Abstract
In this position paper, we introduce a design approach and preliminary evaluation of web interface cues that might trigger privacy heuristics. We use a scenario-based design approach to explore how different scenarios (privacy contexts) and heuristics (cognitive shortcuts or biases) might affect users' decision-making about information disclosure. Our formative study characterizes some of the thinking processes and reasons that may contribute to people's decisions about disclosing (or not) their personal information.

Author Keywords
Scenario-based design; privacy interface; privacy heuristics; thinking aloud.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

Introduction
Privacy researchers have shown that user interface designs can affect users' decisions about information disclosure [2, 4]. However, it is still quite unclear when and in what situations people will behave in accordance with their own stated beliefs. Acquisti [5] notes that users make different decisions for a range of reasons according to the completeness of information on the interface and their corresponding capability to calculate risk and benefits. More broadly, most privacy researchers view the user's perception of risk and
benefit to be an important determinant of information privacy behavior [3] [6].

Our research team is exploring the role of a less rational decision making process that may be influenced by holistic perceptions of cost and benefit that are based on cognitive heuristics or rules of thumb (e.g. bandwagon) [7]. Our goal is to characterize a set of triggered decisions (positive or negative). Thus far, we have used focus groups and a large national survey to investigate a range of possible privacy heuristics in a number of settings for web or mobile interaction. In this brief paper we describe how we are using scenario-based design [1] to explore four usage contexts and a set of cues that might trigger four possible heuristics:

- Payment Platform
- Community activity website
- Discussion Forum
- Social Network

Currently the scenarios and privacy heuristic cues have been rendered as user interface prototypes suitable for a user walkthrough (shown in Table 1). Therefore, based on the prototype design and a formative user study, we try to address whether the decision making for information disclosure in our designed scenarios is triggered by instant heuristic or rational thinking, whether it is based on single heuristic cue or the whole scenario and whether the final decision is rational or not.

**Design Brief**

In designing these prototypes, we followed three design guidelines:

- **Heuristic isolation**: each prototype is designed to present an interface element for triggering one heuristic so that our focus can be on the design of that cue in particular.

- **Website authenticity**: the visual and interface design were as appealing as possible to reduce participants’ perceptions that we were “faking” the activity.

- **Scenario similarity**: the activities are similar to familiar applications, to minimize rational decision-making and enable us to see impacts of heuristic cues.

We designed eight different web interface prototypes for the four heuristics based on the preliminary data and the design guidelines.

Figure 1 shows one example of a cue for community building drawn from a community activity scenario, which shows a blood donation campaign between two public universities. Hypothetically, users would be more willing to give out their information and support the community, when they see their university is falling behind. For triggering bandwagon heuristic, we implemented a progress bar and a series of timeline events separately in the social network scenario, displaying the proportion of users who have already filled out that type of information. Two different designs of additional verification step before linking credit card to the online payment platform have been used to trigger gatekeeping heuristic. At last, we faked unauthorized auto-generated information from Google search history and online vendor order history as a cue for fuzzy boundary heuristic.

The prototype screenshots are shown in Figure 2 – Figure 4. By using these prototypes, we conducted six sessions of user study described in the following section.

**User Study Protocol**

We recruited six participants as pilot study participants (see Table 2; note that all are experts in some aspects of HCI and design). Each study session consisted of two parts. First, the participant carried out a think-aloud walkthrough of all of the scenarios and prototypes, explaining their perceptions and thinking process when encountering each screen. Second, we interviewed the users about the prototype design details. From this study data, we hope to learn 1) whether the corresponding heuristics can be triggered by the interface cues; and 2) whether the participants’
behavior will be affected. In the data analysis section, we elaborate these two questions in three sections: the process, the criteria and the result.

**The Decision Making Process**

Our pilot study suggests that participants’ decision-making may include at least two stages, one that involves interpretation of the interface element design and the other is to be influenced by the heuristic.

As discussed by the participants, when they see the interface elements (such as in Figure 1), they are able to interpret the design’s intent. For instance, five of the six participants were able to explain the meaning of blood donation campaign cue in the community activity scenario, although only three chose to share all of the requested information.

However, despite accurate perception of the cues, the users’ decision-making was also affected by other aspects of the situation. When introducing the notion of privacy heuristics, we have been considering that users will make instant decisions based on their response to heuristic cues. But it seems that their “irrational” decisions are based on more than interface cues. For example, P1 made an immediate decision for whether to give information in each case based on her personal trust of different classes of web applications rather than the details of the user interface design.

As a result, we speculate that although interface designs intended to trigger privacy heuristics can be noticed and interpreted by users, their real-time decision-making includes many more factors, such as personal interests, information sharing habits and specific prior experiences. Further studies are required to explore these factors work together.

**The Decision Making Criteria: Cue interpretation within a scenario context**

In this scenario-based design study, we embedded the heuristics within specific activity contexts and set up these contexts before each walkthrough. We found that participants did at times attribute their decisions to the heuristic, but often with a qualification saying that if this cue was implemented in another different scenario, he or she would not make the same decision. For example, three participants said that bandwagon works well in the professional social network (Figure 2), but they would not be affected by it in the Online Payment scenario because of additional information sensitivity.

In addition, users have their own expectations about privacy-related elements that should appear in different scenarios. In Online Payment scenario (Figure 3), P3 and P5 said that there should be a privacy policy or terms of use to reveal how their information will be used and where the information will go. If the website does not contain such information, they consider it to be unsafe and untrusted. These sorts of comments demonstrate that any single cue cannot work independently, and that the influence of a heuristic will depend on usage context.

Therefore, we suggest that when researchers and designers practice design for privacy (either in academic studies or real world setting), they should analyze likely usage scenarios first and then choose the proper heuristics to encourage desired behavior.

**Decision Making Result: Heuristics are just one tradeoff in the mix**

We find from the study that although the cues may trigger heuristics when users see the interface elements, their final decision may still be a rational trade-off of the perceived benefits and risks. The complexity for designers is recognizing the many context- and user-specific factors that may feed into this process.

For example, P6 raised the issue of trade-offs in half of the tasks, thinking carefully about whether the information disclosure action will lead to future benefits with respect to the task of providing personal information. In our prototypes, the participant should fill in at least six blanks for each task and spend several seconds. Therefore, we speculate that one “cost” in consideration during decision making may be the
amount of information requested (i.e. a cost to pay now but expected as a convenience for the future).

Our general expectation is that cognitive heuristics will have a stronger impact on situations in which users have only seconds to decide whether to click a link or one or more radio buttons or checkboxes. However, in tasks similar to our study, which require the user to fill in several types of personal information, more time is available and providing the information is more time-costly. This may promote a more rational decision process that leads them to weigh costs and benefits, thinking not only about sensitivity of information but also the user interface costs of providing it now in exchange for future benefits. Other more fast-moving (low-cost) activities may be more susceptible to cues that promote different cognitive heuristics.

More broadly, our initial findings imply that users’ reactions to privacy-related dialogs cannot be simply attributed to individual cues designed to trigger heuristics. The overarching activity design has a significant impact on how users will respond to the cues.

Discussion
In this scenario-based design research, we are exploring how users make decisions when encountering different privacy-related interface designs, and in particular whether and how their decisions are influenced by cues for privacy heuristics in a particular scenario. This formative design method is helping us to surface a more complete thinking process about information disclosure decisions. Furthermore, our research helps to build a more detailed rationale and address the factors that would have impact on the decision making process, such as the context, type of information and number of blanks. We propose the design and testing results of different prototypes will provide design insights on privacy interface for reference.

An important qualification is that our pilot users thus far are members of an HCI research lab; they should be viewed as expert users who may be more likely to emphasize rational decision-making than a general population. We will conduct future studies with randomly recruited participants, allowing a more generalizable set of results concerning our designs and the decision-making processes that they evoke.

References