Hitting Authentication on the Nose: Using the Nose for Input to Smartphone security

Ann-Marie Horcher
Nova Southeastern University
horcher@nova.edu

ABSTRACT

Interaction with a touchscreen interface requires a pointer to target the desired interaction. The effort normally requires the use of two hands; one to hold the device and the other to manipulate the device. The lack of haptic or auditory feedback to indicate a specific screen position requires visual confirmation of the input by the user.

Widespread use of smartphones in less than optimal conditions challenges the usability of requiring two hand input and eyes-only feedback. In situations where inconspicuous use of technology is desired, typical manipulation of the interface using eyes and hands may be too obvious. This study looks at the option of using the nose as both a stylus and a valid means of authentication to address such situations where typical hand-eye manipulation of touchscreen security technology is not desirable.

1.1 INTRODUCTION

Smartphones have evolved from curiosity to virtual necessity [10]. As the users of smartphones expand the types of information they access[12], and diversify the situations in which they use the devices [22], the challenges for usable security for the mobile touchscreen increase [15].

Originally touchscreen interfaces on smartphones like the Pocket PC phones and Windows phones were designed to be manipulated with stylus [13]. A non-human stylus is by its nature separate from both the smartphone and the person using the stylus, requiring cognitive effort from the user to both track the stylus and store it in a convenient location. When introducing the iPhone Steve Jobs championed the human stylus.

> ***Who wants a stylus***. *You have to get em and put em away, and you lose em. Yuck. Nobody* ***wants a stylus.*** *So let's not use a stylus. We're going to use the best pointing device in the world. We're going to use a pointing device that we're all born with - born with ten of them. We're going to use our fingers. [1].*

Consequently capacitive touchscreens interfaces optimized for fingers have become the de facto standard [14]. Such touchscreens present usability issues in situations where the hands may be covered with gloves, such as cold weather, or covered with substances that may mar or dirty the touchscreen, such as cooking [21]. Hands may also be engaged in higher priority activities like driving or holding the hand of a small child. Alternatives such as special gloves with conductive fingertips [11] or using frozen meat [21] require additional equipment that subverts the advantage of using the highly available fingers.

Using fingers as a capacitive stylus also presents issues for navigating more complex interfaces [17] such as those typically used for security [8]. Security designed to require coordination of both hands, eyes, and cognitive effort is not only difficult, but highly conspicuous. For users wishing to employ technology in a less obvious manner [6] the obstacle of navigating a security interface blocks them from their primary objective [7] and the users disable or subvert security [2]. Biometrics such as fingerprints simplify the process [16], but still require an available, uncovered hand. Retina or iris-scanning [4] circumvents the hand issue, but requires modifications to the typical smartphone.

This position paper explores the nose as a stylus that provides the advantages of a finger for availability and as a biometric point of authentication. In most situations, even cold weather, the nose is exposed for breathing [3]. Using the nose allows one-handed use of the smartphone without straining the thumb [18] or eyes [14]. Human noseprints, like lipprints, earprints, and handprints, are being explored for forensic identification [4]. Therefore the nose also presents a simplified and stealthy way to navigate authentication.

2. BACKGROUND

Prosthetic noses with embedded touchscreen detectors were proposed humorously as an human-computer interface (HCI) for virtual reality prior to the mobile touchscreen [9]. A more recent prototype embedded a capacitive stylus in an elongated prosthetic [19]. A software overlay named SNOUT was proposed adjust the interaction of the smartphone software to improve the accuracy of nose input [21]. Nose-tapping, with no modification to the touchscreen devices, was successful for simple tasks like unlocking the phone, calling, and sending a text [14].

Both Polacek et al. [14] and Zarek et al. [21] assessed the attitudes of the subjects toward the use of the nose. Both

studies concluded the subjects were willing to use the nose particularly for simple tasks, but there were concerns about cleanliness. The subjects also suggested solutions to improve the accuracy of using the nose as input.

3. PILOT STUDY

The aim of the user study was to gather qualitative data from the users regarding nose-based interaction and authentication. In order to achieve this, semi-structured interviews are conducted with the subjects following by asking the participants to perform the following phone unlocking tasks:

- Scan the noseprint to use as a biometric
- Unlock the phone with a noseprint
- Type in a passcode when noseprint fails

Table 1: Nose operation design principles

Description	Noseprint authentication
Preserve application UI layouts [21]	Uses existing equipment and layout
Minimize nose sliding on the screen of the device [21]	No sliding
Eliminate the need for focused visual feedback while touching the screen [21]	Noseprint uses unfocused peripheral vision for visual feedback.
Minimize the number of nose-taps required [21]	Noseprint is one tap.
Provide means of error mitigation [21]	Nose used to tap access code when noseprint fails.
Avoid using edges [14]	Used fingeprint scanner
Use only simple taps [14]	Access codes designed with no multi-taps

In keeping with the findings of previous studies advocating the use of commercially available equipment over temporary prototypes [22], this study uses the fingerprint scanner and authentication built into the iPhone 5s. The study applies design guidelines for nose operation of touchscreen devices proposed by Zarek et al. [21] and extended by Polacek et al. [14].

Participants brought their own devices if possible because people prefer to interact with their own devices due to hygienic reasons even though the devices are cleaned thoroughly before and after every user test.

Symposium on Usable Privacy and Security (SOUPS) 2014, July 9-11, 2014, Menlo Park, CA.

3.1 PRELIMINARY RESULTS

The lower sensitivity of the nose and no visual feedback made positioning of the nose for success problematic. Holding the phone horizontally improved the success rates of some of the subjects.

The next iteration of the pilot will be conducted using a tactile guide for the nose to improve success. The addition of raised outline around the fingerprint sensor using adhesive beads may improve the ability of the subjects to position the nose during authentication. Consistency seemed to be the key to successfully unlocking via noseprint. Additional subjects will also be used to compare the success rate with the fingerprint scanners on Android smartphones in the next iteration.

Some of the same techniques being used to improve fingerprint recognition could be applied to noseprint recognition. The finger vein image and the width of the finger have been explored as a soft biometric trait to enhance fingerprint recognition [20]. Similar examination of the tip of the nose for vein pattern and width could improve noseprint recognition. Nose geometry may also be extracted from images, similar to the extraction of hand geometry used to improve palmprint recognition [5]. Using the nose as an biometric could also be an option for two-factor authentication popular for enhanced mobile security [8].

4. REFERENCES

[1] Andytgl, " Steve Jobs: "Who wants a stylus?" - Apple - Steve Jobs at Macworld 2007 in San Francisco ", 2007.

[2] Ben-Asher, N., Meyer, J., Moller, S., and Englert, R., "An Experimental System for Studying the Tradeoff between Usability and Security," *2009 International Conference on Availability Reliability and Security (Ares) Proceedings* pp. 882-887, 2009.

[3] Camner, P., and Bakke, B., "Nose or mouth breathing?," *Environmental Research,* vol. 21, no. 2, pp. 394-398, 1980.

[4] Choras, M., "Intelligent computing for automated biometrics, criminal and forensic applications," *Proceedings of the intelligent computing 3rd international conference on Advanced intelligent computing theories and applications* pp. 1170-1181, 2007.

[5] Choraś, R. S., and Choraś, M., *Multimodal Hand-Palm Biometrics*, p.^pp. 46, Berlin: Springer Berlin Heidelberg, 2007.

[6] Gauld, C. S., Lewis, I., and White, K. M., "Concealed texting while driving: What are young people's beliefs about this risky behaviour?," *Safety Science,* vol. 65, no. 0, pp. 63-69, 2014.

[7] Gebauer, J., Kline, D. M., and He, L., "Password Security Risk versus Effort: An Exploratory Study on

User-Perceived Risk and the Intention to Use Online Applications " *Journal of Information Systems Applied Research,* vol. 4, no. 2, pp. 52-62, 2011.

[8] Gunson, N., Marshall, D., Morton, H., and Jack, M., "User perceptions of security and usability of single-factor and two-factor authentication in automated telephone banking," *Computers & Security,* vol. 30, no. 4, pp. 208-220, 2011.

[9] Henry, T. R., Hudson, S. E., Yeatts, A. K., Myers, B. A., and Feiner, S., "A nose gesture interface device: extending virtual realities," *Proceedings of the 4th annual ACM symposium on User interface software and technology*, pp. 65-68, 1991.

[10] Montoliu, R., Blom, J., and Gatica-Perez, D., "Discovering places of interest in everyday life from smartphone data " *Multimedia Tools and Applications*, pp. 1-29, 01/10/, 2012.

[11] Ogata, M., Sugiura, Y., Osawa, H., and Imai, M., "FlashTouch: data communication through touchscreens " *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* pp. 2321-2324, 2013.

[12] Oulasvirta, A., Rattenbury, T., Ma, L., and Raita, E., "Habits make smartphone use more pervasive," *Personal Ubiquitous Comput.,* vol. 16, no. 1, pp. 105-114, 2012.

[13] Parhi, P., Karlson, A. K., and Bederson, B. B., "Target size study for one-handed thumb use on small touchscreen devices," *Proceedings of the 8th conference on Human-computer interaction with mobile devices and services* pp. 203-210, 2006.

[14] Polacek, O., Grill, T., and Tscheligi, M., "NoseTapping: what else can you do with your nose?," *Proceedings of the 12th International Conference on Mobile and Ubiquitous Multimedia* pp. 1-9, 2013.

[15] Qing, L., and Clark, G., "Mobile Security: A Look Ahead," *IEEE Security & Privacy,* vol. 11, no. 1, pp. 78-81, 2013.

[16] Tan, B., and Schuckers, S., "Spoofing protection for fingerprint scanner by fusing ridge signal and valley noise," *Pattern Recognition,* vol. 43, no. 8, pp. 2845-2857, 2010.

[17] Trewin, S., Swart, C., and Pettick, D., "Physical accessibility of touchscreen smartphones," *Proceedings of the 15th International ACM SIGACCESS Conference on Computers and Accessibility* pp. 1-8, 2013.

[18] Trudeau, M. B., Young, J. G., Jindrich, D. L., and Dennerlein, J. T., "Thumb motor performance varies with thumb and wrist posture during single-handed mobile phone use," *Journal of Biomechanics,* vol. 45, no. 14, pp. 2349-2354, 2012.

[19] Wilcox, D. "Finger-Nose™ Stylus for Touch Screens, May 28, 2011: http://tinyurl.com/nosepoint," http://variationsonnormal.com/2011/04/28/finger-nose-stylus-for-touchscreens/.

[20] Yang, L., Yang, G., Yin, Y., and Xi, X., "Exploring soft biometric trait with finger vein recognition," *Neurocomputing*, no. 0, 2013.

[21] Zarek, A., Wigdor, D., and Singh, K., "SNOUT: one-handed use of capacitive touch devices," *Proceedings of the International Working Conference on Advanced Visual Interfaces* pp. 140-147, 2012.

[22] Zhang, C., Parnami, A., Southern, C., Thomaz, E., Reyes, G., Arriaga, R., and Abowd, G. D., "BackTap: robust four-point tapping on the back of an off-the-shelf smartphone," *Proceedings of the adjunct publication of the 26th annual ACM symposium on User interface software and technology* pp. 111-112, 2013.