Broad types of User Studies

Many types exist, ones such as descriptive and experimental research methods are well-suited to problems of usability of privacy and security mechanisms.

- **Descriptive study:** Usually the best methods for collecting information that will demonstrate relationships and describe the world as it exists. Collected data needs to allow you analyse the data to determine hidden patterns. Descriptive studies are quite closely related to observational studies. Can be done with Case Studies, Observations, and Surveys for example. Questions such as "what is" or "what was" can be answered by this research method.

- An example of a descriptive a study *"What is the population of users who use computers and like two-factor authentication?", "What is bad about using story-board agents to provide automated warnings to users in danger of phishing attacks?"*

  One could expand a descriptive study to involve a one-time interaction with groups of people (cross-sectional study) or design the study to follow individuals over time (longitudinal study). When the researcher interacts with the participant, usually surveys or interviews are used to collect the necessary information and when the researcher does not interact with the participant, observational studies of people in an environment and studies involving data collection using existing records (e.g., medical record review, crowdsourcing, …).

- **Experimental Study:** Experiments can typically answer questions such as "why" or "how". In this case, a system is designed and given to users, and then the results or outcome of their usage behaviour is observed. Experiments typically have four elements:

  - **Manipulation:** Implies that something is purposefully changed by the researcher in the environment.

  - **Control:** Used to prevent outside factors from influencing the study outcome. When something is manipulated and controlled and then the outcome happens, it makes us more confident that the manipulation "caused" the outcome. In addition, experiments involve highly controlled and systematic procedures in an effort to minimize error and bias which also increases our confidence that the manipulation "caused" the outcome.

  - **Random assignment** means that if there are groups in the experiment, participants are assigned to these groups randomly (like the flip of a coin). This means that no matter who the participant is, he/she has an equal chance of getting into all of the groups or treatments in an experiment. This process helps to ensure that the groups or treatments are similar at the beginning of the study so that there is more confidence that the manipulation (group) "caused" the outcome. More information about random assignment may be found in section Random assignment.

- o **Random selection** is a form of sampling where a representative group of research participants is selected from a larger group by chance. This can be done by identifying all of the possible candidates for study participation (e.g., people attending the County fair on a Tuesday) and randomly choosing a subset to participate (e.g., selecting every 10th person who comes through the gate). This allows for each person to have an equal chance of participating in the study.

- **Example of an Experimental Study:** A bank would like to test the effectiveness of the new fingerprint authentication mechanism that has been embedded into the new ATM machines at their central office. In order to create experimental groups that are similar to the beginning of the study, users are assigned into two groups at random (they cannot choose which group they are in. Users in both groups made to authenticate using fingerprints everyday, but they do not know whether the fingerprint reader actively scans their fingerprint or simply uses a recorded picture which is matched to other authentication information. Users is Group A receive the fake fingerprint reader, while users in Group B receive the real fingerprint reader. The users' authentication failure rate is compared before and after six weeks of using the finger print readers. No differences in authentication failure rates were found between the two groups which suggests that using fingerprint technology was not an effective extension to the current ATM authentication mechanism.

- **Formative (Initial) versus Summative (Validate):** Formative studies happen at the beginning of the design phase where testing with paper-prototypes and similar structures are use to discover weaknesses and prepare the way for a better finished system. Summative usability testing happens in the later half of the development phase, where there is testing with actual working prototypes. At this stage you need metrics such as (time on task, error rate, success rates,…) which can then be used to compare tests from improved versions against. In summary, Formative testing tells us what is not usable, and summative testing tells us how usable the system/interface is.

Exercise (think about at home …)

Exercise #1:

Think of one major challenge that users face with the security/privacy mechanism on which your project topic is based.

- o If your topic includes several security/privacy mechanisms, then choose one.

o If you can't think of a challenge users face with the mechanism, then ask a few people for some ideas.

- **Example:** Users find it difficult or impossible to remember several distinct, complex passwords for multiple accounts, and so re-use passwords.

Exercise #2:

Write down a research question (of interest to you) that will allow you discover why users face the challenge you have identified.

- **Example 1:** What are user password classification strategies?
- **Example 2:** Investigating whether or not users believe there are security risks in reusing passwords across accounts
- **Example 3:** What are the risks users think there might be in using the same password over multiple accounts?

Exercise #3:

Design a short (4 – 6 questions, and no more than 5 minutes long) interview study exploring a research question of interest to you in the area of coping behaviours (strategies) that users have developed to make using your system "easier", but that are less or not secure or privacy preserving.

**Remember:

- o Try to get as much information as possible, but also try do too much in such a short interview.
- o At some point in the interview have your participants imagine using the system, and ask them to do something.
- o To conduct this interview with 3-5 participants (and, if applicable, improve your script in between interviews).

Exercise #4:

- Prepare a 3-4 slide presentation along with the final script you use for the interview. Include details on your discussion with the participant, such as welcoming them or thanking them and telling them the purpose of your study. Include some discussion of what you learned from the participants.