Investigating Handedness in Air Signatures for Magnetic 3D Gestural User Authentication

Abdallah El Ali
University of Oldenburg

Hamed Ketabdar
Telekom Innovation Laboratories

Introduction

By allowing 3D gestural signatures around the device (Fig 1), magnet-based ADI [1] has been shown to be a secure method for user authentication under a video-based shoulder-surfing attack scenario [2].

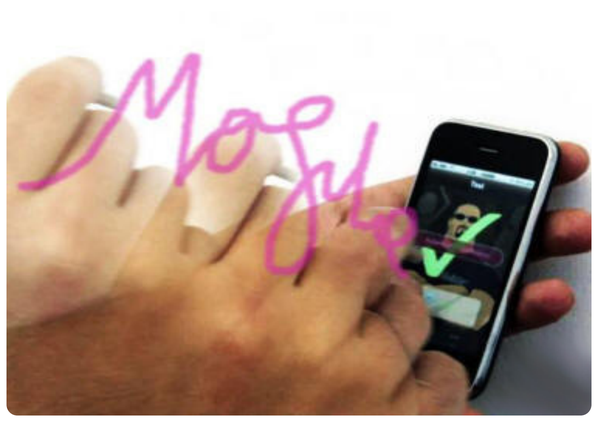


Fig 1

Question

What is the usability and security tradeoff in using 1-handed versus 2-handed air signatures for user authentication?

2-handed signatures would have lower usability, but higher actual and perceived security than 1-handed signatures under a video-based shoulder surfing attack scenario.

Usability Study

☒ 20 participants

☒ Recorded air signatures from 4 different angles: left, right, front, rear

☒ Used foam model (Fig 2) with an embedded SHAKE SK6 sensor and a pole labeled magnet (Fig 3)

☒ 3 login attempts to test recall

☒ Simultaneous dual-handed gesture in 2-handed condition

☒ Data collected:
- Magnetometer time series signals
- System Usability Scale (SUS) responses
- NASA-TLX questionnaire
- Likert-scale questions on perceived usability

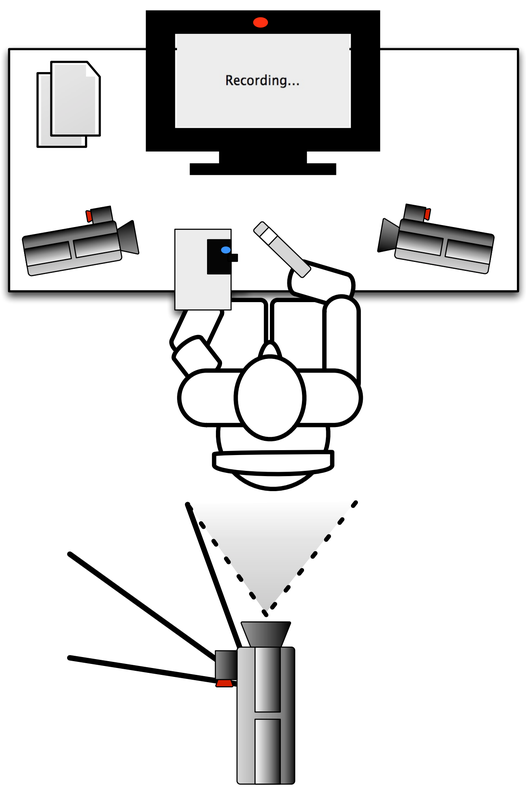


Fig 2

Fig 3

Security Study

☒ 20 adversaries

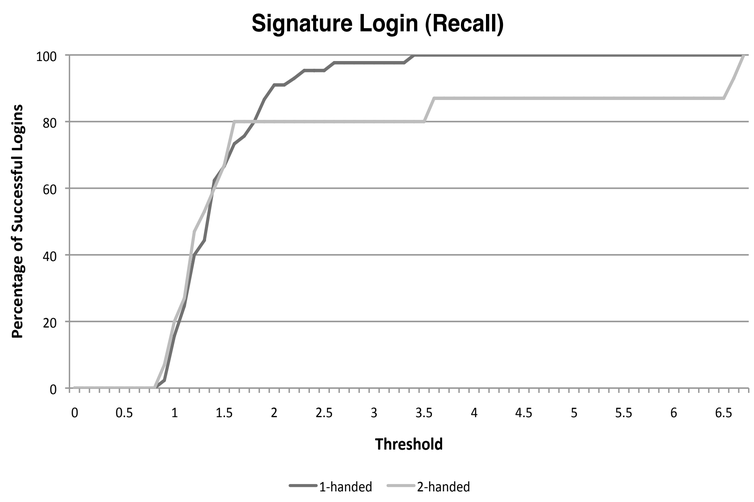
☒ Within-subject (2 x 2) design: signature difficulty (easy vs. difficult) x handedness (1-handed vs. 2-handed)

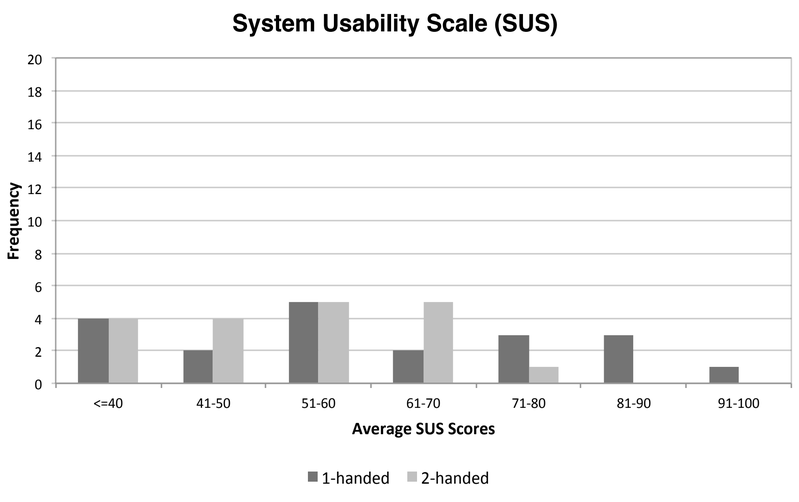
☒ Attackers shown videos of 4 signatures defined in the usability study, allowed only 3 forgery attempts

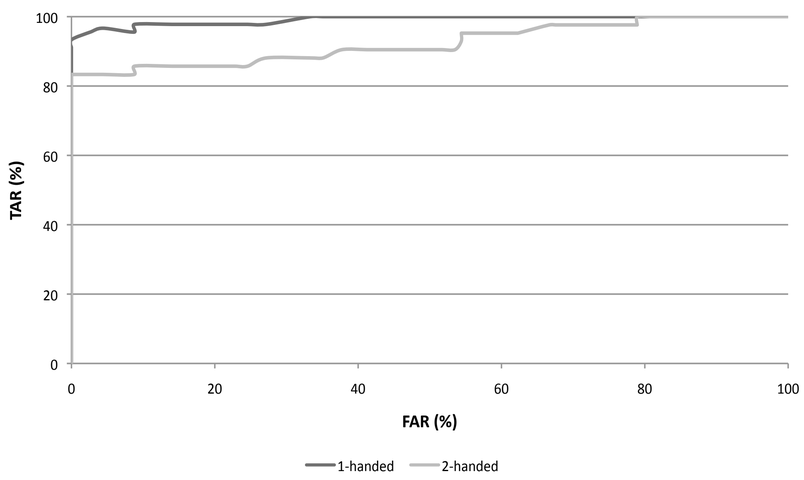
☒ Magnetometer time series signals compared using Dynamic Time Warping

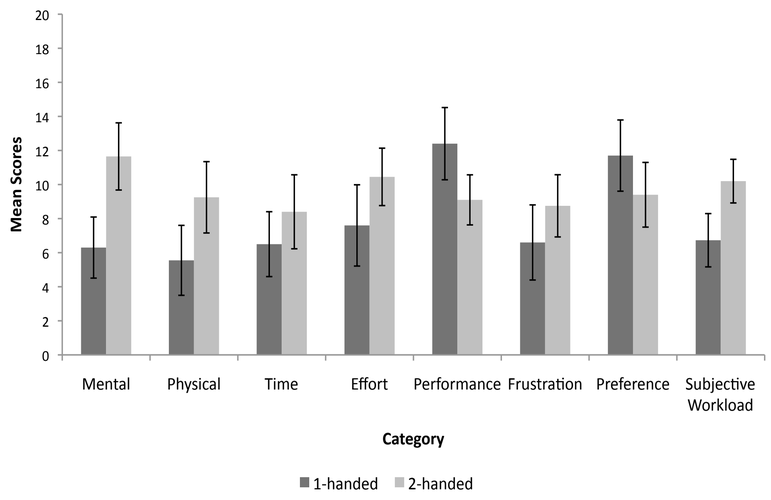
☒ Data collected:
- Magnetometer time series signals
- Likert-scale questions on perceived forgery difficulty

Results









Conclusions

☒ 2-handed signatures **do not** provide an additional layer of actual and perceived security

☒ **Usability** of 2-handed gestures **was poor** (cf., SUS and NASA-TLX)

☒ Authentication speed for both signature types was >3s, which indicates this method may be **too slow** for daily use

☒ Participants found both 1- and 2-handed signatures difficult to forge. However, 2-handed signatures were **not perceived as more secure** against attacks

☒ Future work will investigate further the role of the second hand in user authentication (e.g., unique grasp sensing of the second hand)

[1] Ketabdar, H., Roshandel, M., and Yüksel, K. A. Towards using embedded magnetic field sensor for around mobile device 3d interaction. In Proc. MobileHCI '10, ACM (2010), 153–156.
[2] Sahami Shirazi, A., Moghadam, P., Ketabdar, H., and Schmidt, A. Assessing the vulnerability of magnetic gestural authentication to video-based shoulder surfing attacks. In Proc. CHI '12, ACM (2012), 2045–2048.

Abdallah El Ali
abdallah.elali@gmail.com
www.abdoelali.com

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