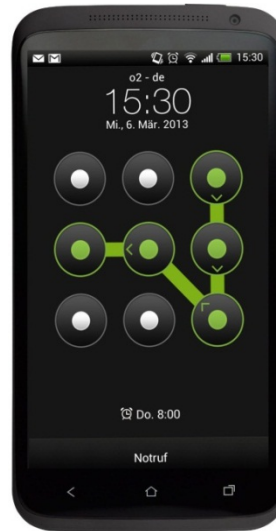
- Usable
- Secure

Password



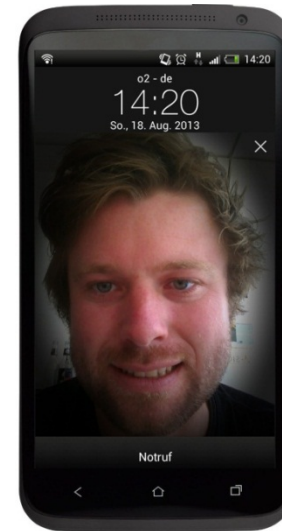
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Pattern



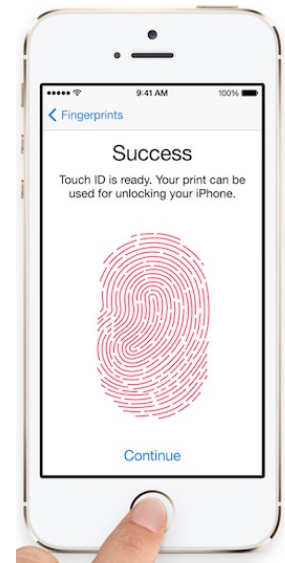
- Usable
- Secure

Face



- Usable
- Secure

Finger



- Usable
- Secure

 **Good**  **Average**  **Bad**

What about Biometrics?



“It is plain stupid to use something that you can’t change and that you leave everywhere every day as a security token”
Frank Rieger (CCC)

“Touch ID is designed to minimize the input of your passcode; but your passcode will be needed for additional security validation: After restarting your iPhone 5s [or] when more than 48 hours have elapsed from the last [unlock]”
Apple Support

Requirements



Passwords have to be

- easy to remember
- hard to guess

Interaction has to be

- hard to observe
- fast & easy

Large practical password space

Graphical / Gesture-based Passwords



Advantages:

- ✓ Well suited for touchscreens
- ✓ Not based on user data
- ✓ Motor memory
- ✓ Pictorial superiority effect
- ✓ More joyful for most users

Graphical / Gesture-based Passwords



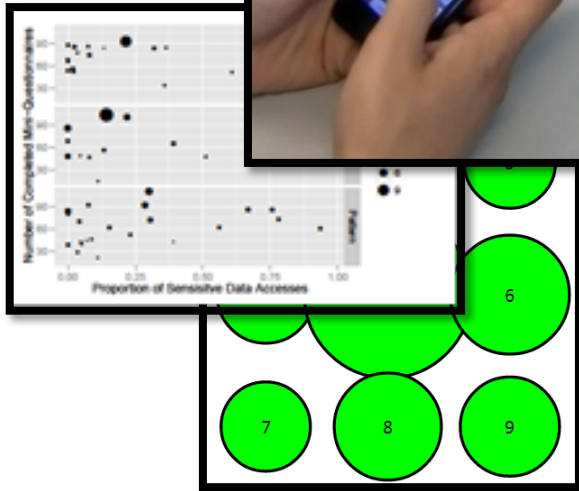
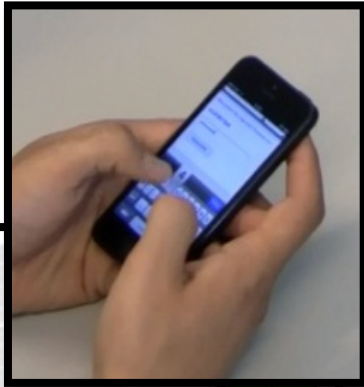
Advantages:

- ✓ Well suited for touchscreens
- ✓ Not based on user data
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- ✓ Pictorial superiority effect
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Drawbacks:

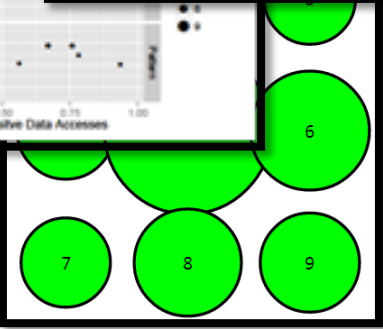
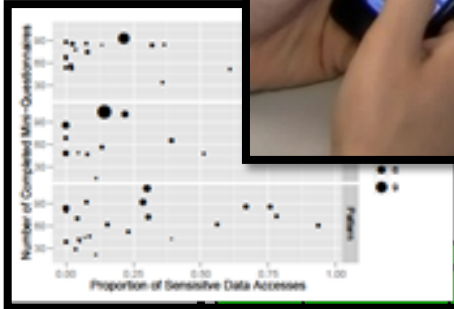
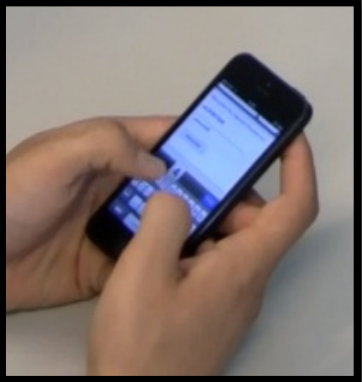
- ✗ Prone to shoulder surfing
- ✗ Prone to smudge attacks
- ✗ Weak passwords? Metrics?

User-centered Approach



Understand
User Behavior
&
Perception

User-centered Approach

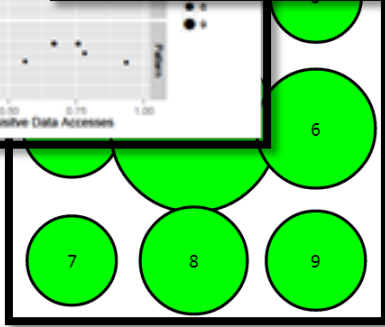
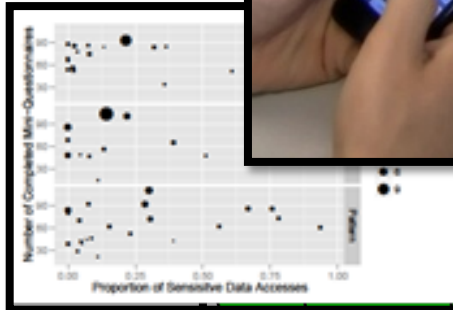
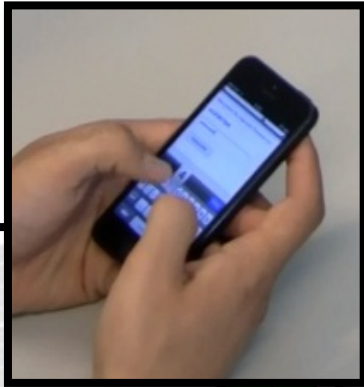


Understand
User Behavior
&
Perception



Develop
Concepts

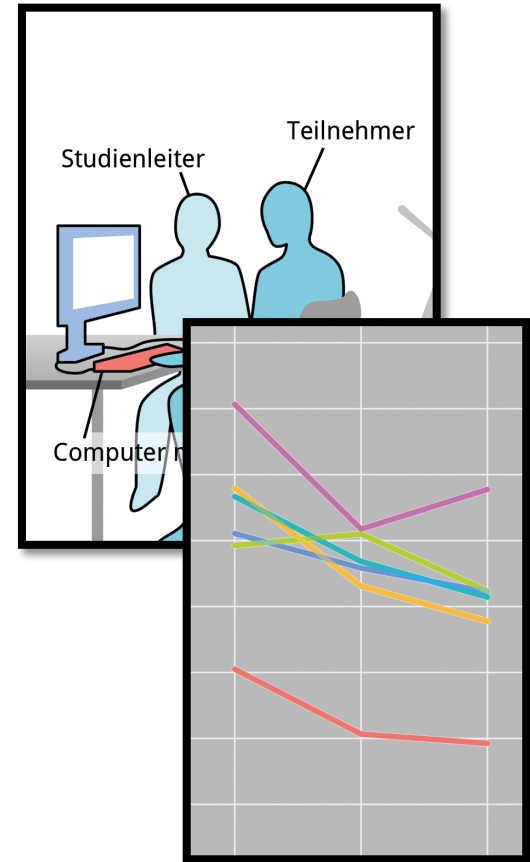
User-centered Approach



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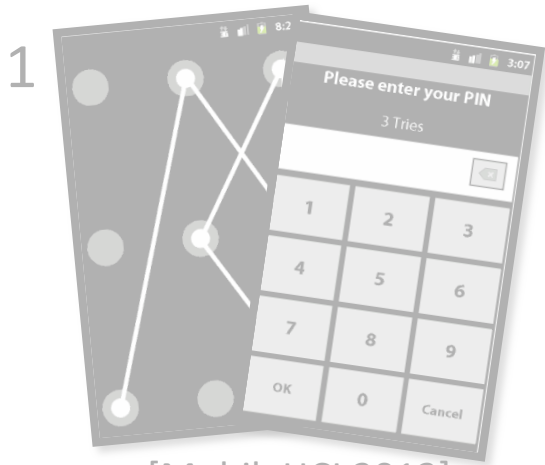
Develop
Concepts



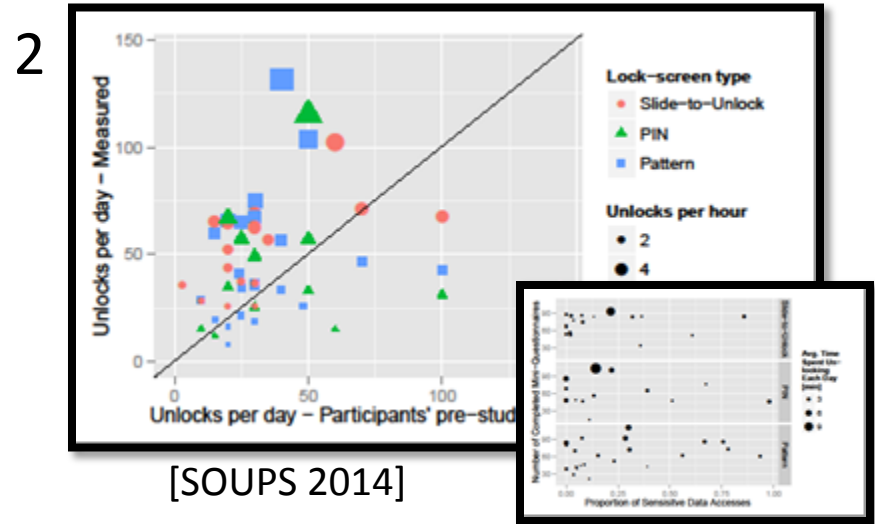
Generalize
Results

Understanding Behavior & Perception

User Behavior & Perception



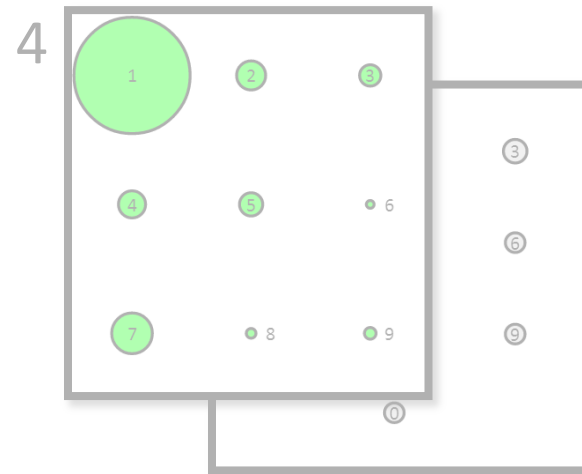
[MobileHCI 2013]



[SOUPS 2014]



[NordiCHI 2014]

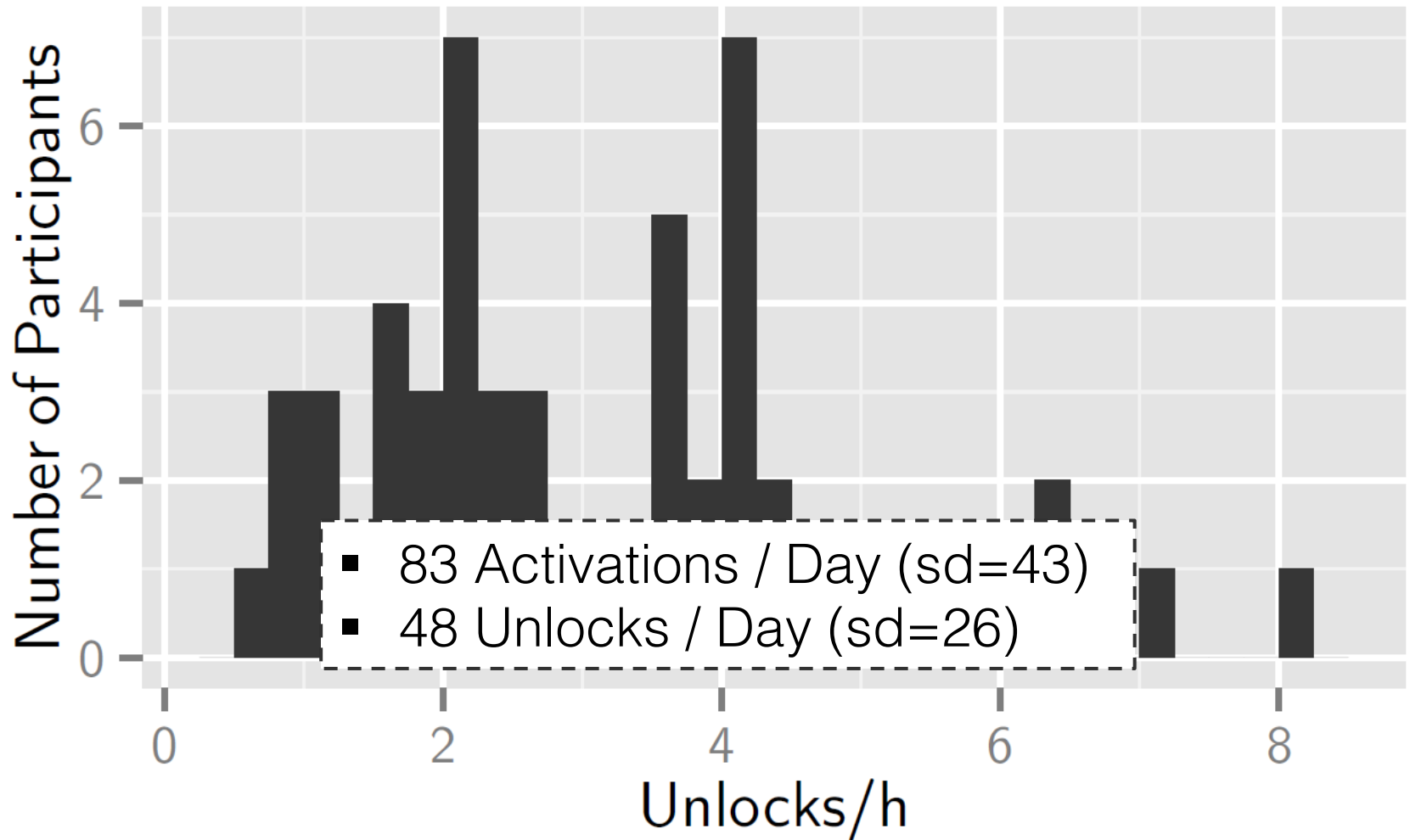


Smartphone (Un)Locking Behavior and Risk Perception

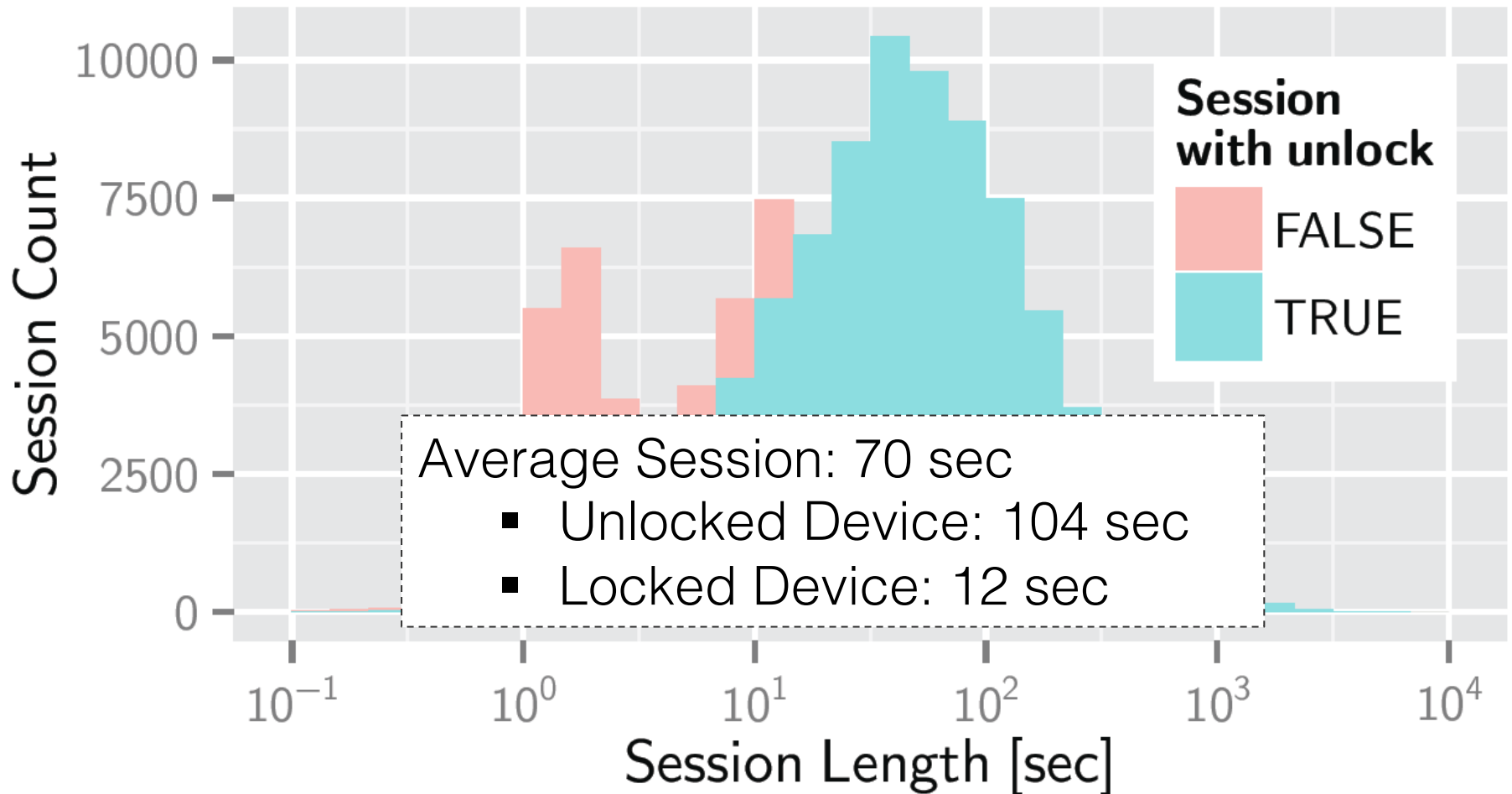


- How, why and in which situations do people use lock screens?
- How often do people access sensitive data?
- Is shoulder surfing and unwanted access an issue?

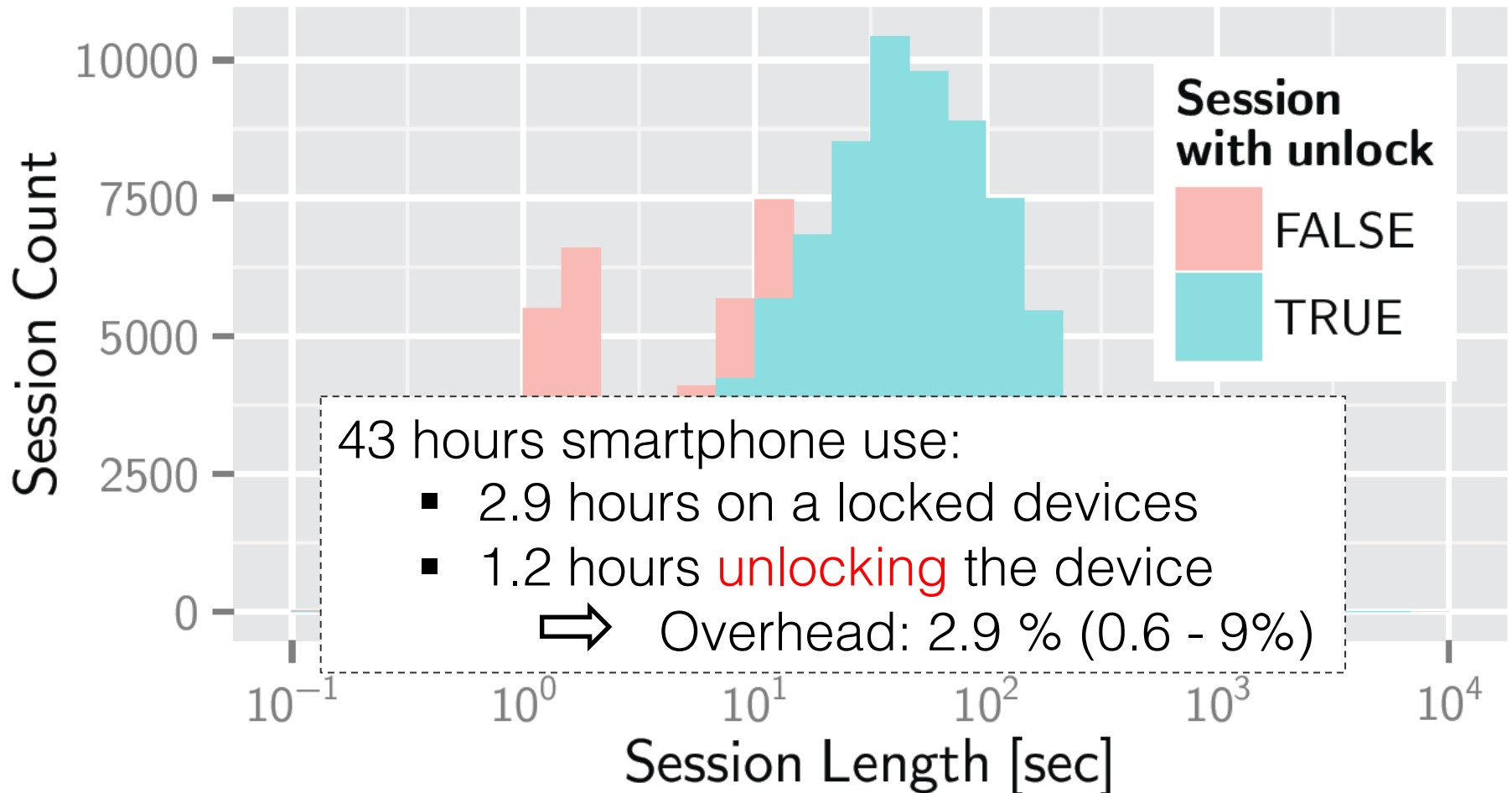
(Un)lock Frequency



Session Length



Session Length



Shoulder Surfing

- Possible in 17% of all sampled situations
- Likely in 41%, Critical in 19%
- Mostly known persons in private environments
- Considered **likely AND critical** in **0.3%**

Key Results

- Every Additional Second Has an High Impact: Unlock Mechanisms Must be (Perceived) Very Fast

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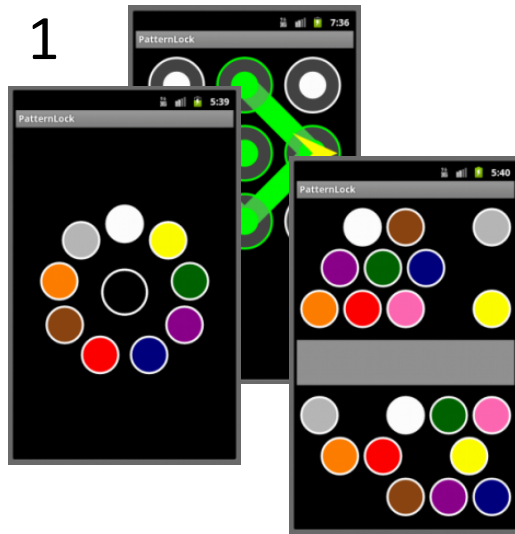
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- Users are Often Dissatisfied with their Current Configuration: The Security Level Should Adapt to the Context
- Sensitive Data is Seldom Accessed: Unlock Mechanisms Should be Content-dependent
- Shoulder Surfing Risks are Perceived Low: Shoulder Surfing Resistance Must Not Reduce Performance

Designing Solutions

Design & Evaluate Solutions



[IUI 2013]

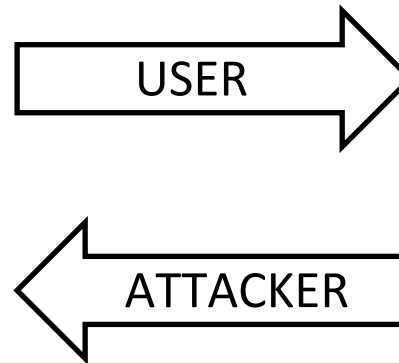


[CHI 2013/2014]

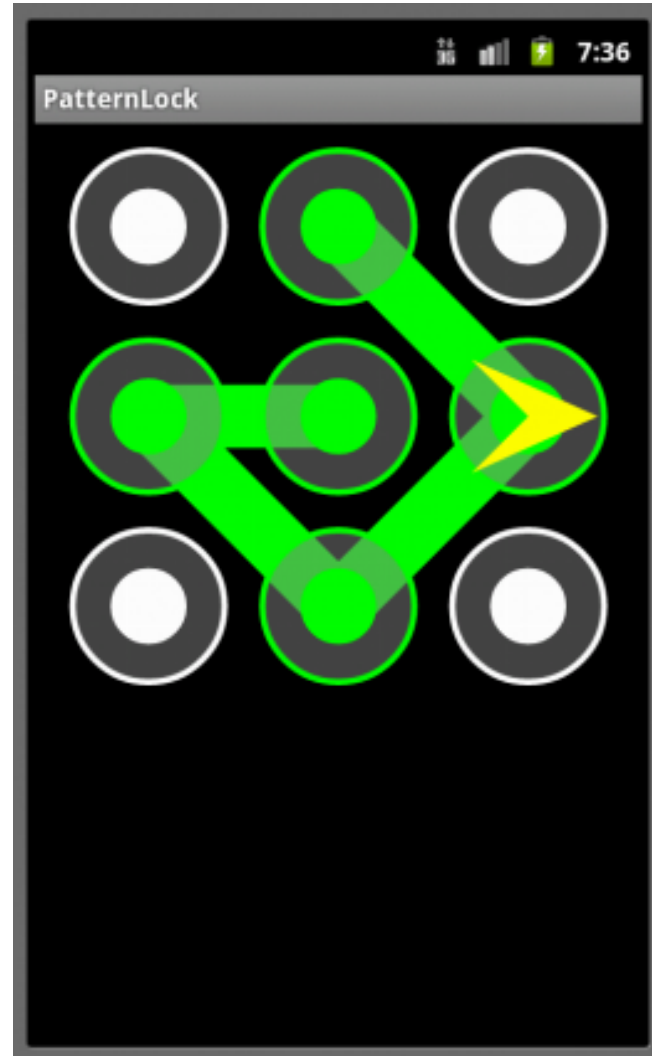


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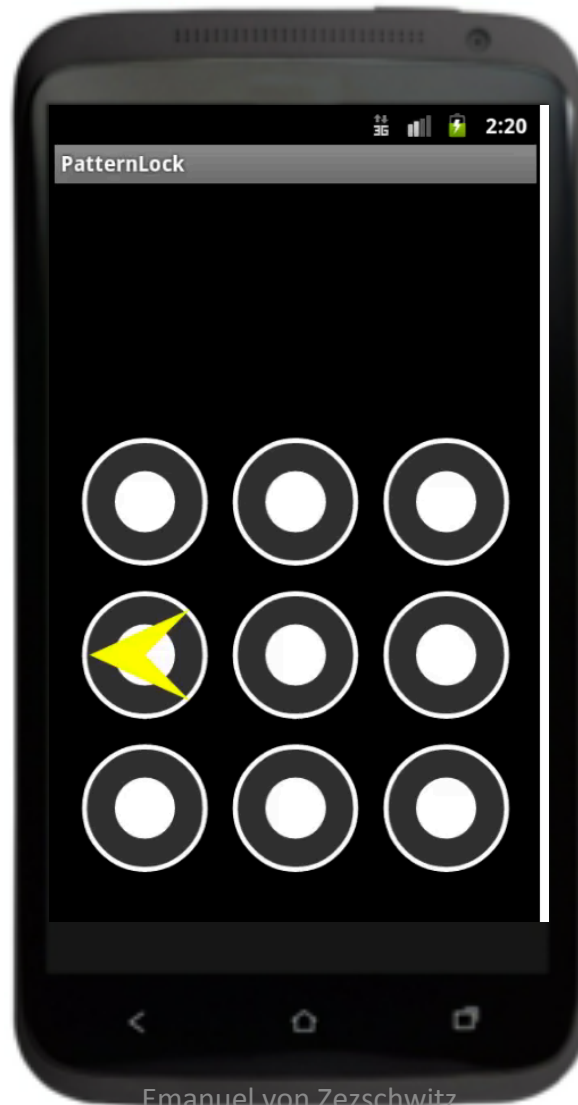
Smudge Attack Protection



Android 90°



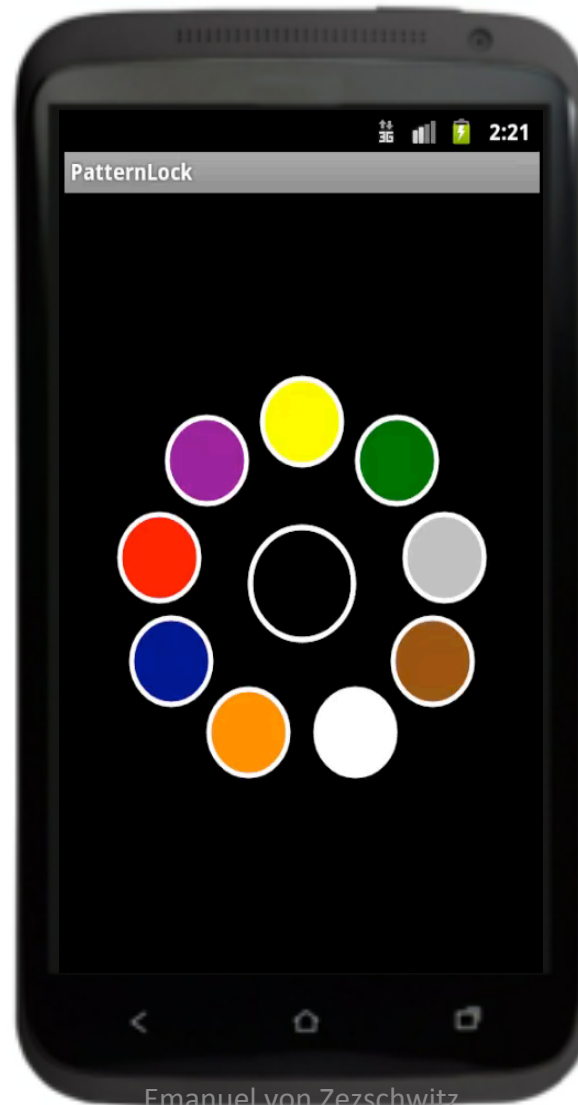
Android 90°



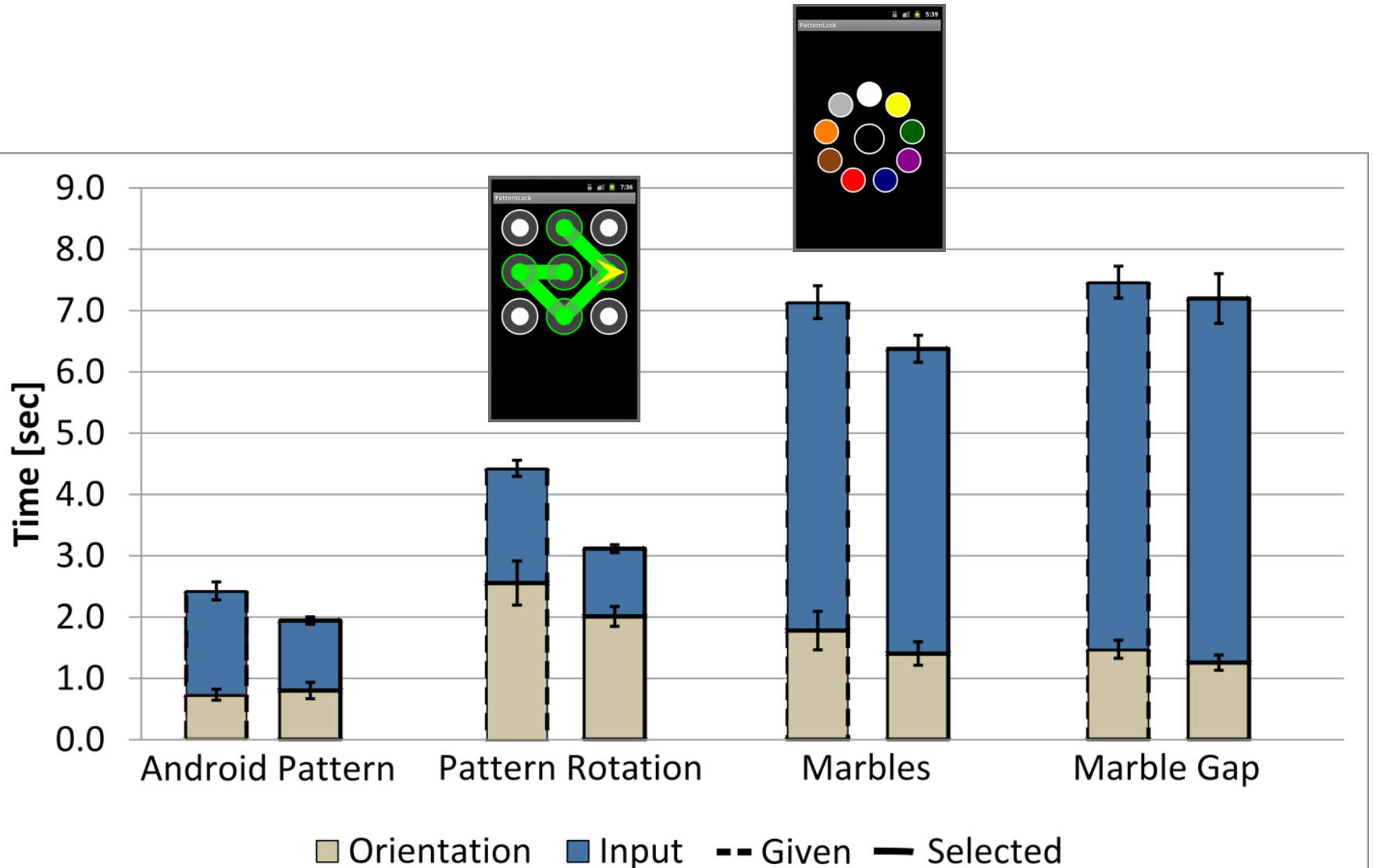
Marble



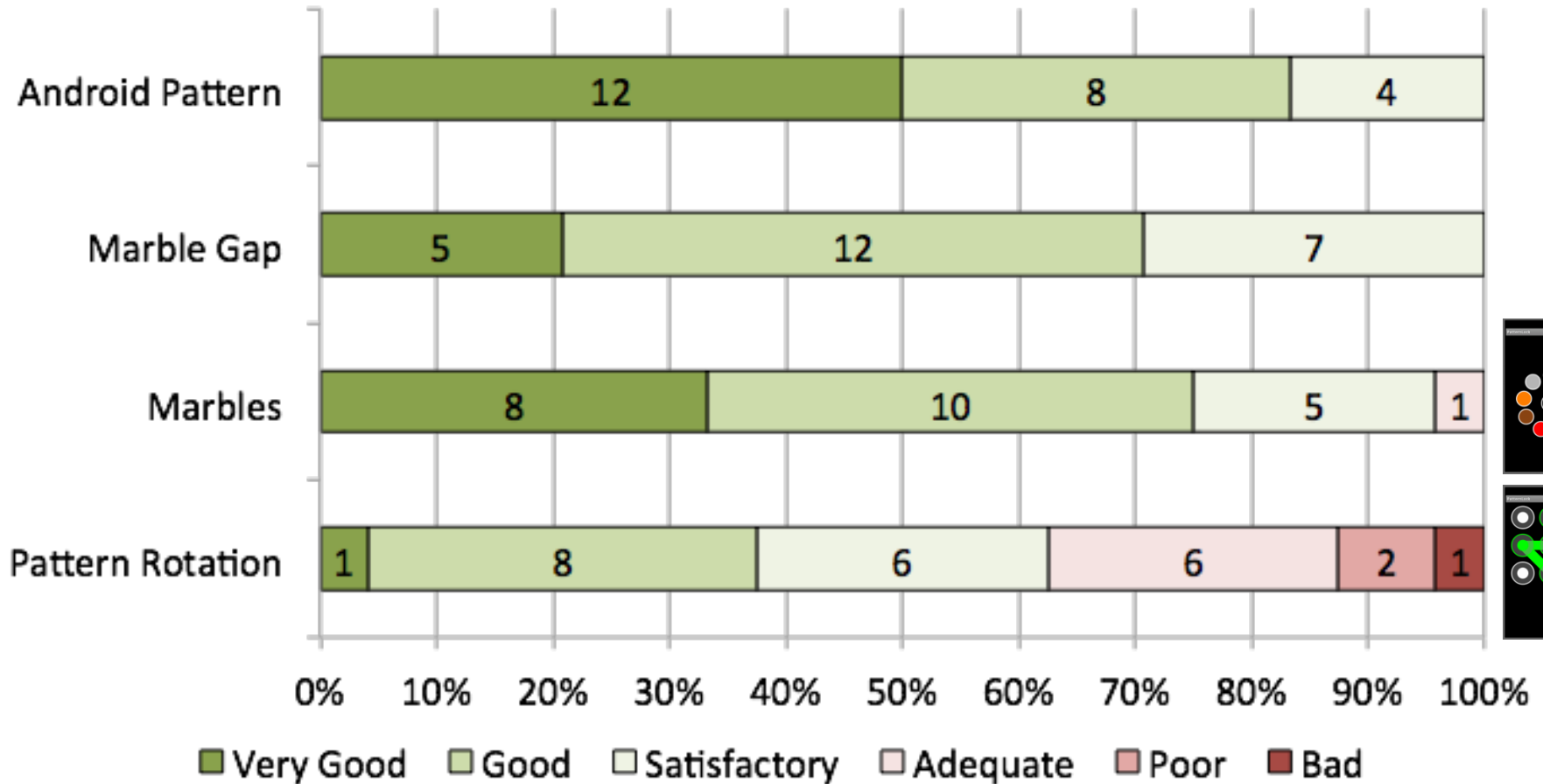
Marble



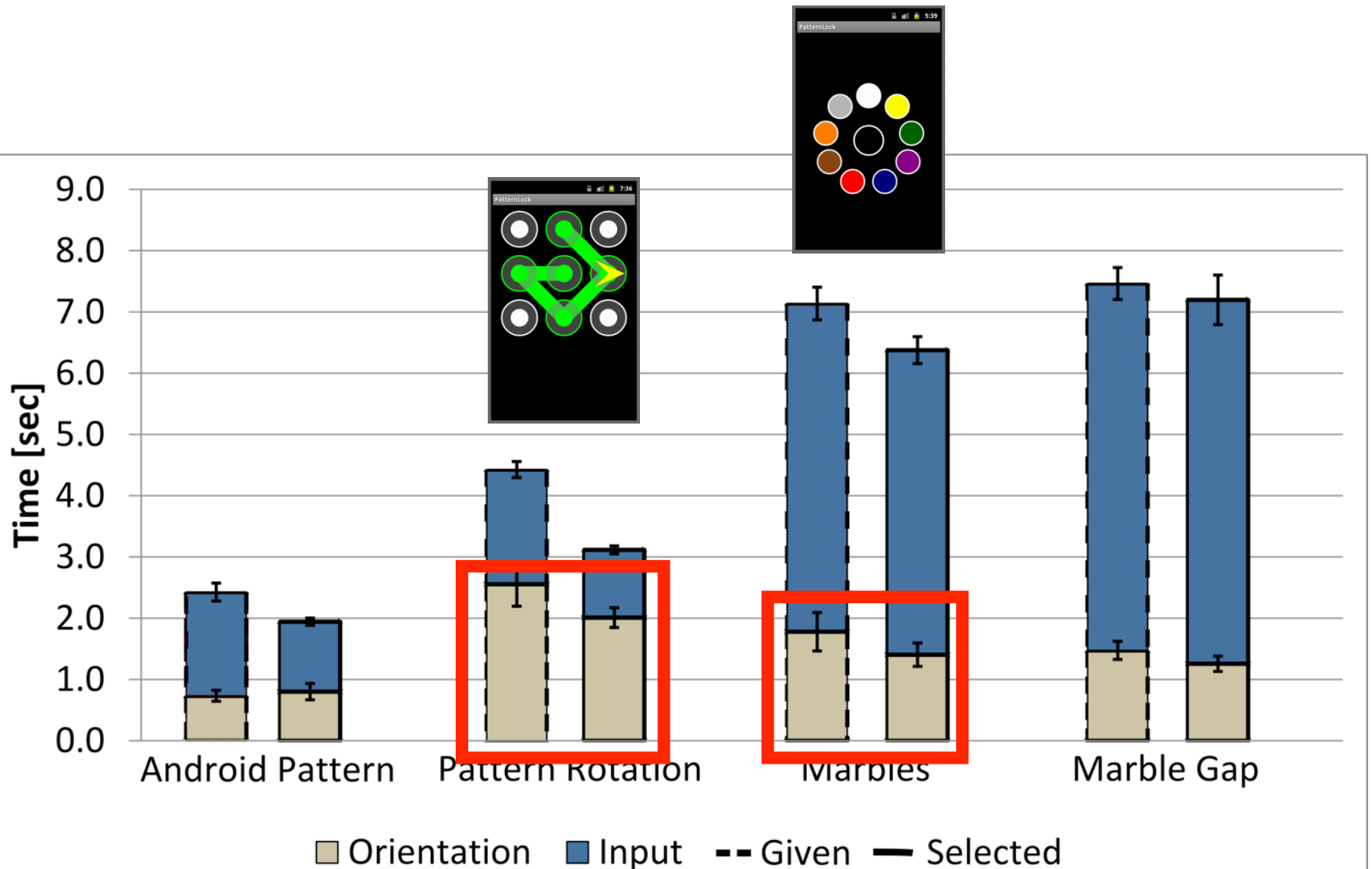
Speed (quantitative)



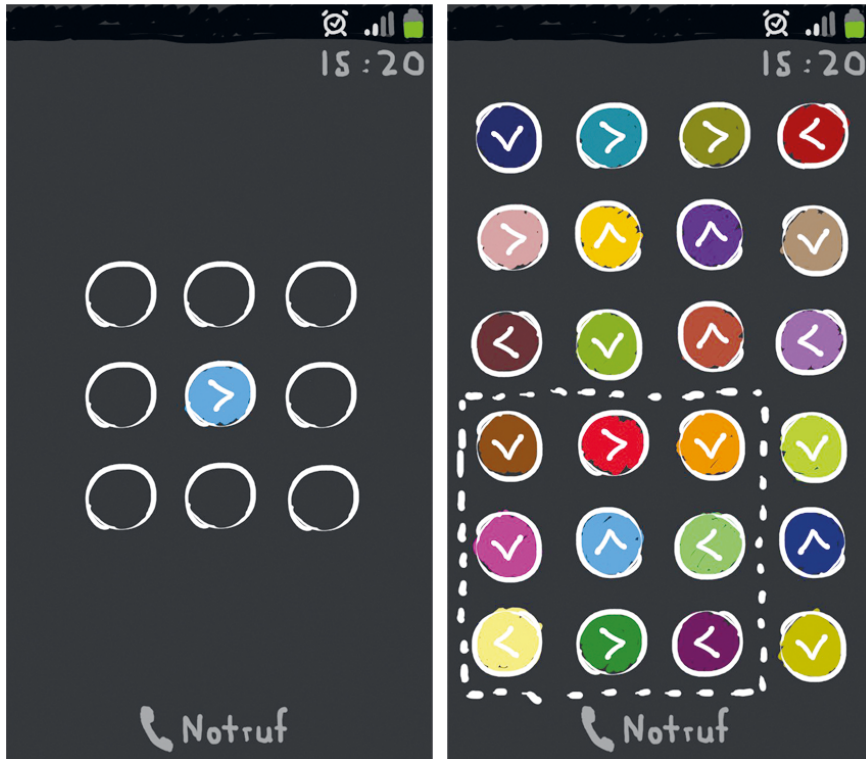
Speed (qualitative)



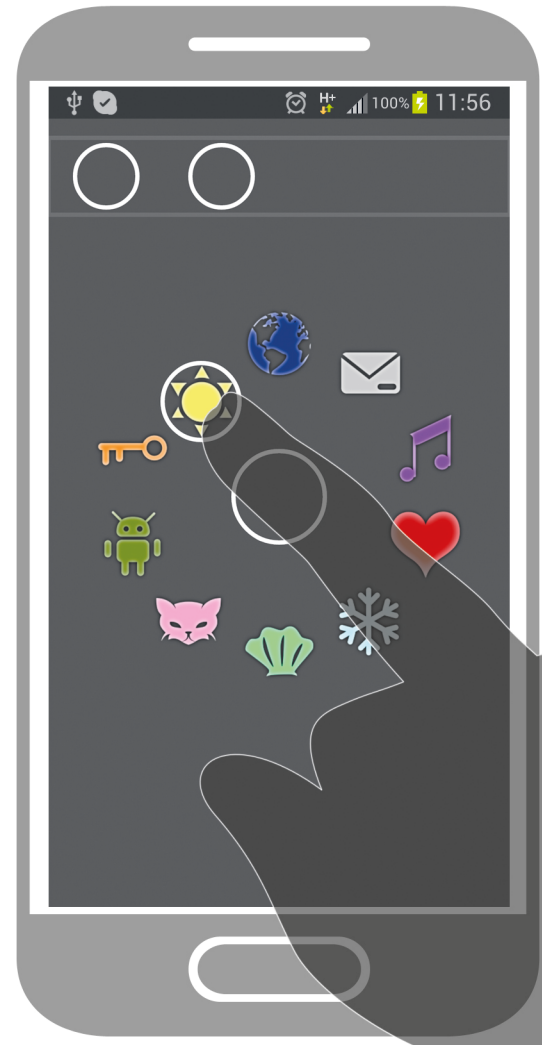
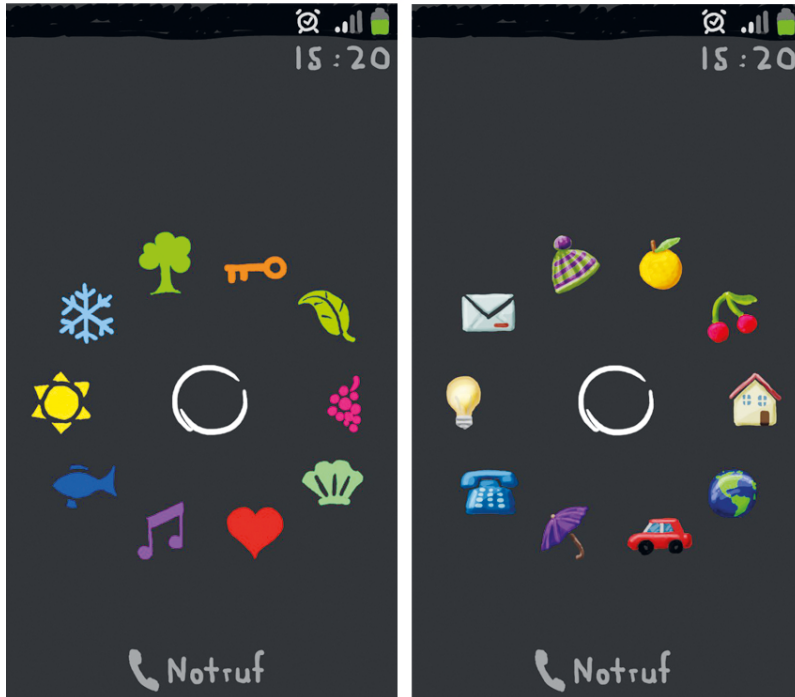
Speed (quantitative)



Pattern 90 II: Four Connect

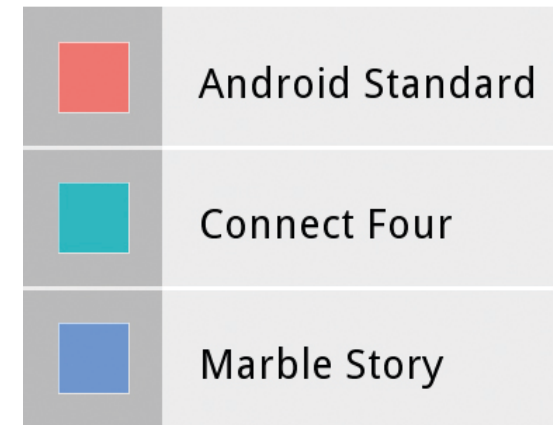
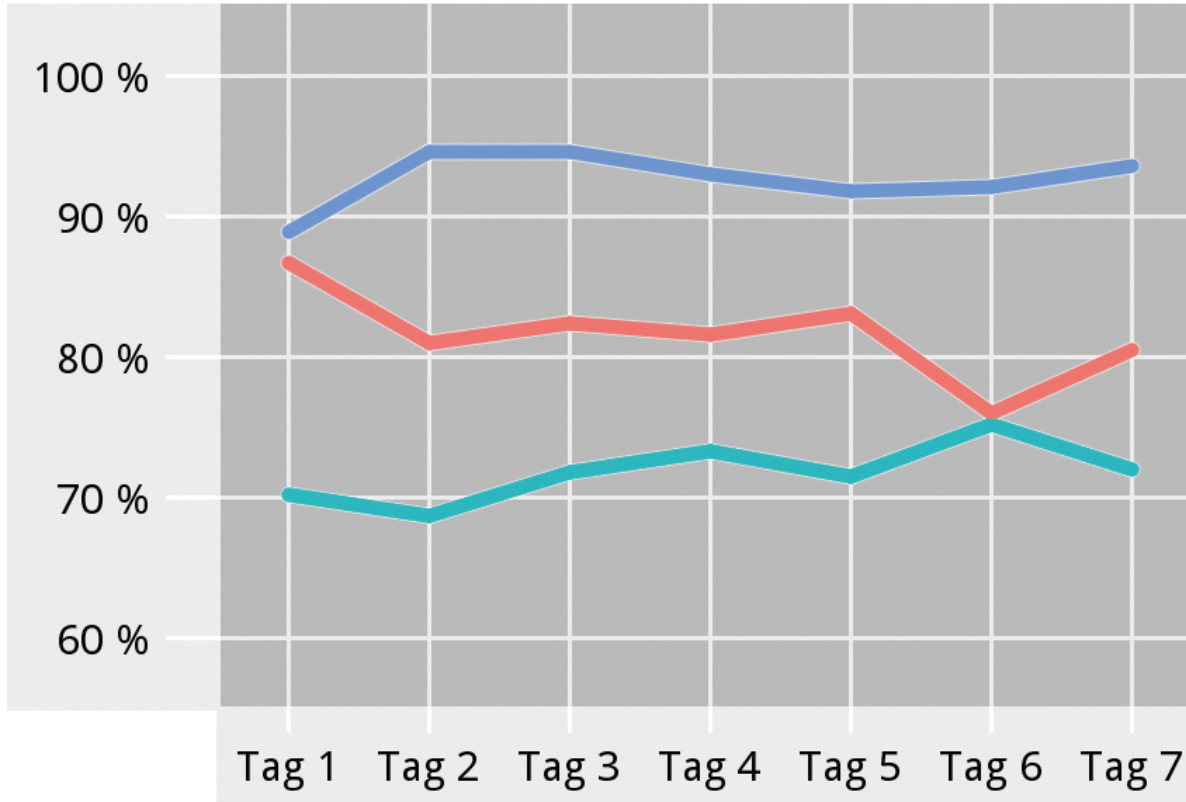


Marbles II: Story-based

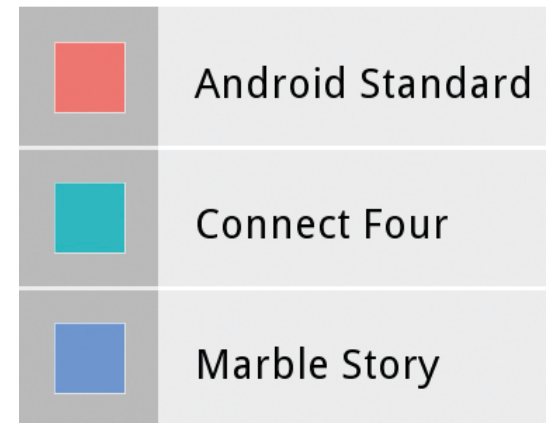
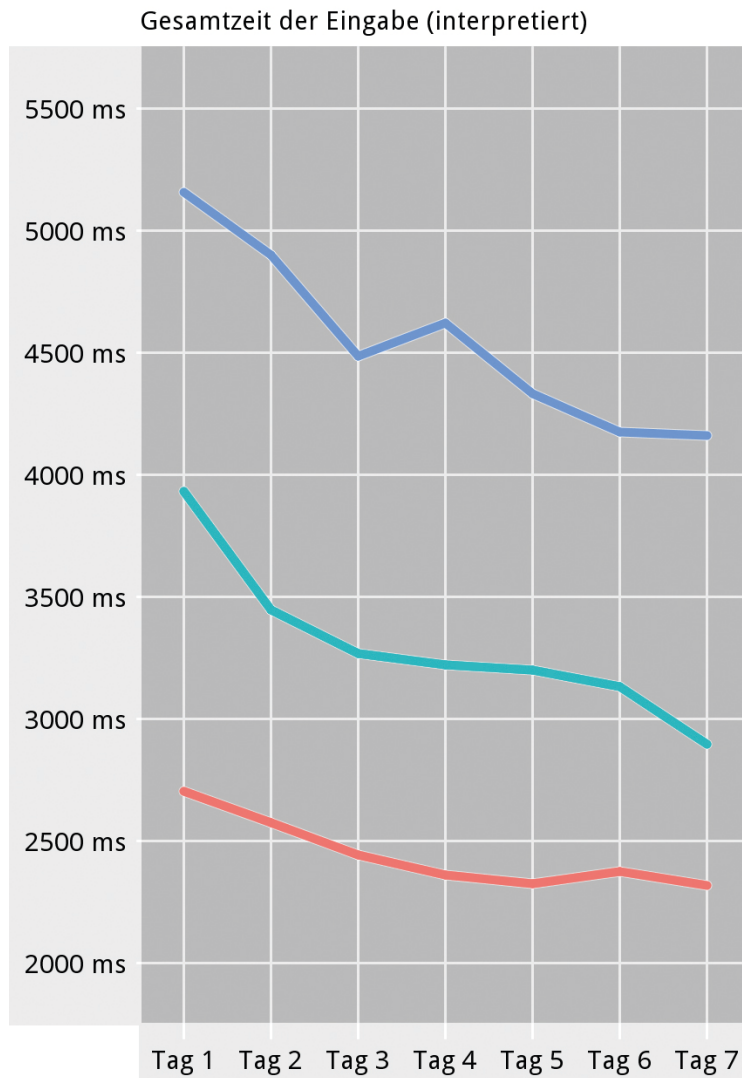


Field Performance

Erfolgsquote (interpretiert)



Field Performance



Key Results

- 83%-100% of the Android patterns were exposed

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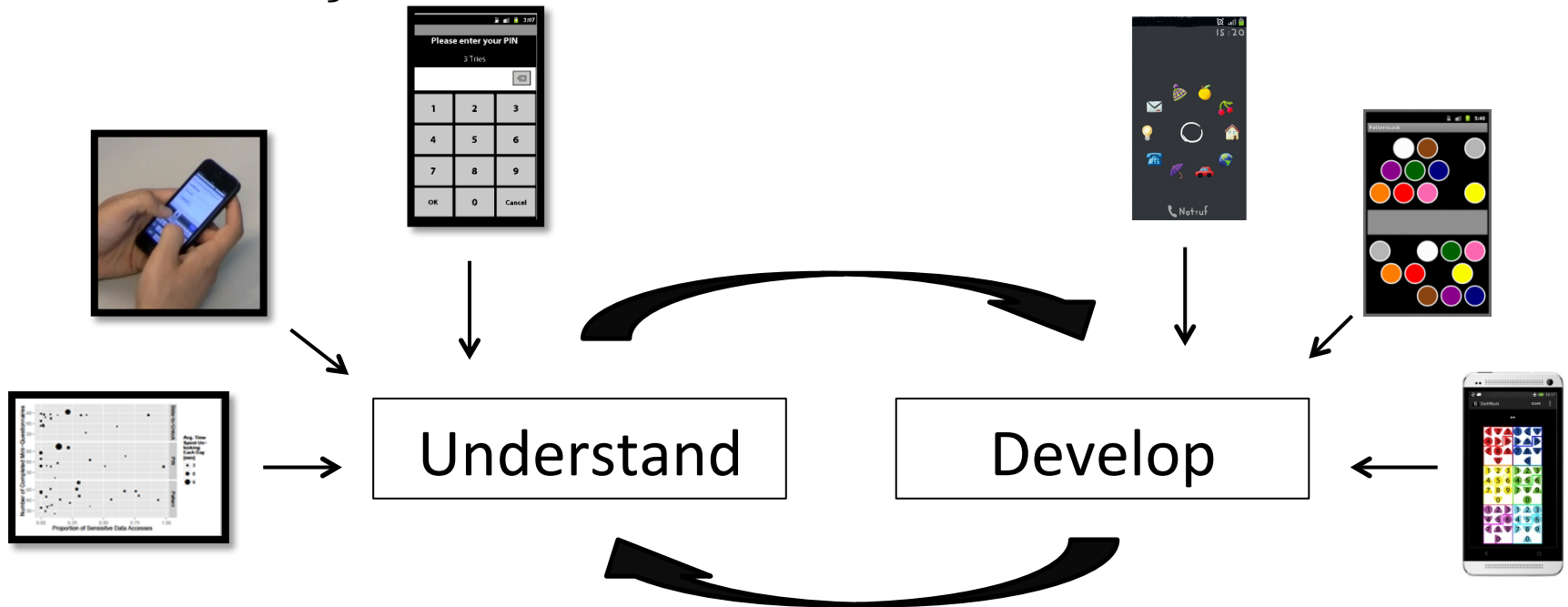
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- 83%-100% of the Android patterns were exposed
- Presented concepts are significantly more secure and equally good concerning ease-of-use and perceived speed
- Orientation time is more critical than input time
- Input complexity influences password composition
- Authentication methods need to be evaluated in the field

Summary



Current & Future Projects

- The Impact of Pattern Composition on Theoretical and Practical Security
- How to Compute and Increase the Strength of User-selected Grid-based Passwords



Thank You

emanuel.von.zezschwitz@ifi.lmu.de

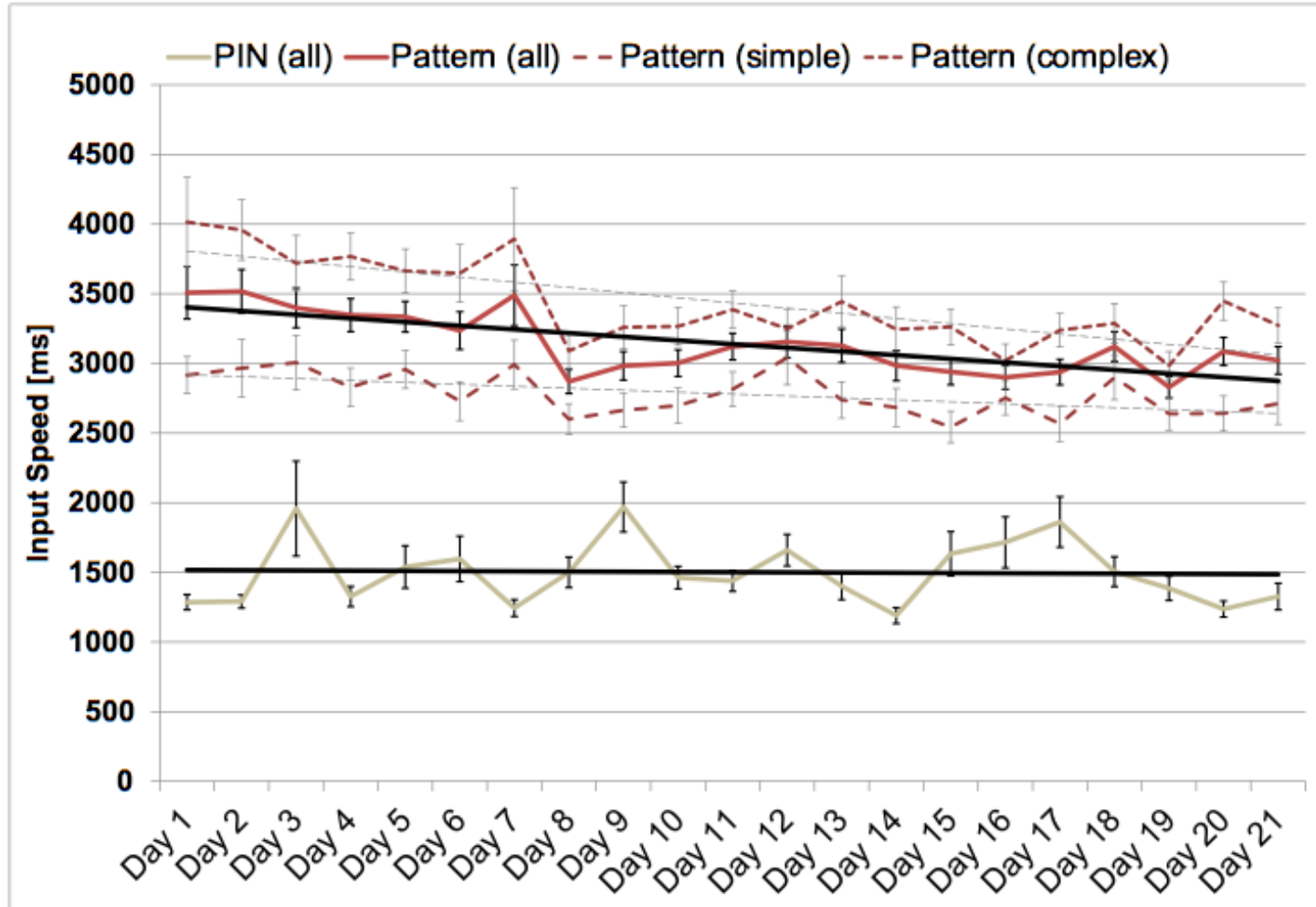
www.mimuc.de/team/

PIN vs. Pattern



A Field Study of the Usability of Pattern and PIN-based Authentication on Mobile Devices

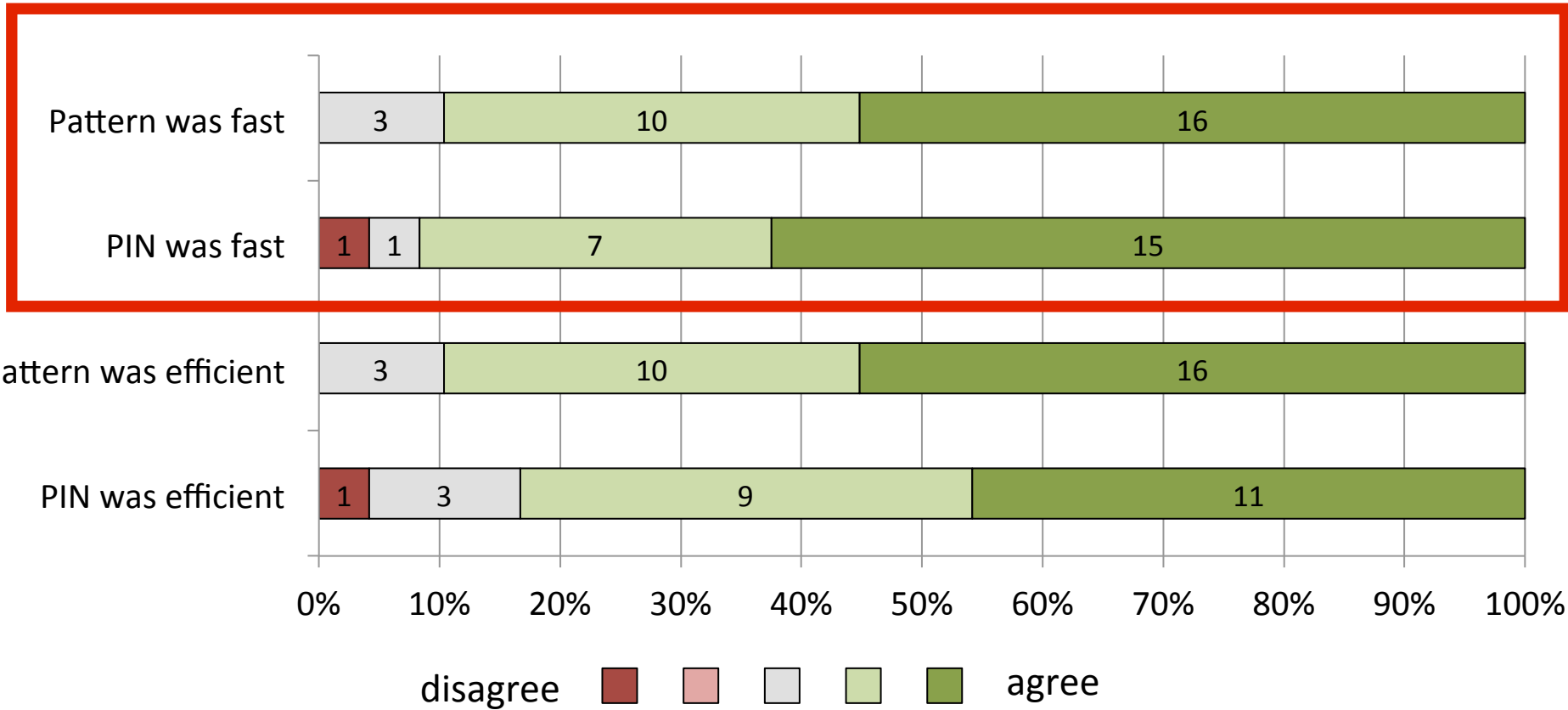
Speed



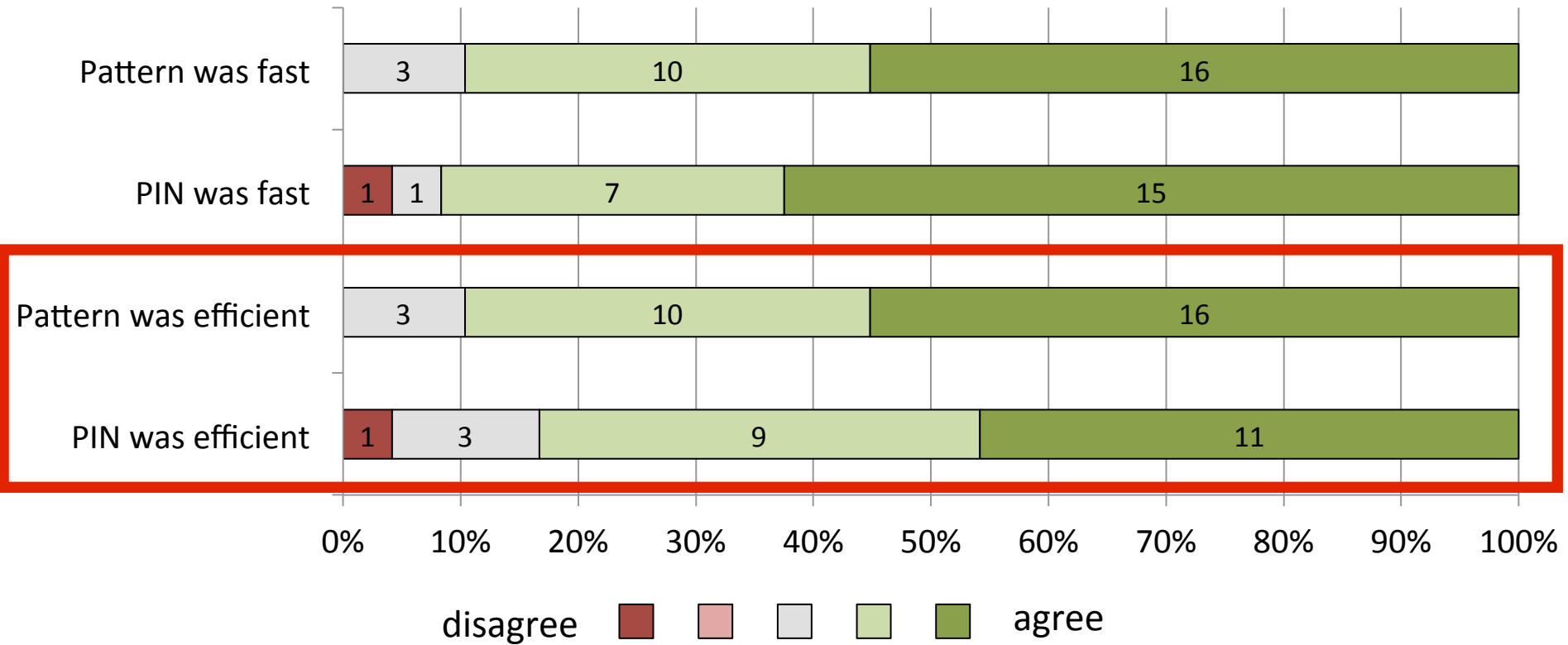
PIN: 1.5s

Pattern: 3.1s

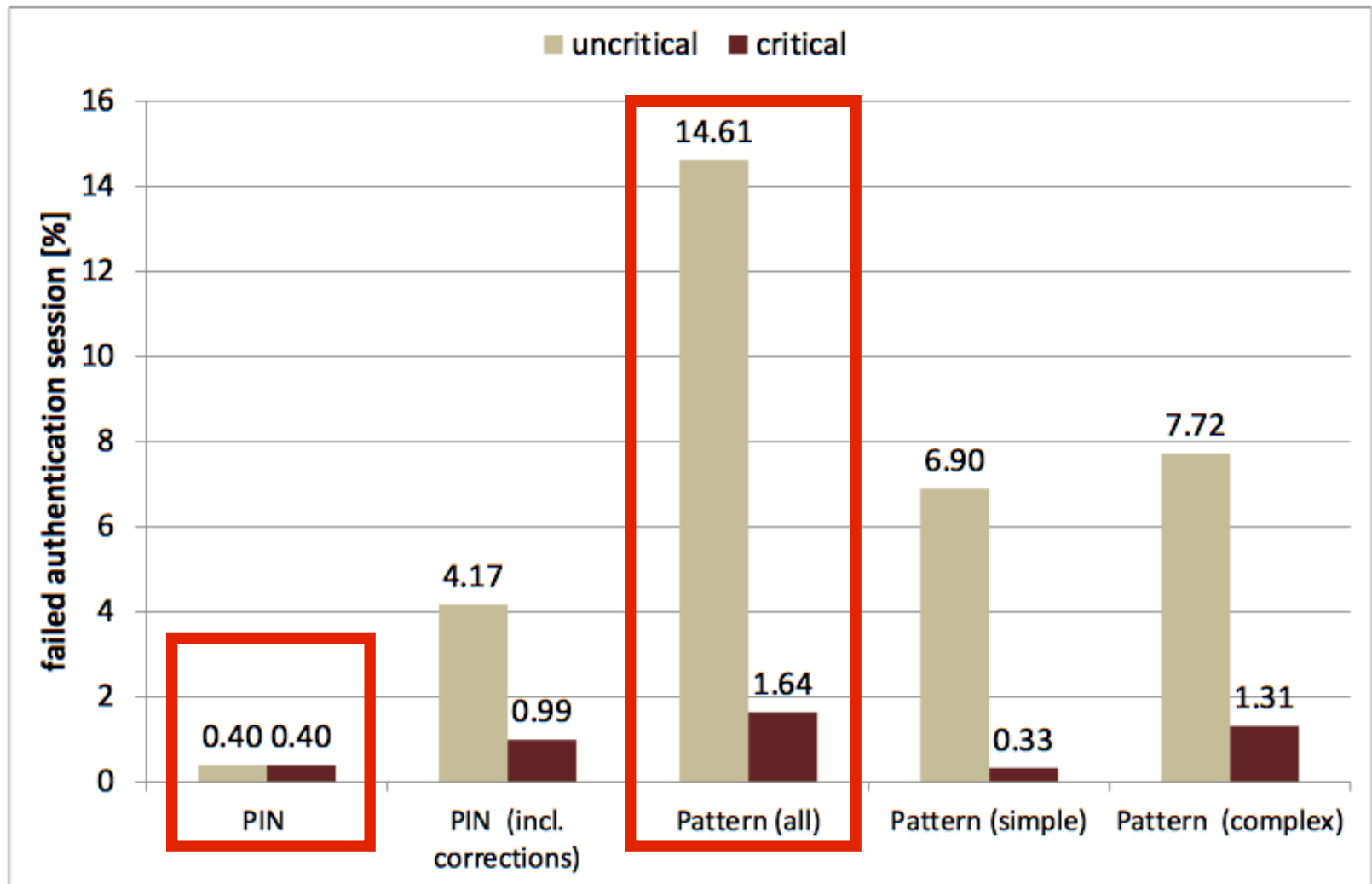
Speed



Speed



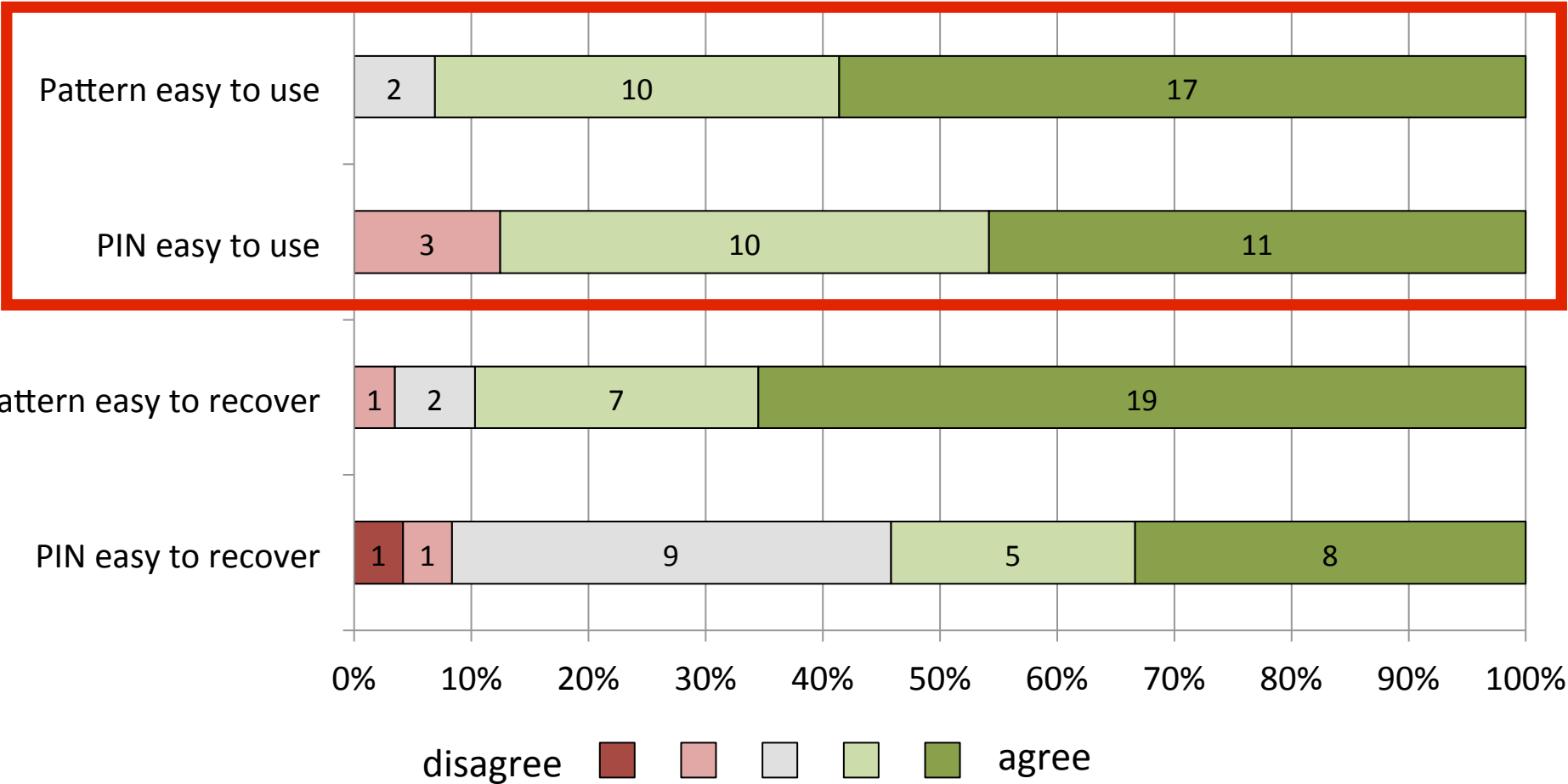
Errors



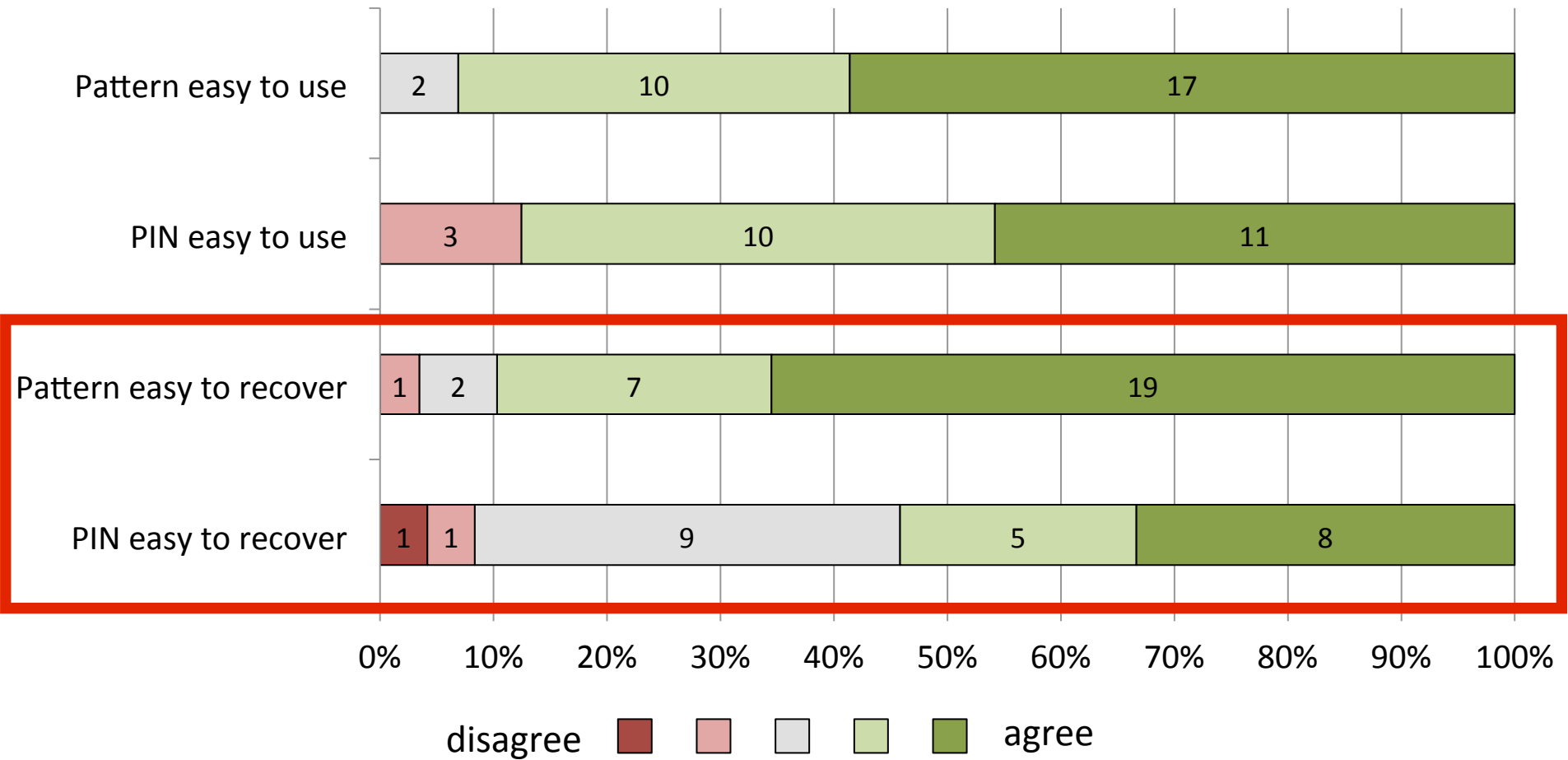
PIN: 8

Pattern: 99

Errors



Errors



Key Results

- Patterns are slower and more error prone, but people do not perceive the difference
- Fast error recovery is more important than error prevention for most users
- Taxonomy for pattern-based errors