(I Can't Get No) Satisfaction: On the Existence of Satisfaction as a Component of Usable Security and Privacy

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Abstract. In the ISO definitions of usability, user satisfaction is specified as an element and effectiveness and efficiency. Jakob Nielsen, who is well known for his work on usability in web and UI design, defines satisfaction as one of the five qualitative elements in usability. Whitten and Tygar's paper, one of the earliest usability studies on usable security, also includes "sufficiently comfortable" as one of the usability definitions for security, which relates to user satisfaction. Although many usable security researches have been conducted and usability evaluations of the proposed methods have been done, most of them have mainly evaluated the effectiveness and efficiency of the proposed methods, and there is a possibility that satisfaction or comfort has not been sufficiently evaluated. Therefore, this paper investigates how satisfaction or comfort is evaluated in usable security research and discusses the results.

Keywords: User acceptance of security and privacy technologies · Usable Security and Privacy

1 Introduction

As cybersecurity, privacy, and trust (CPT) technologies continue to develop, one of the most critical research issues is users' appropriate use of these technologies. Human Computer Interaction (HCI) is the technology that can contribute most to solving this problem. The relationship between HCI and CPT has been the subject of much academic discussion in the usability of CPT technologies, i.e., usable security and privacy (USP). The USP field, which Whitten and Tygar pioneered in 1999 [1], has expanded over the past 20 years into the academic field of CPT. Many sessions at USENIX Security, one of the most challenging international conferences in CPT, have been devoted to discussing the human aspect.

ISO defines the usability of software and systems [2]. Jacobsen's ten principles are well known for web and UI usability [3]. However, there is no common definition of USP meant to the best of our knowledge. However, if security and privacy are one of the non-functional requirements of software and systems, and

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if the USP is an attempt to improve the usability of security and privacy, then the elements listed in those usability definitions may be familiar to the USP. If we look at the ISO definition, three elements make up usability: effectiveness, efficiency, and satisfaction. Of these three elements, "effectiveness" and "efficiency" have been the main focus of evaluation in USP research. But what about the remaining factor, "satisfaction"? It is difficult to say that this has been the focus of the discussion.

For example, a study by Felt et al. on the display of icons indicating the status of certificates in browsers evaluated usability by questionnaires asking whether participants felt safe or not and the difference in their behavior due to the difference in icons and wording [4]. However, the level of satisfaction with using the icons and wording has not been investigated. In the same way, in the study on the display of certificate errors in browsers [5], effective display using colors and wording was discussed and evaluated, and the results were shared widely, and technology was proposed that has become the mainstream of modern browsers, but again, there was no survey on the level of satisfaction with the use of colors and wording.

Let us focus on one of the most successful studies in USP research, the study of password management. Tan et al.'s study [6], the most recent and comprehensive work in the field, surveyed items such as fun and annoyance but did not discuss satisfaction in terms of these items in the paper.

Therefore, the following two research questions were raised in this paper.

RQ1: Has satisfaction been sufficiently discussed in the past USP studies?
RQ2: Can satisfaction be a component of USP?

To answer RQ1, we first surveyed past USP papers to determine whether satisfaction with the proposed methodologies was surveyed in those papers or whether satisfaction was on the agenda when discussing the surveyed content. As a result of surveying 53 papers in SOUPS 2019 and 2020, 47 papers had usability evaluations, and 6 of them were surveyed and discussed under the title of satisfaction.

Next, we also surveyed the evaluation criteria for USPs that have been proposed and used to date to see if any of them had criteria for satisfaction. After surveying the seven evaluation criteria, we found that none directly incorporated satisfaction into the evaluation criteria. At the same time, a few incorporated factors that can be said to be similar to satisfaction into the criteria.

Based on these results, we discussed RQ2. It is interesting to note that the results of RQ1 did not directly cite "satisfaction" as a criterion for survey and evaluation, but at the same time, the USP technologies were surveyed using keywords such as annoying, difficulty, and frustration. This result is fascinating. CPT technology is not the original purpose of the system or software but the technology that supports the execution of that purpose. It has been pointed out that CPT technologies sometimes have a negative impact on user interaction with the original purpose of the technology, so in evaluating the USP technologies, the USP researchers wanted to show that the negativity had been reduced or eliminated.

According to the above results, “No” was obtained for RQ1, and no clear answer was obtained for RQ2. Then, a new research question was clarified, “Is the impact of CPT technology on users as HCI only negative? Is there any positive impact?” This new RQ could be central to HCI-CPT. These possibilities will be discussed further in the paper.

2 Components of Usability

The definition of usability in ISO 9241-11 [2] is “extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, satisfaction” is an element of usability. It indicates that “Satisfaction” is an element of usability. The same document states that Satisfaction is the “extent to which the user’s physical, cognitive and emotional responses that result from the use of a system, product or service meet the user’s needs and expectations.”

Jakob Nielsen, an authority on the usability of websites and information systems, stated in his book that usability comprises the following five attributes [3].

- Learnablity
- Efficiency
- Memorability
- Errors
- Satisfaction

One of which is Satisfaction. He described it as “The system should be pleasant to use, so that users are subjectively satisfied when using it; they like it.”.

In the context of usable security, Whitten and Tygar identified the following four usability requirements for security software in 1999 [1].

- are reliably made aware of the security tasks they need to perform
- are able to figure out how to successfully perform those tasks
- don’t make dangerous errors
- are sufficiently comfortable with the interface to continue using it

The last of the four listed above is “are sufficiently comfortable with the interface to continue using it”, and the keyword ’comfortable’ is mentioned.

They further stated that.

> *If an average user of email feels the need for privacy and authentication, and acquires PGP with that purpose in mind, will PGP’s current design allow that person to realize what needs to be done, figure out how to do it, and avoid dangerous errors, without becoming so frustrated that he or she decides to give up on using PGP after all?*
>
> – Whitten, Tygar [1]

They, therefore, noted the existence of frustration, which is a subjective factor as opposed to time performance or accuracy. Their research is arguably the

paper pioneered in the USP field and still contains several important research factors. The same applies to 'satisfaction,' the factor we focus on in this paper. Unfortunately, their user experiments did not evaluate subjective factors such as satisfaction.

3 Usability Evaluation Item Survey

The System Usability Scale (SUS) is often used in questionnaire surveys in usable security research. SUS is a 10-item questionnaire in which each question is answered on a 5-point Likert chart. The results are scored on a 0–100 scale [7]. The survey items include whether the user wants to use the system frequently, whether it is easy to use, and whether it is not unnecessarily complicated, but there are no items that directly ask about satisfaction.

There are several other common questionnaire items in the HCI field to evaluate usability, validity, and reliability. QUIS (Questionnaire for User Interface Satisfaction) by Chin et al. is a UI-focused questionnaire that includes satisfaction in its title [8]. In the QUIS, frustrating and satisfying were listed as opposing factors in one of the 10-point scales of the overall reaction to the software. The questionnaire asked the respondents which of the two they felt more satisfied with.

In the Computer System Usability Questionnaire (CSUQ) by Lewis [9] , two of the 19 items are related to satisfaction. The first and last questions are unique in that they each ask about the overall satisfaction of the system. On the other hand, the 100-item Purdue Usability Testing Questionnaire (PUTQ) did not include satisfaction or items related to it, probably because many of the questions were about the specific operation of the system rather than about general feelings [10]. The PHUE (Practical Heuristics for Usability Evaluation) by Perlman also asked questions about specific behaviors, etc., and did not include items on satisfaction or related topics [11].

A questionnaire designed explicitly for usable security research is the SeBIS (Security Behavior Intentions Scale) by Egelman et al. [12]. This is not a usability questionnaire but a questionnaire to measure the security behavior of end-users. Therefore, the questionnaire did not ask about the usability of specific technologies, and there was no item asking about the level of satisfaction. The SA-6 by Faklaris et al. was also a questionnaire to measure users' security awareness, but not usability or satisfaction [13]. The UPSP (Users' Perceived systems' Privacy) by Ayalon et al. measures users' perceptions of system privacy and does not ask about usability or satisfaction [14].

4 Satisfaction Survey in Usable Security Research

Have any satisfaction surveys been conducted in the previous usable security and privacy research? In this section, previous papers are surveyed to show whether and what satisfaction surveys have been conducted.

Table 1. User experimental method classification in SOUPS 2019 and SOUPS 2020

User Study Type	Num. of Papers	Papers
Interview	27	[16,17,20,23–25,28,31–35,38,41,42,45,53,56–61,63,65–67]
Survey	24	[15,21,22,29,34–37,40,43,44,46–64]
(no user study)	6	[18,19,39,52,54,62]
SUS	2	[17,51]
Observation	2	[26,30]
Focus Group	1	[23]
Heuristic Walkthrough/ Cognitive Walkthroughj	1	[27]

4.1 Survey Method

The survey covers the international conference SOUPS 2019 and 2020, and 53 papers were surveyed.

The evaluation part of each paper was focused on. First, it was checked whether surveys such as interviews or questionnaires were conducted. If a survey was conducted, the content of the survey was checked to see if it included items or references to satisfaction. In the research on usable security and privacy, in addition to the research that proposes technologies to make it usable, there are many researches on the survey method itself, such as SeBIS and SA-6 mentioned above, and researches on the principles of user behavior that are the background of technological proposals.

4.2 Result

As a result of the survey, among the papers surveyed, there were 47 papers in which evaluation was conducted by user experiments [15–17,20–38,40–51,53,55–61,63–67]. Among them, six papers were identified as having a satisfaction survey [17,21,37,59,60,65]. The questionnaire using SUS was not counted as a satisfaction survey.

Although not directly in line with the objectives of this study, Table 1 shows how users were evaluated in each study, as it is valuable as a trend in USP research.

Among the papers that evaluated satisfaction, Kitkowska et al. analyzed the survey results to find that the proposed method contributed to user satisfaction in evaluating the visual design of privacy notices [37].

In Pearman et al.'s survey on password managers, they interviewed participants about their satisfaction/dissatisfaction with current methods of password management, and several responses were discussed [59].

As for the others, one of the three questionnaires only included a brief satisfaction-related question, and any mention of the results was limited to sim-

ply stating the results and not discussing them in-depth [21]. The other two were indicated in the questionnaire but were not mentioned in the text [17,65].

In many of the papers, there was no satisfaction survey. On the other hand, there were many papers where the purpose of the research was not to evaluate the usability of technology or software but to investigate user behavior and awareness of various security/privacy-related events. In such papers, the evaluation of satisfaction may be out of scope.

5 Discussion

In Whitten and Tygar's paper, comfort is listed as one of the definitions, but in the section that corresponds to the Research Question, they state "*If an average user of email feels the need for privacy and authentication, and acquires PGP with that purpose in mind, will PGP's current design allow that person to realize what needs to be done, figure out how to do it, and avoid dangerous errors, without becoming so frustrated that he or she decides to give up on using PGP after all?*." Moreover, use the word "frustrated" rather than referring to comfort, suggesting that they believe that satisfaction and comfort with security technology are "no/low." If an average email user feels the same as the average user of email, it is because they are dissatisfied.

Even in papers that do not have a direct questionnaire on satisfaction, many items ask about Difficulty and Annoying, indicating that researchers in usable security and privacy tend to do so, although there is no unified opinion.

It cannot be denied that even in studies where satisfaction can be investigated, some have not been investigated. And may decrease in terms of satisfaction while increasing effectiveness and efficiency. In some studies, there were questionnaire items regarding satisfaction, but the results did not mention it [6,17]. In these studies, it is possible that there was no statistically significant difference or that there was a significant difference in the lower satisfaction level that was not mentioned.

6 Conclusion

In addition to the fact that there is room for re-evaluation of existing research with satisfaction evaluation as part of Replication Work, the question "Is satisfaction evaluation vital in usable security research?

To clarify the question, "**If there are a group of elements that constitute usable security, are satisfaction and comfort included in the elements?**" and "**Can we consider satisfaction and comfort to be synonymous with dissatisfaction and annoyance?**" These are new questions in this field. These questions may be considered new research questions in this field for further study.

References

1. Whitten, A., Tygar, J.D.: Why Johnny can't encrypt: a usability evaluation of PGP 5.0. In: Proceedings of the 8th Conference on USENIX Security Symposium - vol. 8 (SSYM 1999). USENIX Association, USA, 14 (1999)
2. ISO, "Ergonomics of human-system interaction - Part 11: Usability: Definitions and concepts," Iso/Np 9241–11 (2018). https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en. Accessed 22 Oct 2021
3. Nielsen, J.: Usability Engineering. Morgan Kaufmann, Burlington (1994)
4. Felt, A.P., et al.: Rethinking connection security indicators. In: Twelfth Symposium on Usable Privacy and Security (SOUPS 2016) (2016)
5. Felt, A.P., et al.: Improving SSL warnings: comprehension and adherence. In: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (2015)
6. Tan, J., et al.: Practical recommendations for stronger, more usable passwords combining minimum-strength, minimum-length, and blocklist requirements. In: Proceedings of the 2020 ACM SIGSAC Conference on Computer and Communications Security (2020)
7. Brooke, J.: SUS: a quick and dirty' usability. Usability Eval. Ind. **189**, 4–7 (1996)
8. Chin, J.P., Diehl, V.A., Norman, K.L.: Development of an instrument measuring user satisfaction of the human-computer interface. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (1988)
9. Lewis, J.R.: IBM computer usability satisfaction questionnaires: psychometric evaluation and instructions for use. Int. J. Hum. Comput. Interact. **7**(1), 57–78 (1995)
10. Lin, H.X., Choong, Y.-Y., Salvendy, G.: A proposed index of usability: a method for comparing the relative usability of different software systems. Behav. Inf. Technol. **16**(4–5), 267–277 (1997)
11. Perlman, G.: Practical usability evaluation. In: Conference Companion on Human Factors in Computing Systems (1996)
12. Egelman, S., Peer, E.: Scaling the security wall: developing a security behavior intentions scale (seBIS). In: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (2015)
13. Faklaris, C., Dabbish, L.A., Hong, J.I.: A self-report measure of end-user security attitudes (SA-6). In: Fifteenth Symposium on Usable Privacy and Security (SOUPS 2019) (2019)
14. Ayalon, O., Toch, E.: Evaluating users' perceptions about a system's privacy: differentiating social and institutional aspects. In: Fifteenth Symposium on Usable Privacy and Security (SOUPS 2019) (2019)
15. Jayakrishnan, G.C., Sirigireddy, G.R., Vaddepalli, S., Banahatti, V., Lodha, S.P., Pandit, S.S.: Password: a serious game to promote password awareness and diversity in an enterprise. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 1–18. USA (2020). Article 1
16. Farke, F. M., Lorenz, L., Schnitzler, T., Markert, P., Dürmuth, M.: You still use the password after all - exploring FIDO2 security keys in a small company. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 19–35. USA (2020). Article 2
17. Samuel, R., Markert, P., Aviv, A.J., Neamtiu, I.: Knock, knock. who's there? on the security of LG's knock codes. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 37–59. USA (2020). Article 3

18. Lee, K., Kaiser, B., Mayer, J., Narayanan, A.: An empirical study of wireless carrier authentication for SIM swaps. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 61–79. USA (2020). Article 4
19. Dev, J., Moriano Salazar, P., Camp, J.: Lessons learnt from comparing WhatsApp privacy concerns across Saudi and Indian populations. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 81–97. USA (2020). Article 5
20. McDonald, N., Larsen, A., Battisti, A., Madjaroff, G., Massey, A., Mentis, H.: Realizing choice: online safeguards for couples adapting to cognitive challenges. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 99–110. USA (2020). Article 6
21. Fanelle, V., Karimi, S., Shah, A., Subramanian, B., Das, S.: Blind and human: exploring more usable audio CAPTCHA designs. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 111–125. USA (2020). Article 7
22. Geeng, C., Hutson, J., Roesner, F.: Usable sexurity: studying people's concerns and strategies when sexting. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 127–144. USA (2020). Article 8
23. Obada-Obieh, B., Spagnolo, L., Beznosov, K.: Towards understanding privacy and trust in online reporting of sexual assault. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 145–16. USA (2020). Article 9
24. Danilova, A., Naiakshina, A., Deuter, J., Smith, M.: Replication: on the ecological validity of online security developer studies: exploring deception in a password-storage study with freelancers. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, , pp. 165–183. USA (2020). Article 10
25. Chalhoub, G., Flechais, I., Nthala, N., Abu-Salma, R.: Innovation inaction or in action? the role of user experience in the security and privacy design of smart home cameras. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 185–204. USA (2020). Article 11
26. Palombo, H., Ziaie Tabari, A., Lende, D., Ligatti, J., Ou, X.: An ethnographic understanding of software (in) security and a co-creation model to improve secure software development. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 205–220. USA (2020). Article 12
27. Smith, J., Do, L. N., Murphy-Hill, E.: Why can't Johnny fix vulnerabilities: a usability evaluation of static analysis tools for security. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, USA, pp. 221–238 (2020). Article 13
28. Tiefenau, C., Häring, M., Krombholz, K., Von Zezschwitz, E.: Security, availability, and multiple information sources: exploring update behavior of system administrators. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 239–258. USA (2020). Article 14
29. Reinheimer, B., et al.: An investigation of phishing awareness and education over time: when and how to best remind users. In: Proceedings of the Sixteenth USENIX

Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 259–284. USA (2020) Article 15
30. Becker, S., Wiesen, C., Albartus, N., Rummel, N., Paar, C.: An exploratory study of hardware reverse engineering technical and cognitive processes. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 285–300. USA (2020). Article 16
31. Michalec, O., Van Der Linden, D., Milyaeva, S., Rashid, A.: Industry responses to the european directive on security of network and information systems (NIS): understanding policy implementation practices across critical infrastructures. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 301-317. USA (2020). Article 17
32. Alomar, N., Wijesekera, P., Qiu, E., Egelman, S.: You've got your nice list of bugs, now what? vulnerability discovery and management processes in the wild. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 319–339. USA (2020). Article 18
33. Mai, A., Pfeffer, K., Gusenbauer, M., Weippl, E., Krombholz, K.: User mental models of cryptocurrency systems - a grounded theory approach. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 341–358. USA (2020). Article 19
34. Wermke, D., Huaman, N., Stransky, C., Busch, N., Acar, Y., Fahl, S.: Cloudy with a chance of misconceptions: exploring users' perceptions and expectations of security and privacy in cloud office suites. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 359–377. USA (2020). Article 20
35. Story, P., Smullen, D., Acquisti, A., Cranor, L.F., Sadeh, N., Schaub, F.: From intent to action: nudging users towards secure mobile payments. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 379–415. USA (2020). Article 21
36. Barbosa, N.M., Zhang, Z., Wang, Y.: Do privacy and security matter to everyone? quantifying and clustering user-centric considerations about smart home device adoption. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 417–435. USA (2020). Article 22
37. Kitkowska, A., Warner, M., Shulman, Y., Wästlund, E., Martucci, L.A.: Enhancing privacy through the visual design of privacy notices: exploring the interplay of curiosity, control and affect. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 437–456. USA (2020). Article 23
38. Rader, E., Hautea, S., Munasinghe, A.: I have a narrow thought process: constraints on explanations connecting inferences and self-perceptions. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 457–488. USA, Article 24 (2020)
39. Bird, S., Segall, I., Lopatka, M.: Replication: why we still can't browse in peace: on the uniqueness and reidentifiability of web browsing histories. In: Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 489–503. USA (2020). Article 25
40. Cobb, C., et al.: How risky are real users' IFTTT applets? In Proceedings of the Sixteenth USENIX Conference on Usable Privacy and Security (SOUPS 2020). USENIX Association, pp. 505–529. USA (2020). Article 26

41. Hayes, J., Kaushik, S., Price, C.E., Wang, Y.: Cooperative privacy and security: learning from people with visual impairments and their allies. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 1–20. USA (2019)
42. Frik, A., Nurgalieva, L., Bernd, J., Lee, J., Schaub, F., Egelman, S.: Privacy and security threat models and mitigation strategies of older adults. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 21–40. USA (2019)
43. Ayalon, O., Toch, E.: Evaluating users' perceptions about a system's privacy: differentiating social and institutional aspects. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp, 41–59 USA (2019)
44. Faklaris, C., Dabbish, L., Hong, J.I.: A self-report measure of end-user security attitudes (SA-6). In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 61–77. USA (2019)
45. Fulton, K. R., Gelles, R., McKay, A., Abdi, Y., Roberts, R., Mazurek, M.L.: The effect of entertainment media on mental models of computer security. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 79–95. USA (2019)
46. Das, S., Dabbish, L., Hong, J.: A typology of perceived triggers for end-user security and privacy behaviors. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 97–115. USA (2019)
47. Busse, K., Schäfer, J., Smith, M.: Replication: no one can hack my mind revisiting a study on expert and non-expert security practices and advice. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 117–136. USA (2019)
48. Wu, J., et al.: Something isn't secure, but i'm not sure how that translates into a problem: promoting autonomy by designing for understanding in signal. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 137–153. USA 2019
49. Simoiu, C., Gates, C., Bonneau, J., Goel, S.: I was told to buy a software or lose my computer. i ignored it: a study of ransomware. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 155–174. USA (2019)
50. Kum, H.C., Ragan, E.D., Ilangovan, G., Ramezani, M., Li, Q., Schmit, C.: Enhancing privacy through an interactive on-demand incremental information disclosure interface: applying privacy-by-design to record linkage. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 175–189. USA (2019)
51. Qin, L., et al.: From usability to secure computing and back again. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 191–210. USA (2019)
52. Drury, V., Meyer, U.: Certified phishing: taking a look at public key certificates of phishing websites. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 211–223. USA (2019)
53. Mhaidli, A.H., Zou, Y., Schaub, F.: We can't live without them! app developers' adoption of ad networks and their considerations of consumer risks. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 225–244. USA (2019)

54. Patnaik, N., Hallett, J., Rashid, A.: Usability smells: an analysis of developers' struggle with crypto libraries. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 245–257. USA (2019)
55. Voronkov, A., Martucci, L., Lindskog, S.: System administrators prefer command line interfaces, don't they? an exploratory study of firewall interfaces. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 259–271. USA (2019)
56. Li, F., Rogers, L., Mathur, A., Malkin, N., Chetty, M.: Keepers of the machines: examining how system administrators manage software updates. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 273–288. USA (2019)
57. Mecke, L., Rodriguez, S.D., Buschek, D., Prange, S., Alt, F.: Communicating device confidence level and upcoming re-authentications in continuous authentication systems on mobile devices. In Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 289–301. USA (2019)
58. Mecke, L., Buschek, D., Kiermeier, M., Prange, S., Alt, F.: Exploring intentional behaviour modifications for password typing on mobile touchscreen devices. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 303–318. USA (2019)
59. Pearman, S., Zhang, S.A., Bauer, L., Christin, N., Cranor, L.F.: Why people (don't) use password managers effectively. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 319–338. USA (2019)
60. Ciolino, S., Parkin, S., Dunphy, P.: Of two minds about two-factor: understanding everyday FIDO U2F usability through device comparison and experience sampling. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 339–356. USA (2019)
61. Reese, K., Smith, T., Dutson, J., Armknecht, J., Cameron, J., Seamons, K.: A usability study of five two-factor authentication methods. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 357–370. USA (2019)
62. Di Martino, M., Robyns, P., Weyts, W., Quax, P., Lamotte, W., Andries, K.: Personal information leakage by abusing the GDPR "Right of access". In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 371–386. USA (2019)
63. Habib, H., et al.: An empirical analysis of data deletion and opt-out choices on 150 websites. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 387–406. USA (2019)
64. Vance, A., Eargle, D., Jenkins, J.L., Kirwan, C.B., Anderson, B.B.: The fog of warnings: how non-essential notifications blur with security warnings. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 407–420. USA (2019)
65. Alqhatani, A., Lipford, H.R.: There is nothing that i need to keep secret: sharing practices and concerns of wearable fitness data. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 421–434. USA (2019)
66. Tabassum, M., Kosinski, T., Lipford, H.R.: I don't own the data: end user perceptions of smart home device data practices and risks. In: Proceedings of the

Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 435–450. USA (2019)
67. Abdi, N., Ramokapane, K.M., Such, J.M.: More than smart speakers: security and privacy perceptions of smart home personal assistants. In: Proceedings of the Fifteenth USENIX Conference on Usable Privacy and Security (SOUPS 2019). USENIX Association, pp. 451–466. USA (2019)