

Problem statement

As contemporary users are prone to reject systems that offer an inadequate UX, organizations must adopt human-centered design (HCD) to design technologies capable of competing successfully in a saturated global market [1]. Despite an abundance of related literature [2], the integration of software development and user experience (UX) remains challenging to practitioners and organizations attempting it [3–5]. There are several barriers to UX integration [6], [7]: lack of understanding of UX return on investment (ROI); mistaken belief that performing UX requires no UX expertise or that UX can be performed informally; contentious attitudes towards users, UX practitioners and UX activities; and mistaking UX for aesthetics or user interface. Moreover, low UX literacy manifests itself in insufficient understanding of HCD and UX, insufficient awareness of UX return on investment (ROI), and contentious attitude towards users [6]. In turn, low UX maturity is characterized by a lack of resources for UX and difficulty in fully committing to UX design from the onset of the project [8].

This case study reports how we introduced and conducted UX activities in a cybersecurity project aiming at supporting the creation of cyber range scenarios. Integrating human factors into the development of systems and infrastructures for cybersecurity is crucial if users are to make these technologies their own. Furthermore, creating cyber range scenarios tailored to their users is key for effective learning. Failure to meet user needs may result in disengagement from the system [9], [10], reduced the relevance and practical application [11], [12], inability or disinterest in completing the training when tasks do not match trainees' capabilities (too simple or too difficult) [13].

Objectives and significance of the proposed presentation

The objective of this case study is to explore the progressive integration of UX activities, first without, then with users, to promote an HCD-oriented mindset within a cybersecurity project. In particular, we aim to answer the following research questions:

- What are project stakeholders' perceptions of UX (specifically their UX literacy)?
- How does involvement or lack of involvement of users in UX activities affect project stakeholders UX literacy?
- What are the barriers and opportunities to UX integration in the project?

The contribution of this paper is to uncover and discuss ways to facilitate UX integration in a cybersecurity project. This case study presents a preliminary account of the gradual involvement of users into project development lifecycle to reduce the amount friction between project stakeholders and UX staff. We believe that UX methods without users have increased stakeholders' UX literacy, which paved the way to further improve stakeholders' attitude towards users.

Methodology

We conducted an exploratory case study since data on perception of UX is scarce and contextual conditions relevant to the research questions above cannot be controlled [14]. We used participant observation in projects with which we were involved as UX researchers and designers to collect observational data from events occurring in the field (e.g., meetings, decisions, and discussions). Further, we administered the survey presented in [6] to measure project stakeholders' UX literacy, specifically the UX dimensions understanding of HCD, understanding of UX, attitude towards users, awareness of UX ROI, as well as the perceived opportunities for and barriers to UX integration. Figure 1 depicts how we conducted the case study (UX activities and data collection on UX literacy).

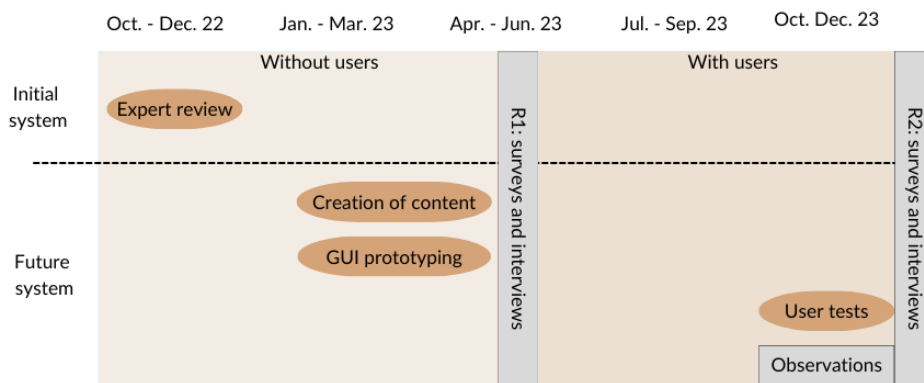


Figure 1. Timeline of UX activities (orange ellipses) and data collection (grey rectangles) in the project. R1 refers to round 1, R2 to round 2.

We first introduced UX activities through methods **without** users for two reasons

1. Methods without users are recommended when resources (e.g., budget, time) are limited [15]
2. Non-UX stakeholders exhibit contentious attitudes towards users and misunderstand the UX ROI [6], [7].

Then, we introduced methods **with** users during the evaluating phase. Believing they already know users' needs and requirements, clients struggle to see the value of HCD and user involvement, preferring user testing over user research [8]. This makes the evaluation phase the most opportune moment to introduce methods with users.

Discussion of results

The data collection allows us to (1) measure the UX literacy of each participant per UX dimension and per round, (2) compare participants' UX literacy before and after using methods with users, (3) identify barriers and opportunities to UX integration, and (4) analyze the demand for and consistency in implementation of UX activities. We triangulated the data and cross-checked the findings.

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