Changing users’ security behaviour towards security questions: A game based learning approach

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Bio

• Awarded PhD at Glasgow Caledonian University, UK (Topic: using ambient sensors in smartphone authentication).

• 1 year Postdoc at Heriot-Watt University, UK (focus: privacy nudges for mobile apps).

• Postdoctoral Fellow @ UNSW Canberra (focus: involving users in the design of novel fallback authentication mechanisms)

Introduction & Motivation (1)

Early life and family

Pain was born in Sandpoint, Idaho, the third of four children (three daughters and one son) of Sarah “Sally” Heath (née Sheeran), a school secretary, and Charles R. "Chuck" Heath, a science teacher and track-and-field coach. Pain’s siblings are Chuck Jr., Heather, and Molly. Pain is of English, Irish, and German ancestry. [11]

When Pain was a few months old, the family moved to Skagway, Alaska,[12] where her father received his teaching job.[13] They relocated to Eagle River in 1969 and finally settled in Wasilla in 1972.[14][15]

Pain played flute in the junior high band and then attended Wasilla High School, where she was the head of the Fellowship of Christian Athletes[16] and a member of the girls’ basketball and cross-country running teams.[17] During her senior year, she was co-captain and point guard of the basketball team that won the 1982 Alaska state championship, earning the nickname “Sarah Barracuda” for her competitive streak.[18][19][20]

In 1984, Pain won the Miss Wasilla beauty pageant[21] then finished third in the Miss Alaska pageant.[22][23] She played the flute in the talent portion of the contest. [24] One author reports that she received the Miss Congeniality award in the Miss Wasilla contest (but this is disputed by another contestant and classmate of Pain’s).[21] and a college scholarship.[18]

College

After graduating from high school in 1982, Pain enrolled at the University of Hawaii at Hilo.[25] Shortly after arriving in Hawaii, Pain transferred to Hawaii Pacific University in Honolulu for a semester in the fall of 1982 and then to North Idaho College, a community college in Coeur d’Alene, for the spring and fall semesters of 1983.[26] She enrolled at the University of Idaho in Moscow for an academic year starting in August 1984 and then attended Matanuska-Susitna College in Alaska in the fall of 1985. Pain returned to the University of Idaho in January 1986 and received her bachelor’s degree in communications with an emphasis in Journalism in May 1987.[27][28][29]

In June 2008, the Alumni Association of North Idaho College gave Pain its Distinguished Alumni Achievement Award.[30][31]

Early career and marriage

After graduation, she worked as a sportscaster for KTUU-TV and KTVA-TV in Anchorage[32][33] and as a sports reporter for the Mat-Su Valley Frontiersman.[34][35] fulfilling an early ambition.[36]

In August 1988, she eloped with her high school sweetheart, Todd Pain.[37] Following the birth of their first child in April 1989, she helped in her husband’s commercial fishing business.[38]
Introduction & Motivation (2)

Embarrassment

Effect reputation

Loss of money
Related work

[1] security questions cannot be used as main mechanism to recover passwords.

[2] proposed an avatar profile - to represent system-generated data of a fictitious person

[3] [4] used autobiographical info of mobile phone usage of last few days

[5] successfully used gamified approach to change users’ behaviour on susceptibility to phising attacks.

Contribution

Design of a serious game that enhance users’ long-term memorability of answers to security questions by using:

1. Memorability concepts (e.g. graphical and verbal cues) and
2. Gamified approach (interactive, engaging nature of the game).
Memorability Concepts

- We use the picture superiority effect [7] since previous research which uses graphical authentication schemes [8][9][10][11] confirmed that humans are better at remembering images than textual information.

Gamified approach

• Adapted “4 Pics 1 Word” \(^1\) mobile game (see Figure 2).
• Selected this game due to use of pictures and cues which psychology research found to improve memorability.
• Game asks to pick word that relates the 4 given pictures.
• Adapted game to ask users to solve challenges related to system-generated data (answers of security questions).

\(^1\) https://play.google.com/store/apps/details?id=de.lotum.whatsinthefoto.us&hl=en
12 letters are provided to help the players solve the challenge.

Points are awarded / deducted based on the type of challenge (10/15/20).

Points could be used to obtain hints (30/50 points).

Added feature to show verbal cues (see Figure 3b) to help memory.
Game Design - Features (2)

• At certain intervals players solve challenges related to system-generated information (see Figure 4a and 4b).
• System-generated information challenges are either recognition-based (see Figure 4b) or recall-based (see Figure 4a).
• Use of a fixed set of images and same images are always shown in the same order to help semantic priming.
• Does not show the length of the word (to improve security).

Figure 4: a) recall security questions challenge, b) recognition security questions challenge
Game Design – Engagement

Persuasive technology principles [12]: Tunnelling, Conditioning, Suggestion, Self-monitoring, Surveillance and Social cues and Humour, Fun and Challenges.

Proposed Game Logic

Start

Randomly select standard challenge from available challenges and show it to user

If answer is correct

Add 10 points

Remove challenge from available list

If recognition-based challenges are available

Randomly select recognition-based challenge and show it to user

If recall-based challenges are available

Randomly select recall-based challenge and show it to user

If answer is correct

True

Add 15 points

False

Decrement 15 points

If answer is correct

True

Add 20 points

False

Decrement 20 points

Reward user with a badge based on the following:
   a) “Smiley” if 1 challenge is correct
   b) “Cake” if half the challenges are correct
   c) “Trophy” if all challenges are correct

Remove challenge from available list

End
Future Work

• Lab study to involve users in the design of the game. (under review)
• Evaluate and address security vulnerabilities of the game. (work in progress)
• Conduct longitudinal field study to understand whether the proposed game design improves long-term memorability and investigate how much learning is required.
Conclusion

- Aims to nudge users to provide stronger answers to security questions.
- Aims to improve security by reducing vulnerability to observational and guessing attacks.
- Interacting/engaging nature of the game should help users to learn stronger answers to security questions through rehearsals.
Thank You

Questions?

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