



LUDWIG-  
MAXIMILIANS-  
UNIVERSITÄT  
MÜNCHEN

MEDIA INFORMATICS  
DEPARTMENT FOR COMPUTER SCIENCE



**Robert Kowalski**  
**Final Presentation Student Research Project**  
**20.07.2010**

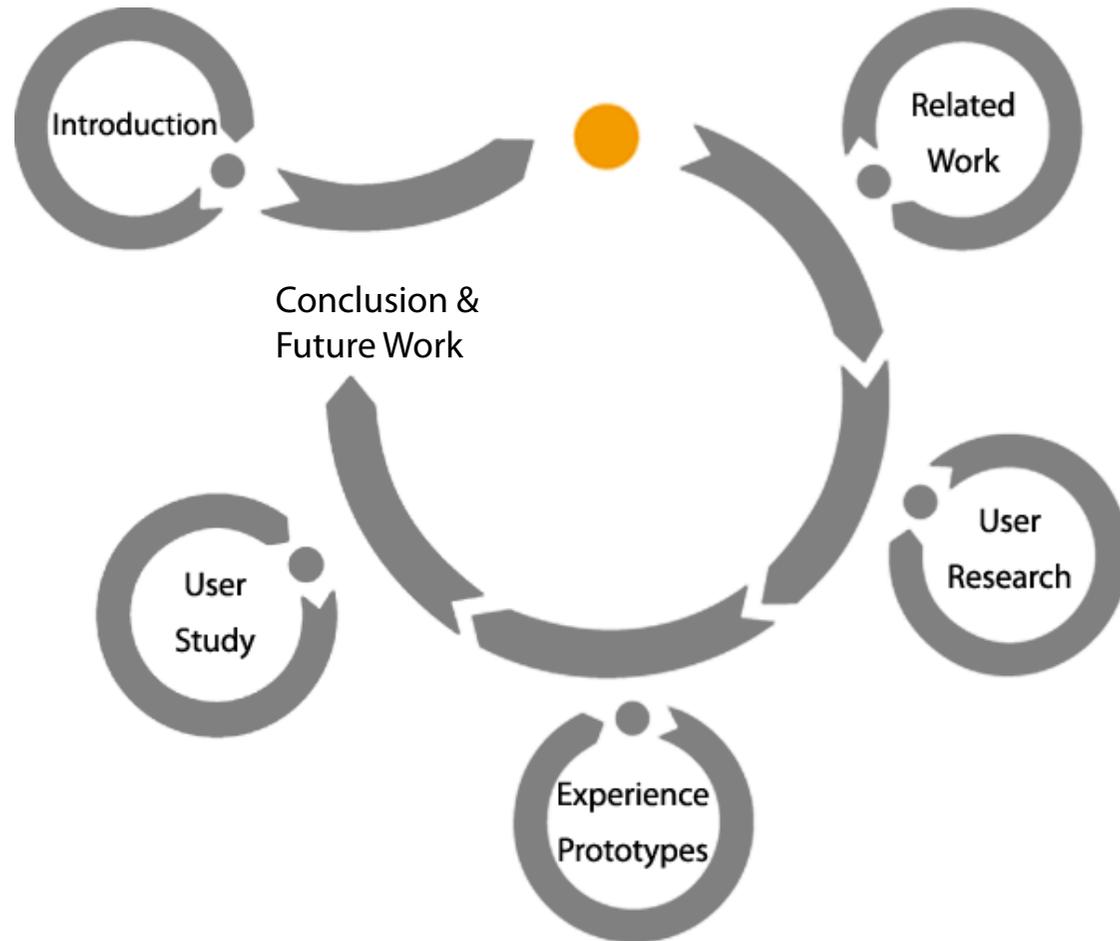


## **Easy Accessible and Personalized Content on Interactive Surfaces**

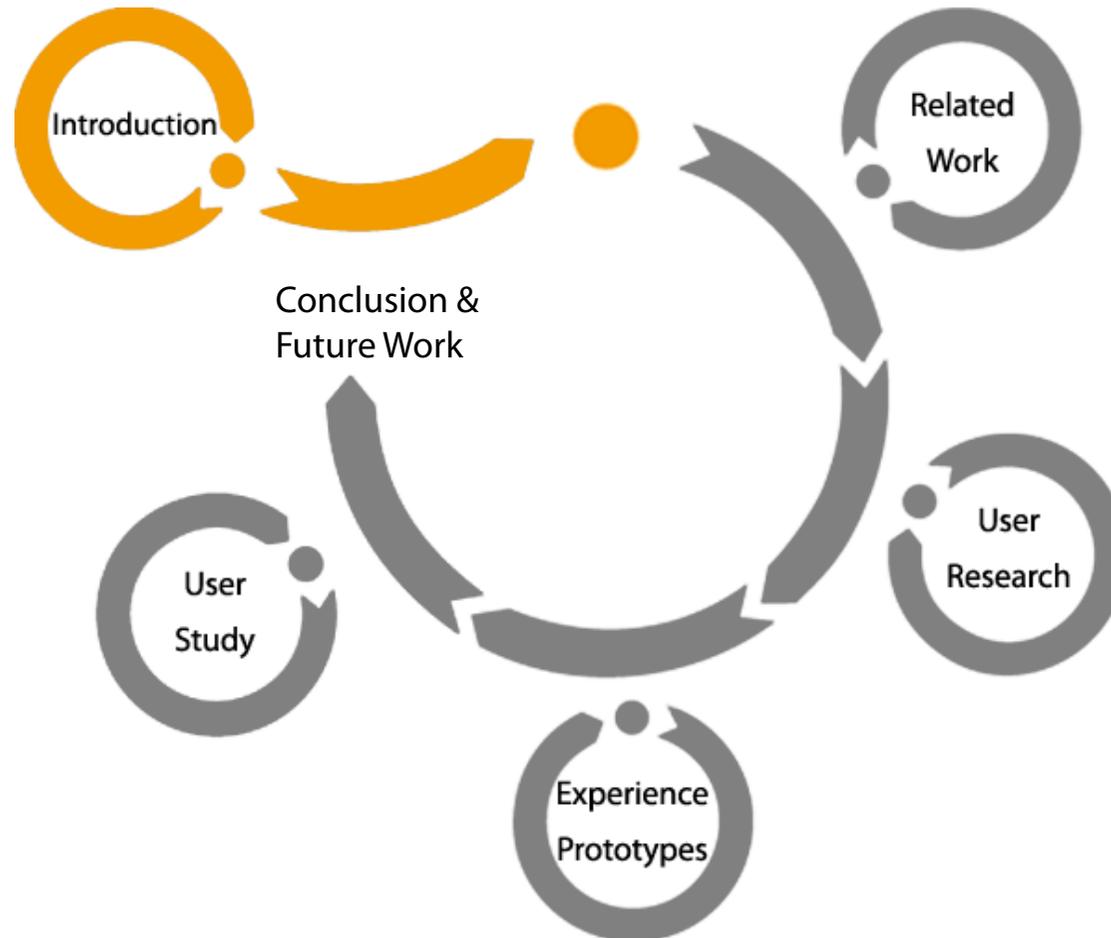
**Supervisor: Alexander Wiethoff**  
**Professor: Prof. Dr. Andreas Butz**

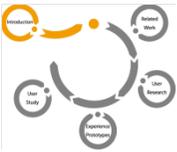


# Agenda



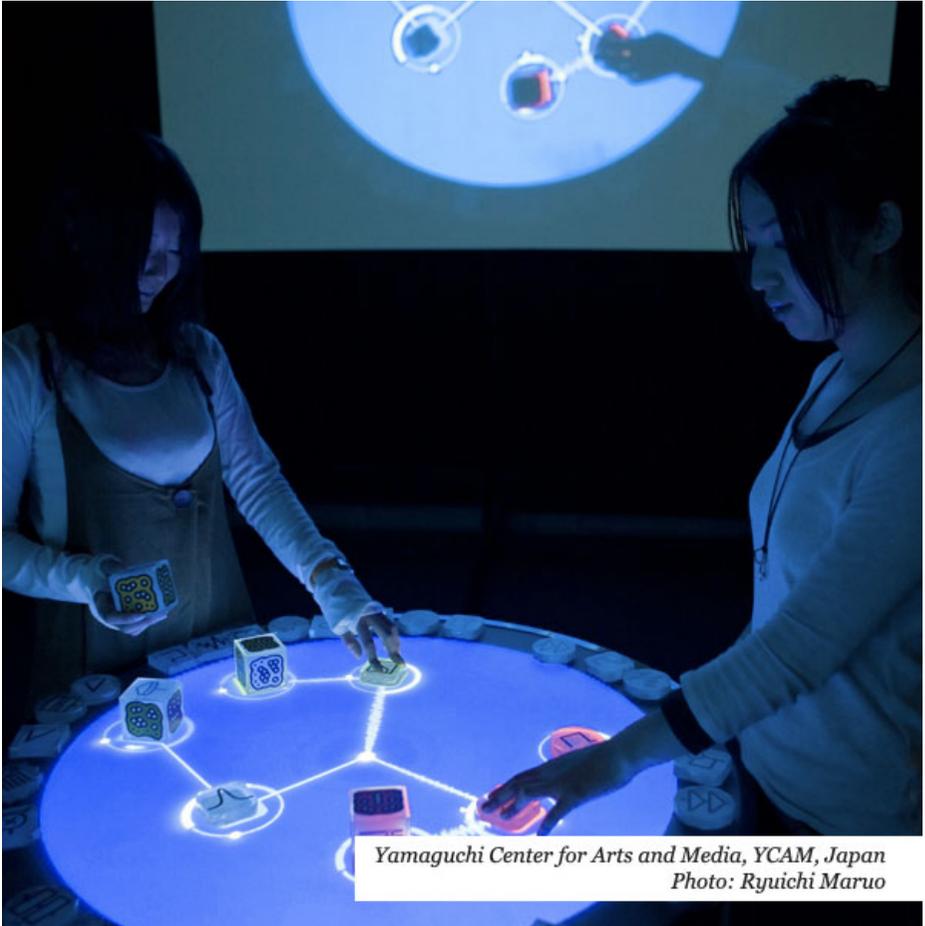
# Agenda





# Introduction

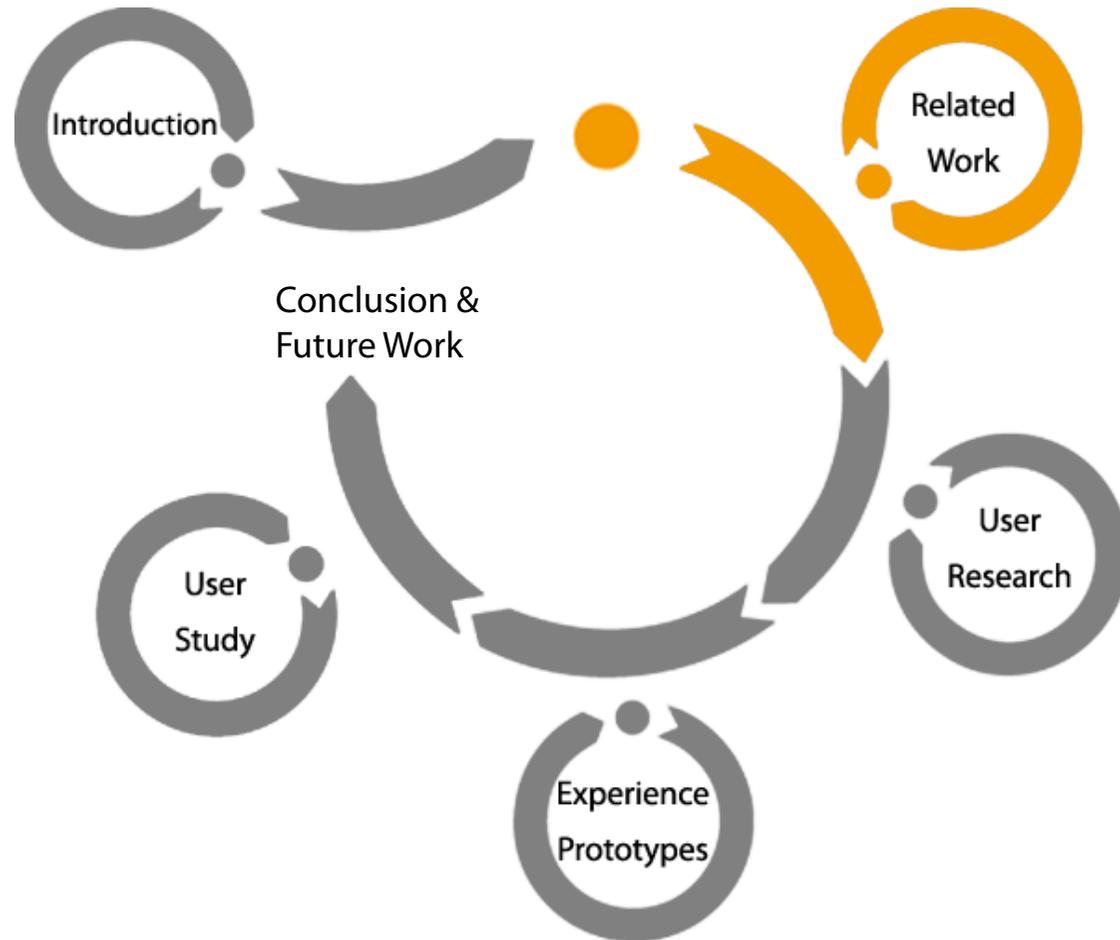
- Combination of TUIs and digital surfaces
- Aim: Collaborative scenario use cases
- Problem: Establishment of ownership
  - Login identification
  - Bring own TUI along
- Scenario of the project:
  - Accessing public data
  - Finding better fitting id-methods

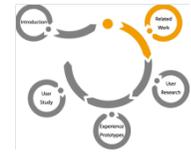


Yamaguchi Center for Arts and Media, YCAM, Japan  
Photo: Ryuichi Maruo

Source: [http://www.reactable.com/images/experience\\_ycam\\_big.jpg](http://www.reactable.com/images/experience_ycam_big.jpg)

# Agenda



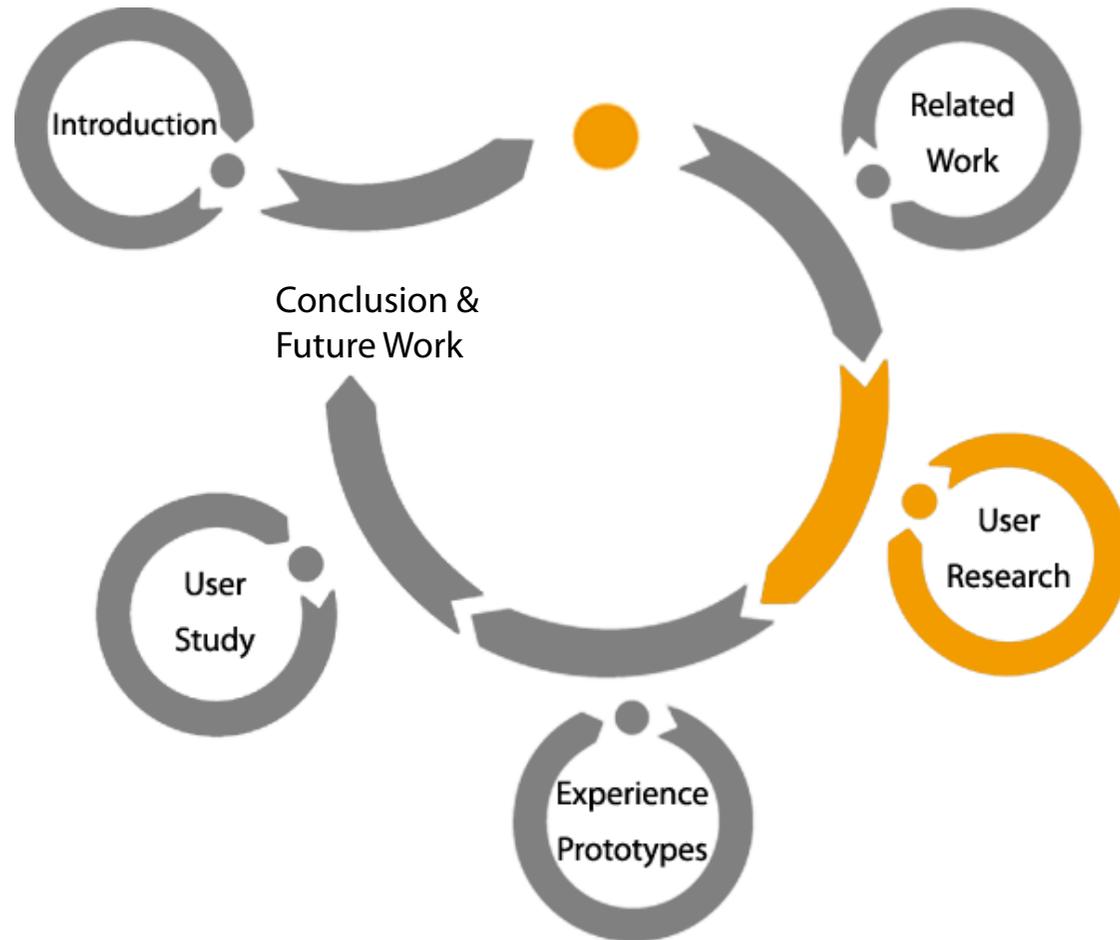


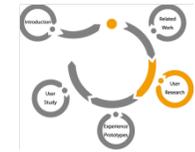
## Related Work

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- Imprinting (Stajano, Anderson)
  - Physical contact, infrared, speech (Balfanz et al.)
  - Image Recognition (Claycomb, Shin)
  - Tapping patterns (Wobbrock)
  - RFID / NFC (Rukzio et al.)
  - Blinking Lights / Sound / Shaking, Bumping / PIN (Kumar et al.)
  - Smartphones as id tokens (Toye et al.)
-

# Agenda



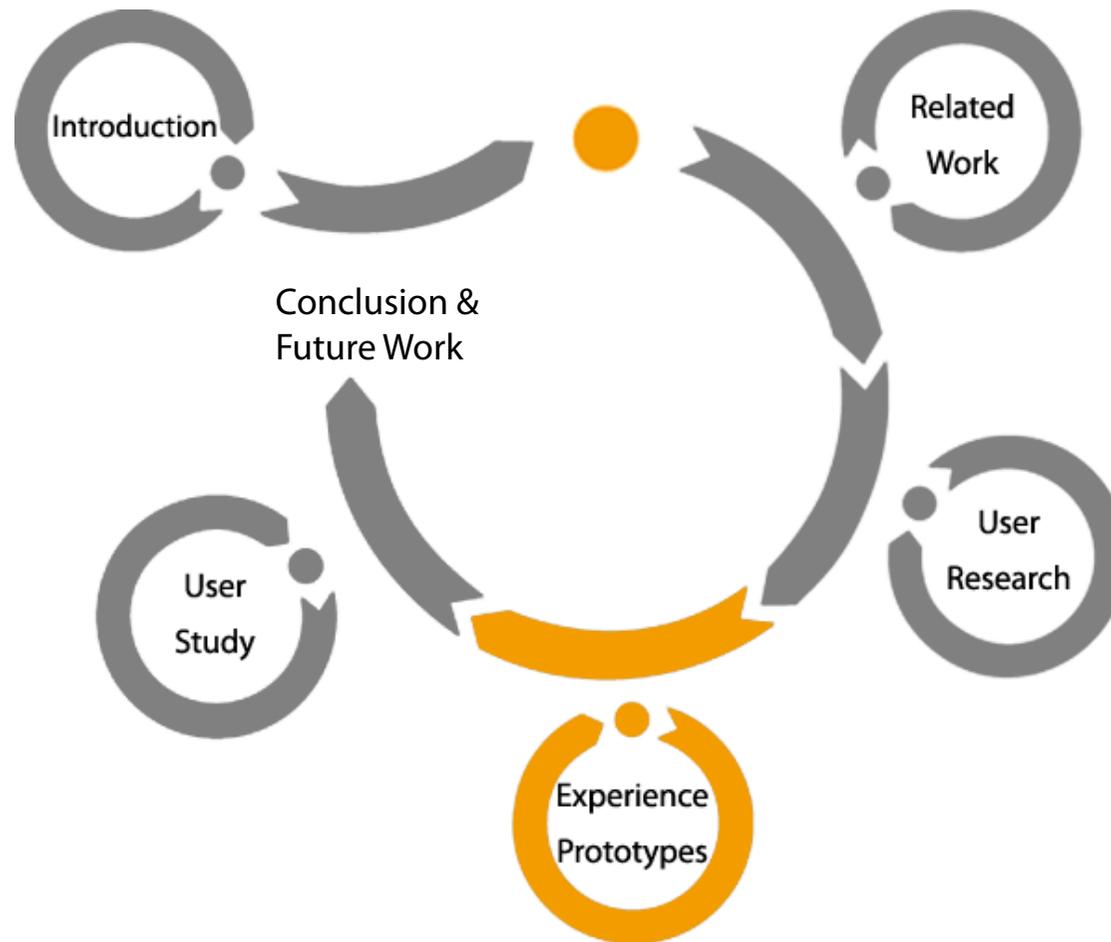


## User Research

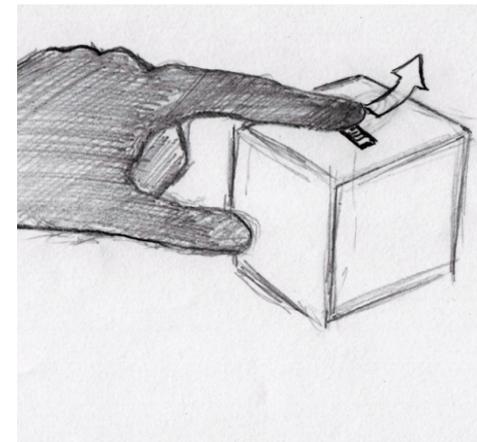
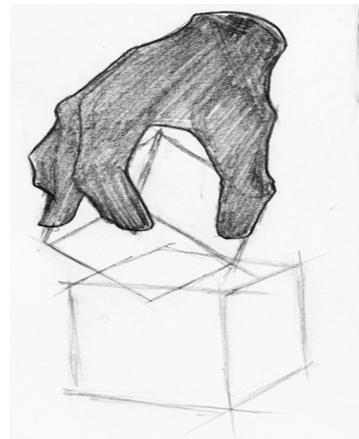
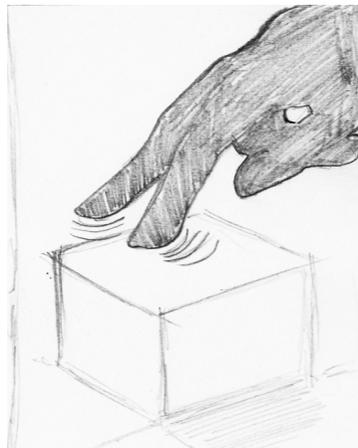
- 7 persons (23 - 28 years) from various backgrounds
- Approx. 30 min interview + additional questionnaire
- Brainstorming on TUI identification
  - Paperbox 3D (Wiethoff et al.)
  - Sketching with Objects
- Identification via TUIs
  - Tapping a rhythm
  - Handwriting of name
  - Orientation changes of a cube
  - Speech recognition
  - Fingerprint / iris recognition



# Agenda

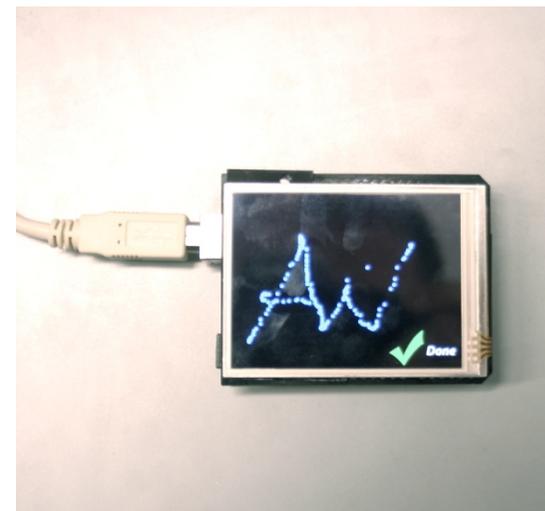
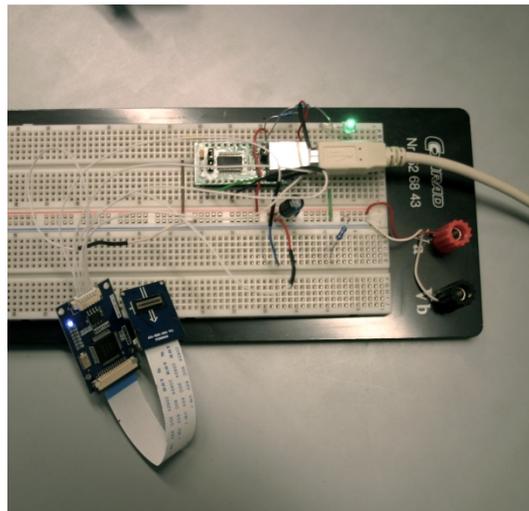
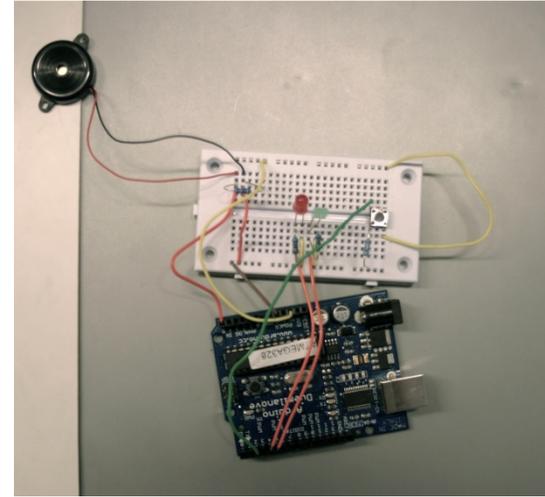
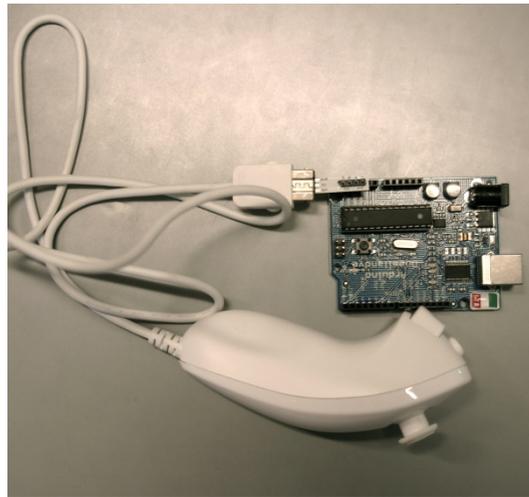


# Experience Prototypes – Early Sketches

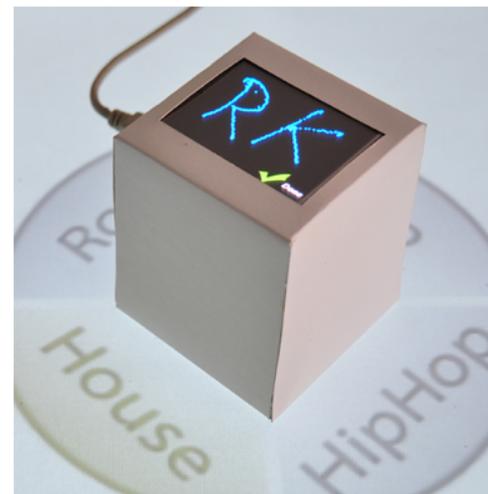
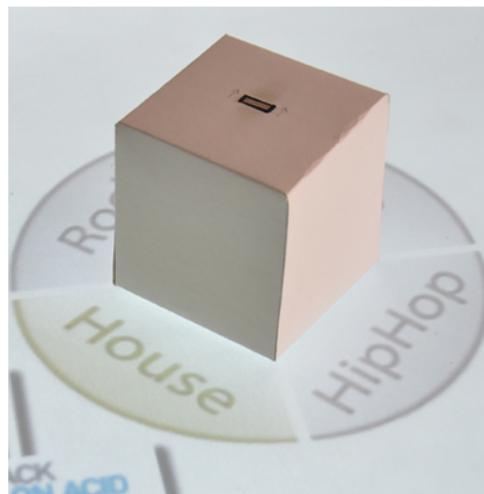
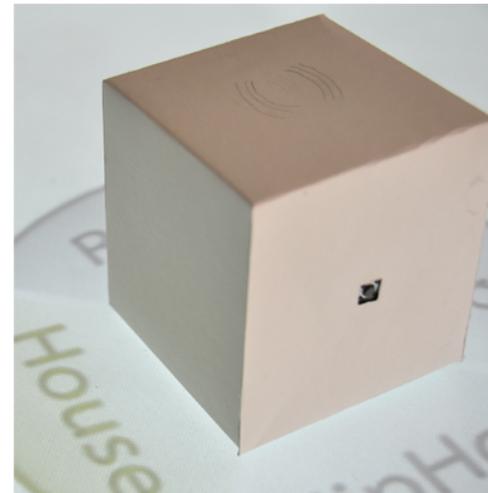
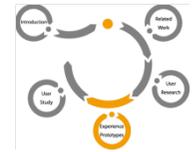




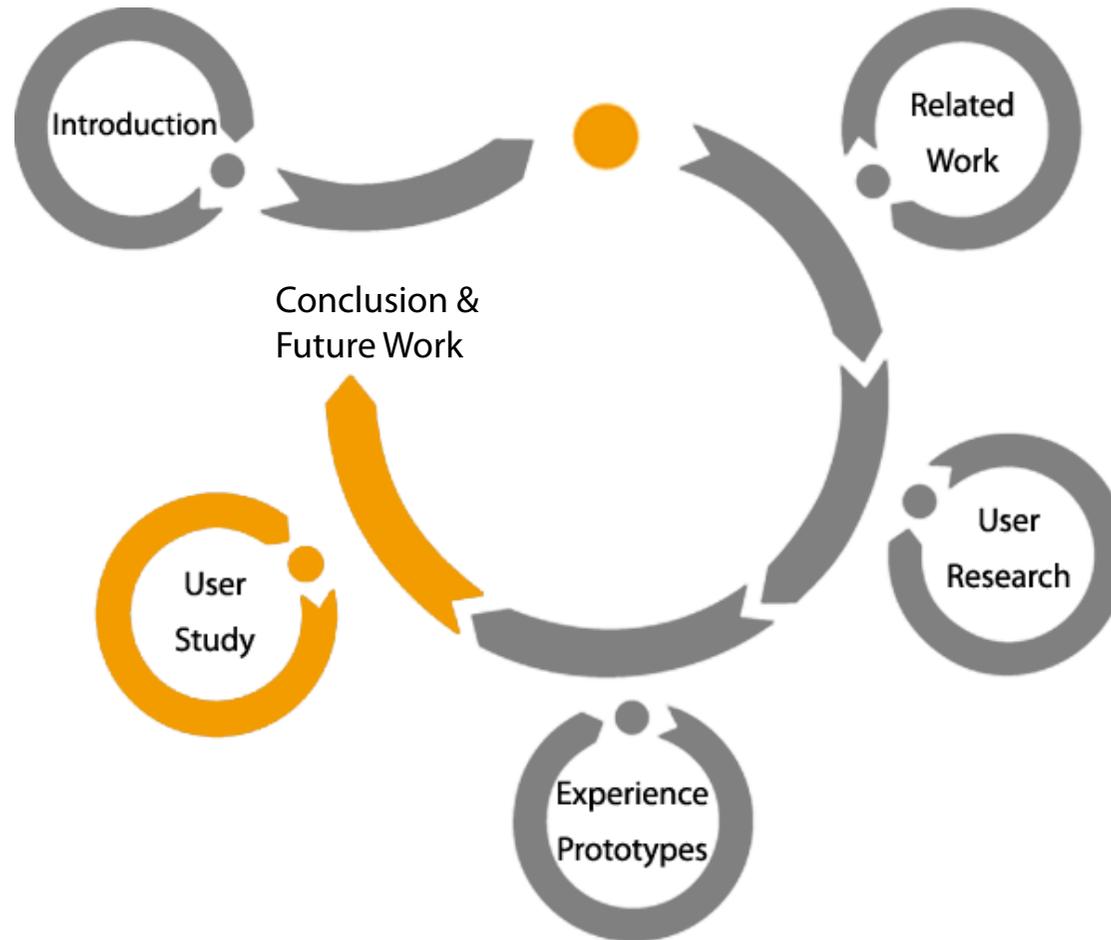
# Experience Prototypes – First Implementations



# Experience Prototypes – Low Fidelity Prototypes

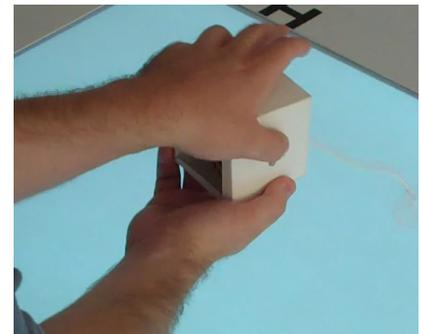
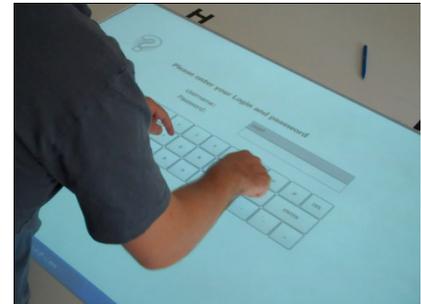
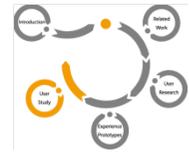


# Agenda



## User Study

- 13 participants (25 – 30 years) from various backgrounds
- Approx. 40 min in total, questionnaires in between
- Tasks
  - Programming a TUI
  - Identifying on TUI
  - TUI specific questionnaire and qualitative feedback
  - At the end: TUI comparative questionnaire
- Comparison against virtual keyboard identification





# User Study

## User ranking of id techniques

1. Rhythm Tapping
2. Fingerprint
3. Initials
4. Virtual Keyboard
5. Spatial Gestures

## Pleasance to use ranking

1. Rhythm Tapping
2. Fingerprint
3. Initials
4. Spatial Gestures
5. Virtual Keyboard

## Ease of use ranking

1. Fingerprint
2. Rhythm Tapping
3. Initials
4. Virtual Keyboard
5. Spatial Gestures





# User Study

Measured identification times do *not* coincide with perceived usage speed

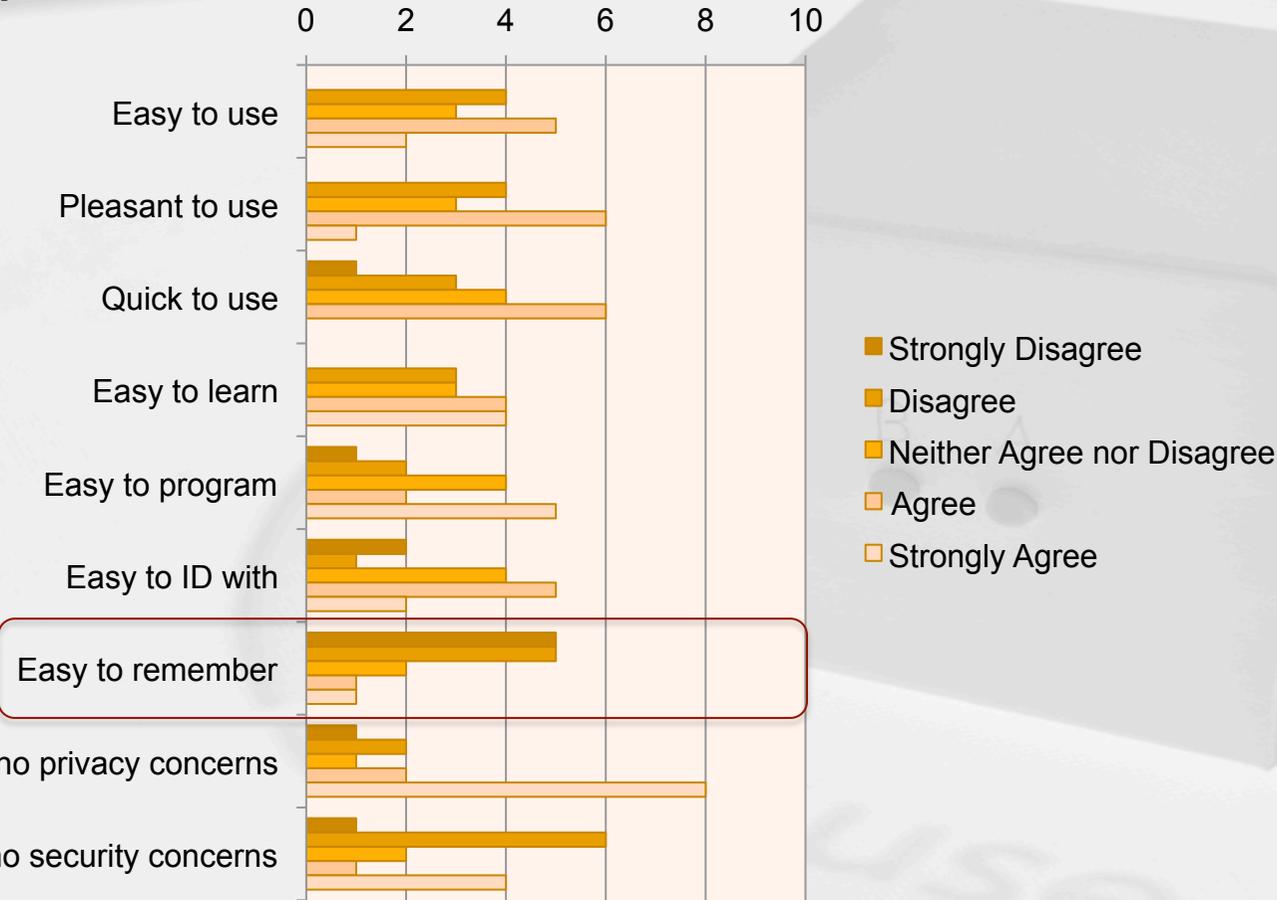
Time ranking	Time measurements	seconds
1. Fingerprint	1. Rhythm Tapping	8,5
2. Rhythm Tapping	2. Initials	11,2
3. Initials	3. Fingerprint	14,9
4. Virtual Keyboard	4. Spatial Gestures	17,6
5. Spatial Gestures	5. Virtual Keyboard	18,0





# User Study

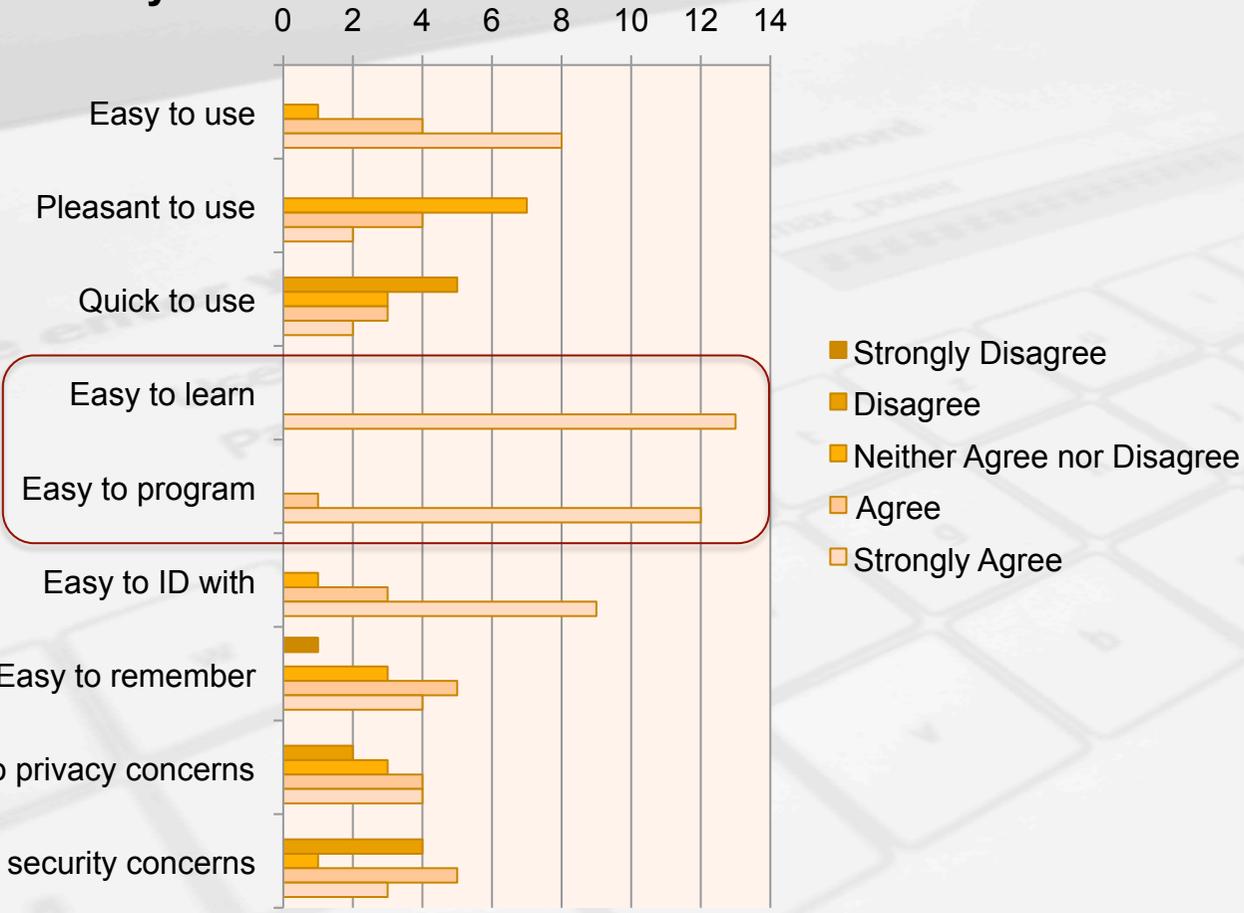
- Spatial Gesture**





# User Study

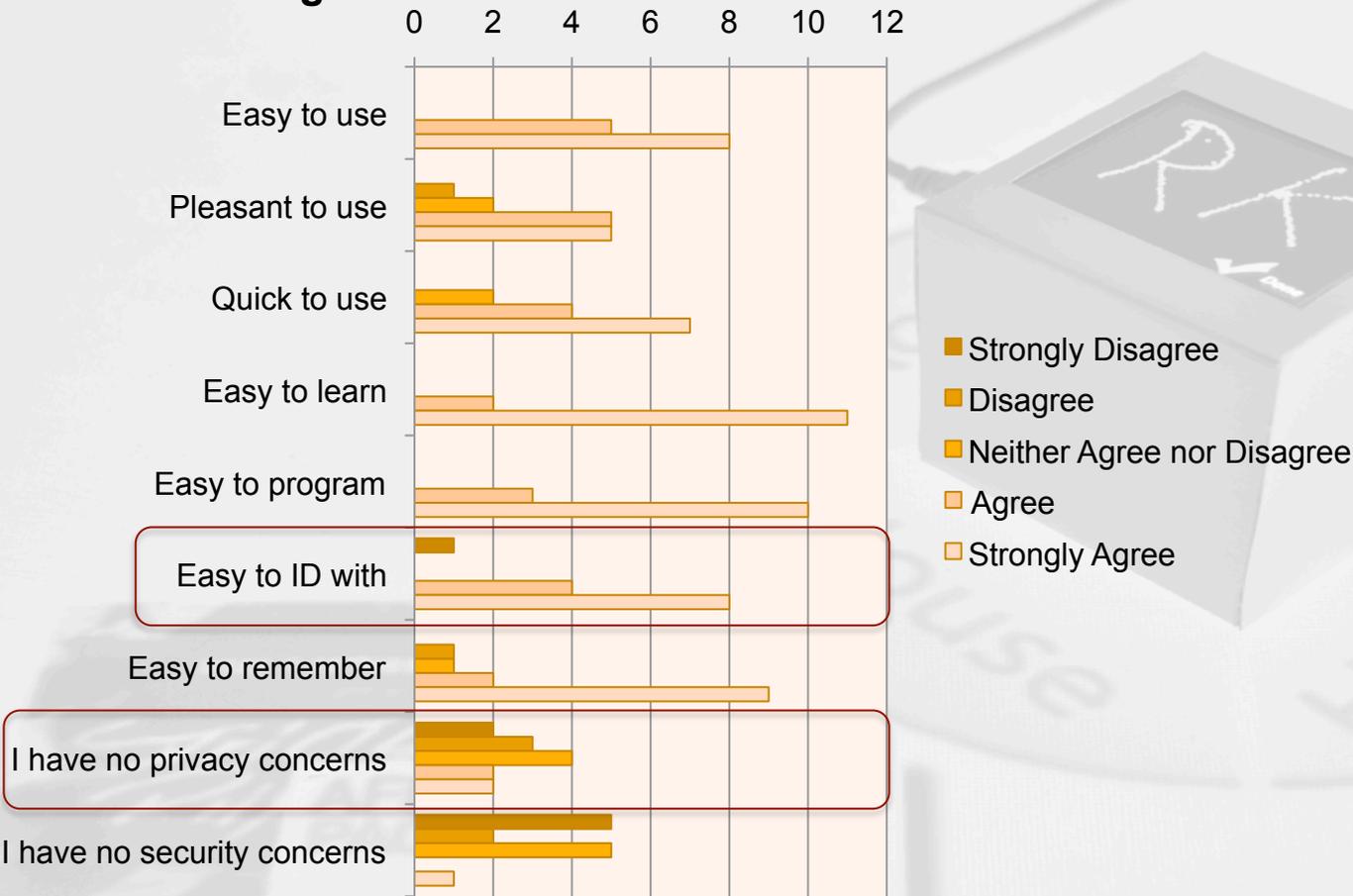
## Virtual Keyboard





# User Study

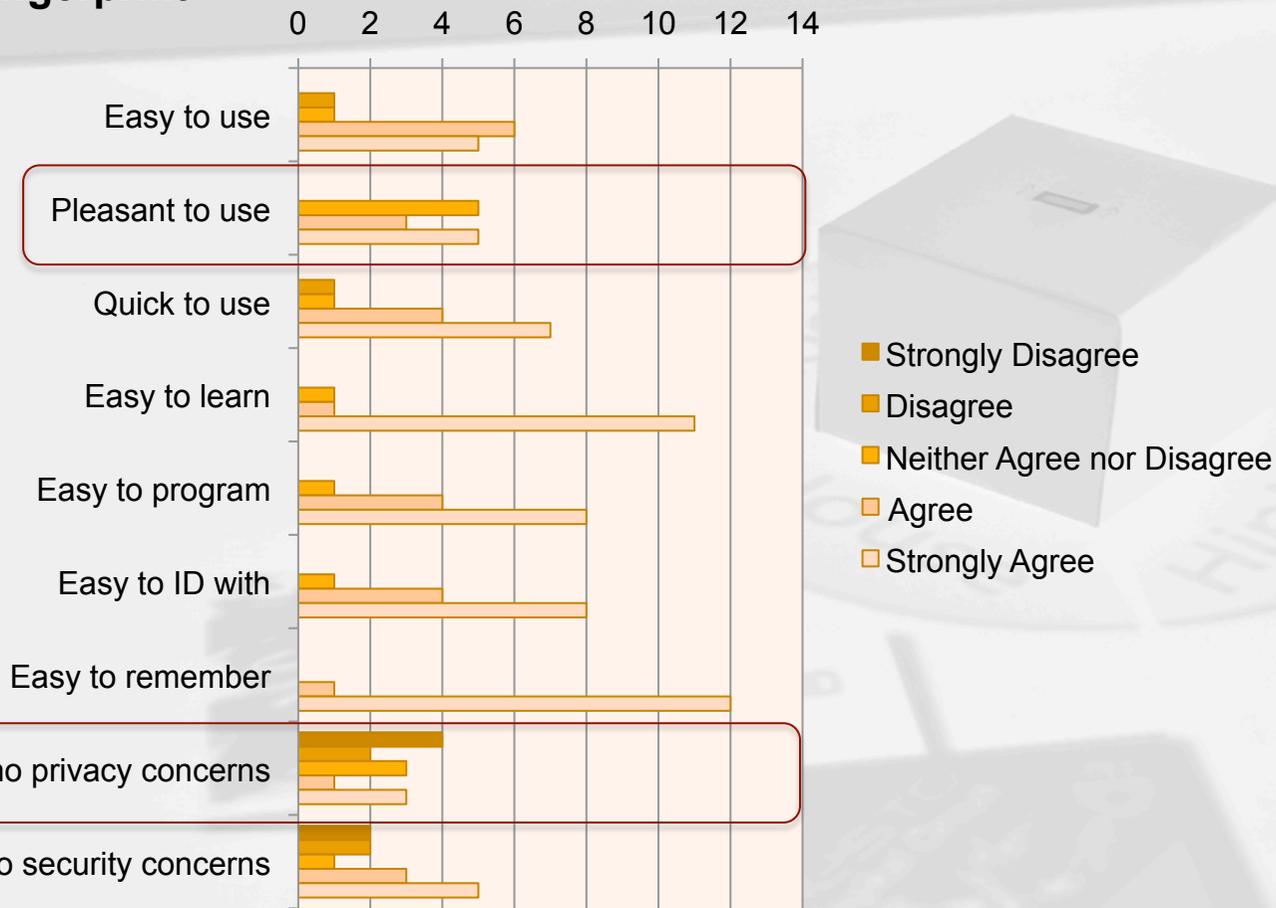
## • Handwriting





# User Study

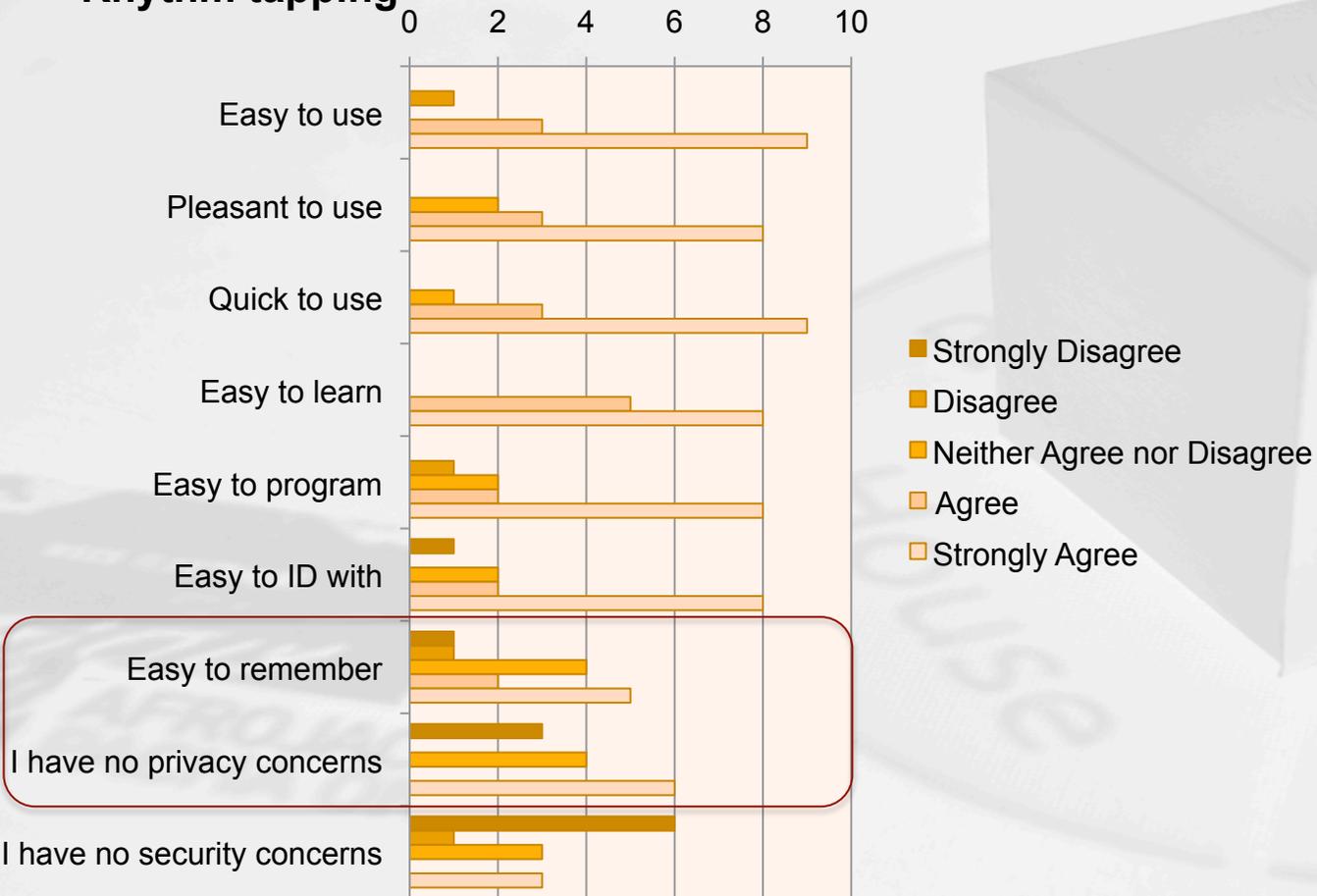
## Fingerprint



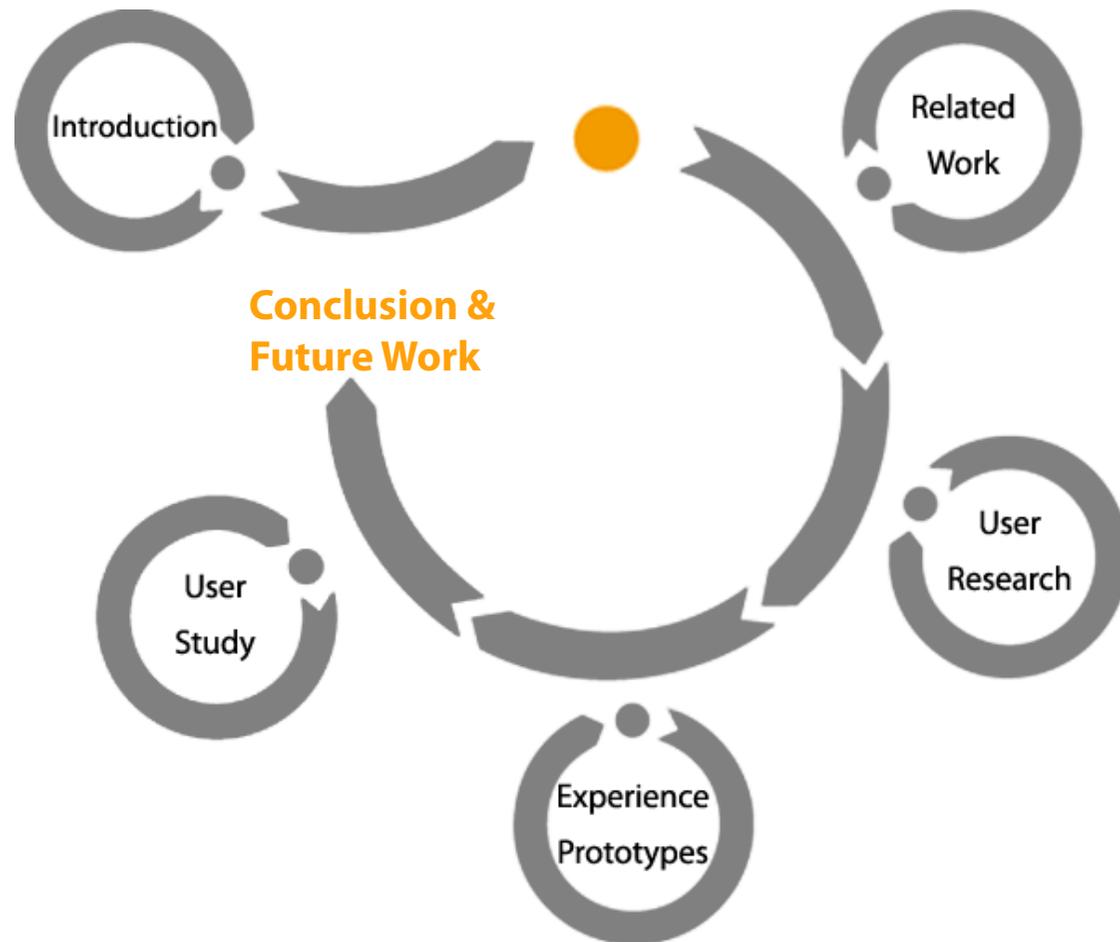


# User Study

## Rhythm tapping



# Agenda





## Conclusion and Future Work

### Conclusions

Users favor new id  
methods

Privacy awareness

Chinese do not document

### Future Work

Long term study

Simplification of TUIs

Ergonomic aspects

**Questions?**

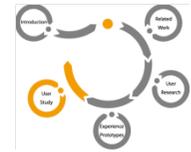


**Thank you!**



## Related Work

- Frank Stajano, Ross Anderson, "The Resurrecting Duckling: Security Issues for Ubiquitous Computing (Supplement to Computer Magazine)," *Computer*, vol. 35, no. 4, pp. 22-26, Apr. 2002, doi:10.1109/MC.2002.10040
- Balfanz D, Smetters DK, Stewart P, Wong HC. Talking To Strangers : Authentication in Ad-Hoc Wireless Networks. *Citeseer* 2003
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- Wobbrock JO. TapSongs. *In Proc.UIST '09*. 2009:93
- Rukzio E, Wetzstein S, Schmidt A. A Framework for Mobile Interactions with the Physical World. *Architecture*.:1-5. 2005
- Kumar A, Saxena N, Tsudik G, Uzun E. A comparative study of secure device pairing methods. *Pervasive and Mobile Computing*. 2009;5(6):734-749
- Wiethoff A, Wimmer R, Richter H, Butz A: In Proceedings of the 2nd International Conference on Technology for Education (T4E), Bombay, India, July 01-03, 2010



## Backup

- Willingness of use
  - Rhythm tapping (5 votes)
  - Fingerprint (4 votes)
  - No use (3 votes)
  
- Identification methods
  - Voice- and facial recognition
  - Iris scans
  - “Connect the dots“ (HTC Sense UI)
  
- TUIs make authentication more graspable
  - No (5 votes)
  - Yes, for less technical affine persons (4 votes)

