Accounts from a Claims Reuse Experience: Design of an Airline Fares Tracker

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ABSTRACT

Previous research efforts have led to the establishment of a repository of claims as reusable knowledge entities. Through the analysis, design, and prototyping of a notification system aimed at monitoring airfares across time, airlines, and location, this paper presents the various work-products resulting from a scenario-based design approach coupled with the Claims Reuse Library to support reuse-centric claims analysis. Finally, we share our experience and findings using the Claims Reuse Library as a core to knowledge transfer.

Author Keywords

Notification system, scenario, claim, reuse, interface design.

ACM Classification Keywords

H1.1. Models and principles: General systems theory; H1.2. Models and principles: Human factors; H5.2. Information interfaces and presentation: User interfaces.

INTRODUCTION

User attention is a limited resource that should be reallocated only if the information gains outweigh the interruption cost [2]. A successful user-centric design technique is scenario-based design. Usage situations are captured through scenarios which are then analyzed to extract key features along with their associated tradeoffs—claims [6]. To streamline the design process from a knowledge management standpoint, previous research initiatives have led to the establishment of the Claims Reuse Library [1, 5, 3, 7]—a "repository that stores claims that are reusable and can make notification system design easier and quicker for designers" [1]. The aim is to provide ready-at-hand reusable design knowledge to reduce both development costs and time as well as capitalize on lessons learned.

Through the description of a case study for a notification system aimed at decimating airfare information in a non-intrusive manner, we present the various work-products of each major phase of a scenario-based design approach coupled with the Claims Reuse Library to support reuse-centric claims analysis. Finally, we share our experience and findings with respect to knowledge reuse using the claims repository.

CASE STUDY

Finding and purchasing airline tickets at a reasonable price is a time-consuming task that often turns into a very frustrating experience as airfares continuously fluctuate based on time, airlines, and departure airports. By offering a comprehensive access to ticket fares across multiple airlines in a single location, websites such as Expedia.com, Orbitz, and Travelocity have pioneered ticket price comparisons and quickly established themselves as the benchmark of online travel agencies. Although the implementation of such infrastructures made the purchase of reasonably priced ticket an easier endeavor, it failed to support the activity in an optimal way. A reliance on the aforementioned websites is merely capable of providing a time-dependant and space-dependant view of the airfares. A time-based snapshot of airfares makes it difficult to interpolate data between multiple browser sessions as users are forced to remember past fares in order to get a basis for comparison with the prices currently displayed. Similarly, a space-based snapshot forces users to remember fares associated with each potential departure airport in order to get a basis for comparison with the prices associated with the route currently displayed. To uncover the best possible fare in an optimal fashion, users need real-time access to a three dimensional view of the available airfares—time, airlines, and location.

Scenario-based Design

This section presents the scenarios and claims either directly extracted from these narrations or spurred from navigating through the Claims Reuse Library.

Domain Analysis

The first step of scenario-based design is concerned with an analysis of the work practices in the problem domain. Through the elaboration of a problem scenario and subsequent claims analysis, the objective is to gain an understanding of the problem resulting from a current usage situation [6].

Problem Scenario

John is an employee of a small engineering firm located in Fairfax, VA. His position requires him to travel domestically several times a month to various locations. Because of the company's limited travel funds, the price of individual airline tickets is a major area of concern: Paying a high price for a ticket would have a significant impact on the firm's ability to conduct business with distant clients.

Finding the lowest price for a ticket is a time consuming task that forces John to monitor the rates on travel websites such as Expedia.com numerous times throughout the day. In fact, the hunt for affordable tickets simply rules out a reliance on tiers such as traditional travel agents. Given the company's location, John has several options for departure airports (*i.e.* Washington Dulles International Airport, Ronald Reagan Washington National Airport, and Baltimore-Washington International Airport). This makes monitoring airline prices online an even more time-consuming task since John first has to enter his route and other travel-related information for each alternative departure airports and then has to keep track of price changes across all of these multiple locations. In spite of all these efforts, John is unaware of the fare fluctuations that occur every few minutes across the multiple airports and which consistently result in missed opportunities. Advertisements also interfere with John's searching process, as animated and colorful banners pull his attention away from his primary task. However, when John actually makes a ticket purchase, he would enjoy being informed about hotel discounts and other specials available in his destination city. John likes the freedom and flexibility that web-based reservation systems provide (*e.g.* ability to handle direct online credit-card payment, 24/7 availability). Accomplishing a successful transaction requires a lot of time and attention that John feels should be put towards his work.

Claims Analysis

Claims associated with the problem scenario are presented in Table 1-3.

Online reservation system

IRC: (0.0, 1.0, 1.0)
Description: Webpage-based system for searching available reservation for subject of interest that supports secure online payment
Upside:
+ Multiplatform
+ Lots of content displayed about each reservation
+ Supports a secure payment system
Downside:
- Difficult to keep track of information displayed across multiple pages
- Does not necessarily support error recovery
- Does not record information if cookies are disabled
- Waste of screen space
- Distracting advertisement

Design Issues:
What is the optimal amount of information displayed on each page?
Should potentially related links be displayed?

Table 1. Problem claim extracted from the problem scenario

Advertisements within systems (ID#152187)

IRC: (0.7, 0.7, 0.7)
Description: Advertisements such as other websites, special promotions, or related items sometimes appear on systems as a selling vehicle
Upside:
+ Advertisements usually decrease the cost of the product
+ Advertisements can inform users of items they may not otherwise be known
Downside:
- Advertisements can be distracting to the user
- Take up more screen space
- Advertisements are not necessarily targeted to a user or project
Design Issues:
What size is appropriate for advertisements?

Table 2. Problem claim retrieved from the Claims Reuse Library

Online payment system

IRC: (0.0, 1.0, 1.0)
Description: Webpage-based system for securely completing a transaction
Upside:
+ Allows the user to act upon information received by a notification system
+ Provides a secure environment
+ Fast and paperless
Downside:
- Susceptible to web server/browser crashes
- Need to be a bank account holder (no cash transactions)
- Poor support for error recovery
Design Issues:
What is the best balance between security and ease of use?
Is sensitive information hidden? (*e.g.* credit card numbers)

Table 3. Problem claim extracted from the problem scenario

Activity Phase

The second step of scenario-based design is concerned with the functional requirements of the envisioned system. Through the elaboration of an activity scenario and subsequent claims analysis, designers focus on "the basic concepts and services of the new system" [6].

Activity Scenario

During a meeting with his manager, John expressed a need to travel to Los Angeles, CA for a meeting with potential clients that may help the company strengthen its presence in the west coast market. After going over the details, the firm owner agrees it would be a valuable opportunity but implores John to find the best price for the airline ticket because the company is desperately trying to save money. Despite his busy workload before the trip, John agrees that he will find time to get the best possible price.

Back in his office, John loads up his travel system. He will be departing for Los Angeles International Airport on December 19th. He inputs this information and then realizes that since he is located in the Northern Virginia area and is willing to drive a bit to save money, there are several airports nearby that offer service to LAX. Consequently, he selects Washington Dulles International Airport, Ronald Reagan Washington National Airport, and Baltimore-Washington International Airport as departure airports. As soon as the information is entered, airfares appear. Departing from Washington Dulles International Airport the price is $300. Departing from Ronald Reagan Washington National Airport the price is $290. Departing from Baltimore-Washington International Airport the price is $583. While John is impressed by the system, the prices initially displayed are greater than what John was originally expecting to pay. His main concern is not keeping track of historical prices, but rather to let the system notify him of an airfare meeting his price requirements. Since lunchtime is approaching, John sets the system to alert him if the price drops below $275.

During lunch, John receives an alert. He is pleased to find that the system has alerted him that the price from Washington Dulles International Airport to Los Angeles International Airport has dropped to $269. Eager to lock in on this opportunity, John immediately interacts with the system to complete his transaction. John is satisfied with his decision to rely on Expedia.com Price Tracker (ExPT) to monitor airfares on his behalf.

Claims Analysis

Claims associated with the activity scenario are presented in Table 4-6.

Alarm metaphor for event notification (ID#152287)

IRC: (1.0, 1.0, 0.0)
Description: Notification of events set by the user is done by a sound [or some other means]
Upside:
+ Notification is very intrusive to make sure the user is notified of important events
+ Customizable sounds inform the user on the type of information
+ No use of screen space
Downside:
- Some users may not want their notification system to be this much intrusive

Design Issues:
Which level of intrusiveness is acceptable?
What kind of sounds to use for particular types of information?

Table 4. Activity claim retrieved from the Claims Reuse Library

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Periodic updates for planning purposes (ID#000012)

IRC: (0.6, 0.2, 0.7)
Description: The information required by the user is located in a small space and updates are provided every so often as the particular topic is cycled through with other topics
Upsides:
+ Animation is used to display many different pieces of data in a limited area
+ Use of animation for updating is not intrusive and has low interruption
+ Animation is predictable, so users have a rough idea of when a certain topic is coming up
+ User can control animation in desktop situations
Downsides:
- When WH is on a large, common display, the user cannot control the animation and has to wait for the information s/he is interested is to cycle through
- There is no difference in how the information is presented, so there is no reflection of priority of information
- Because this is primarily a desktop application, font may not be optimal for a large screen
Design Issues:
Size of screen needs to affect size of font
Can a user ever exercise the configurability (*i.e.* pausing animation) if the system is on a common, large screen display?
What kind of data formats do you need to support with animation?
How will the size of the window affect the ability to display certain types of data?
How can user controls affect information updates?

Table 5. Activity claim retrieved from the Claims Reuse Library

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Linking to a web-based "complete transaction" page from a software agent that handles an order details

IRC: (0.5, 1.0, 1.0)
Description: The software tool handles all aspects of the order. This may include personal information and information such as what is ordered, quantity, etc. After the software tool collects this information from the user, a link can be clicked to connect the user to a website that uses this information to allow a transaction to be completed

Upsides:
  + User can avoid websites where they may be bombarded by ads, etc
  + A clean and efficient interface can make the user experience more enjoyable
  + All information will be entered for the user to review before a transaction is made
  + Personal information could be stored using the software tool making future uses of the software less time intensive
  + Allows the notification system to be a small, efficient system without unnecessary functionality
Downsides:
  - The software tool could end up being a "middle man" which would result in a poor experience for the user
  - Fake software tools could be made for stealing a user's personal information
Design Issues:
  What personal information is stored?
  How securely is personal information stored?
  Will there be any overlap between the software tool and the linked website?
  Are there any more areas that can be exploited to enhance the user experience?

Table 6. Activity claim extracted from the activity scenario

Information Design
The third step of scenario-based design is concerned with the establishment of a design solution that facilitates the crossing of the Gulf of Evaluation [4]. Through the elaboration of an information scenario and subsequent claims analysis, designers focus on the visual elements of the new system [6].

Information Scenario
Returning to his desk after a talk with his manager about his upcoming trip to the west coast, John is determined to find the cheapest flight from a nearby departure airport to Los Angeles International Airport. He logs onto his computer and launches ExPT.

A small application window fitting snugly in the bottom corner of his screen appears. John likes the idea of having this software agent find the best match for his budget while he resumes working on more important work items. After the application has loaded, John observes a simple, user-friendly interface. There are fields for entering an arrival airport, a departure date, and various potential departure airports. In addition, John notices several standard dropdown menus available for using the system. A *File* dropdown menu displays a *Save Search*, an *Open Search* as well as a *Quit* option. In addition, a *Settings* dropdown menu features a *Profile* (to provide contact information) and a *My Settings* option (for use with departure airports and alert information). John observes that all information is presented in a crisp manner and is organized effectively.

John provides the above information without trouble. He especially enjoys how the system automatically displays up-to-date ticket pricing as soon as all the information has been inputted. John notices that prices higher than his price threshold are colored in black but the color turns to red if the current fare drops below this figure. These ticket prices are updated every minute with information fetched from the Expedia.com database. John appreciates not being unnecessarily distracted by irrelevant advertisements while ExPT monitors airfares on his behalf. John may like to view advertisements related to his destination city when he actually books his flight, but judges it is premature until then. To the right of the ticket prices, a button links to a page where John can book the flight if he is satisfied with the fare.

Claims Analysis
Claims associated with the information scenario are presented in Table 7-9.

Non-scrolling information display (ID#152204)

IRC: (0.0, 0.2, 0.5)
Description: Visual summary of information that is easily readable
Upsides:
  + User gets the latest information
  + User is not overwhelmed by information
  + User knows which category has new information
  + User is satisfied with easy comprehension of notification
Downsides:
  - Showing content for the current time slot while some users may prefer reading information from previous time slots
Design Issues:
  Displaying information – What and how information should be displayed?
  Size of the notification system – How big or small should the system be?
  Where should the default location of the system be – near the system tray or in the middle of the screen or elsewhere?
  Proper use of colors – What color combinations are the least distracting and most pleasing to the user?
  Information organization – How do we group/organize information according to a particular category, in a particular time slot?
  Consistent and appropriate visual language

Table 7. Information claim retrieved from the Claims Reuse Library

Real-time notifications (ID#152182)

IRC: (0.6, 0.5, 0.5)
Description: Updates are made to the notification system as soon as they are processed. The display reflects these updates so the user sees them in real time

Upsides:
  + Content is pushed to users
  + User is confident s/he will not miss new headlines
  + User can customize the news s/he prefers to receive
  + No need for the user to refresh the screen manually
Downsides:
  - User may be annoyed by too many updates
  - Frequent notifications cause interruption
Design Issues:
  What is the time lapse allowed to be "real time"?

Table 8. Information claim retrieved from the Claims Reuse Library

Red color for displaying urgent information (ID#000036)

IRC: (0.3, 0.4, 0.2)
Description: Deadlines on the GAWK system are displayed on the timeline in red
Upsides:
  + red deadlines stand out and imply importance
  + showing deadlines helps students form goals
  + showing deadlines helps teachers focus students on tasks
Downsides:
  - heavy use of red draws focus away from past and current screen areas
  - clickability of deadlines not conveyed

Table 9. Information claim retrieved from the Claims Reuse Library

Interaction Design
The final step of scenario-based design is concerned with the establishment of a design solution that facilitates the crossing of the Gulf of Execution [4]. Through the elaboration of an interaction scenario and subsequent claims analysis, designers focus on the mechanisms for accessing task information and manipulating system states [6].

Interaction Scenario
Returning to his desk after a talk with his manager about his upcoming trip to the west coast, John is determined to find the cheapest flight from a nearby departure airport to Los Angeles International Airport. He logs onto his computer and launches ExPT.

He first goes to the *Settings* dropdown menu and clicks on *My Profile*. A secondary window appears, allowing him to input his detailed contact information (*i.e.* full name, address, phone number, and email address). He then clicks on the *Ok* button to close this *First Time Setup Wizard*. Now that John has completed *My Profile*, ExPT is capable of fetching Expedia.com's information pages automatically at the actual time of booking which will save John's time. Subsequently, John clicks on *My Settings*. A secondary window appears, allowing him to specify the range (in miles) with respect to the location he provided in *My Profile*, of potential departure airports he might be willing to depart from. Additionally, a check box allows John to choose to be alerted if a ticket drops below an upper limit price that he can type in a text box. Finally, he can select the level of interruption (high or medium) using a radio button. He chooses a high interruption since he does not want to miss a cheap ticket opportunity. He then clicks on the *Ok* button to close this *My Settings* window. Back onto the main ExPT window, John selects his arrival airport, departure date, and chooses four different departure airports within the range he provided. The system is now set. He minimizes the ExPT window to get more screen space available for his other application windows. John can focus again on the project he needs to present to his prospective California clients.

As John is working on his presentation slides, a system tray icon flashing at a fast rate and an orange flashing color in the taskbar instantly grabs his attention. He understands right away that ExPT has found a ticket matching his criteria. He then clicks on the system tray icon, which restores ExPT application window. John notices that a red price is displayed next to Ronald Reagan Washington National Airport and he understands that a ticket matches his requirements. Satisfied with the price listed, he clicks on the *Buy it Now* link located on the right-hand side of the red marked price. A web browser opens displaying the credit card information form of Expedia.com–last step of the booking process. John provides his payment information and clicks on the *Submit* button. An advertisement on Expedia.com website offering two discounted nights in Los Angeles, CA grabs his attention. He is interested by the offer as it is relevant to his trip, but decides to take care of lodging later. A few seconds afterward, John receives a confirmation email from Expedia.com encompassing his flight itinerary and payment summary.

John is very satisfied with ExPT as it minimized the amount of time spent on finding an affordable ticket and booking a flight. John can now go back to his work and get ready for his trip.

Claims Analysis
Claims associated with the interaction scenario are presented in Table 10-12.

Flashing update notification in system tray (ID#152188)

IRC: (0.8, 0.7, 0.5)
Description: An icon that begins to flash when an update has taken place and will continue to flash until some action is taken to acknowledge the change
Upsides:
  + Assures that the user will see the update if not there at the time it actually occurs
  + Makes the user instantly aware of the update

Downsides:
  - The constant blinking may be a nuisance
  - Distraction from the main task may be overly intrusive
Design Issues:
  Should the flashing last only a limited amount of time (*e.g.* 5 minutes) then stop?

Table 10. Interaction claim retrieved from the Claims Reuse Library

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Flashing icon indicating status change (ID#000039)

IRC: (0.4, 0.7, 0.4)
Description: The GAWK system uses flashing icons to indicate when a group's status has changed
Upsides:
  + new item flashing allows quick recognition of changes
  + new icon flashing and presence provides acknowledgement of item submission
Downsides:
  - flashing duration may be too short and go unnoticed
  - flashing with highlighting changes may be confusing

Table 11. Interaction claim retrieved from the Claims Reuse Library

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Using standard menus (*e.g.* file, settings, help)

IRC: (0.0, 0.0, 1.0)
Description: Using the standard dropdown menus provided by Windows and Apple graphical user interface
Upsides:
  + Content is familiar to the user
  + Most options fit under one of the standard menu names
  + Time tested menu names are efficient for finding information
  + Keyboard Shortcuts (ALT + underlined letter)
Downsides:
  - Oddball options might fit under multiple menus
  - Submenus within the main menu headers might be hard to find
Design Issues:
  Creativity may be lost by trying to remain in the same standard framework provided by the major Operating Systems
  Should the functionality of the program be proportional to the number of menu options?

Table 12. Interaction claim extracted from the interaction scenario

Prototype Description
Expedia.com Price Tracker (ExPT)—a notification system powered by Expedia.com—allows users to monitor airfares

across multiple itinerary regardless of airlines simultaneously and in real time. ExPT consists of an application window with three standard option menus available to the user:

- The *File* dropdown menu allows users to *Save* a search, *Open* a search that was previously saved, or *Quit* the program. The information recorded in a saved search includes arrival airport, departure date, and potential departure airports. When a user opens a saved search, this information is loaded back into the program automatically for user convenience. The user also has the ability to exit the program by using the *Quit* command.

- A *Settings* dropdown menu offers a *My Profile* option (Figure 1) where users can enter detailed contact information such as full name, address, phone number, and email address. Providing such information allows the program to fetch the first three pages of the Expedia.com's website required for checkout with this data at the time of the actual booking. A *My Settings* option (Figure 2) allows users to provide the range (in miles) they are willing to depart from, with respect to the location specified in *My Profile*. Furthermore, users are prompted for an upper price limit and can select among three proposed levels of alerts (*i.e.* no alert, medium level of alert, and high level of alert) to better suit their attention-reallocation comfort levels.

- A *Help* dropdown menu offers a *Help* link as well as an *About* option. The former option provides specifics about the use and setup of the system as well as answers to frequently asked questions (FAQs). The latter option supplies information about the current version of the program and copyrights.


Figure 1. My profile screen

Figure 2. My settings screen

The blue sky with white clouds background of the main application window evokes the freedom of mind of an upcoming trip planned with ExPT. Embedded in the background are several dropdowns that allow users to customize their itinerary based on their settings (Figure 3).

The first set of dropdown boxes allows users to choose the arrival airport. Users select their destination state and ExPT automatically filters the national airport list to include merely the airports in the selected state. The rationale for this filtering mechanism is to address the scalability issue resulting from a dropdown encompassing close to 15,000 airports in the United States alone. We determined that most users were familiar with filtering mechanisms and that it would increase the interface efficiency by reducing both cognitive load and selection time.

Using the second dropdown box, users select a departure date. When the down arrow on the dropdown box is selected, a calendar appears in a fly-out fashion, which facilitates the date selection and reduces the risk of errors. Additionally, the day of the week is displayed for user convenience.
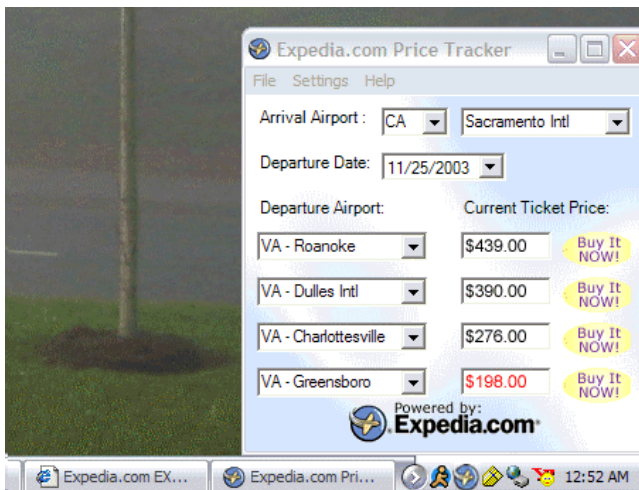
Figure 3. The main application window in its maximized state

Below the departure airport and departure date are four independent dropdown boxes that allow the user to select up to four alternative departure airports within the range

specified in *My Settings*. These airports are displayed according to the following format: <State> - <Airport Name>. We believe this format offers improved spatial visualization and thus enables users to select a departure airport easily. Displayed beside each departure airport are the lowest airfares currently associated with the itinerary. These fares are updated every minute using data pulled automatically from Expedia.com's database. Next to the prices display are *Buy it Now* links. These links are intuitive for the user to use and provide direct access to the purchase of airline tickets. Personal information inputted by the user in *My Profile* is automatically fetched to Expedia.com's purchase page to facilitate the transaction.

When a price drops below the threshold set by the user, the display of the fare turns to red and an alert is triggered according to the user's alert settings:

- If a medium alert was selected, the system tray icon associated with the notification system flashes at a rate of 25 ms.

- If a high alert was selected, in addition of the event described above, the task bar button also flashes in a burnt orange color at a rate of 25 ms.

CLAIMS REUSE EXPERIENCE

Throughout the design process, the Claim Reuse Library [1, 5] proved to be a very valuable tool. Browsing through the repository allowed us to uncover key issues that might have been neglected otherwise. A case in point is claim *152187 Advertisements within system*s (Table 2). After looking through the Claims Reuse Library, we were able to locate an advertisement claim and capitalize on it to increase the coverage of our problem scenario. This spurred additional functional requirements and ideas relating to how advertisements influence the user of a system like ExPT, which ended up drastically shifting our design direction. From this particular example, we can infer that a systematic reliance on a Claims Reuse Library throughout the design process might not only extend requirements but also prompt new design directions.

While constructing our information scenario, questions arose on what the best color would be to highlight pertinent information. Originally, we thought of associating the color red with irrelevant information, as red suggests negativity. Since we did not have the opportunity to conduct user testing to validate this claim, we turned to the Claims Reuse Library to confirm this aspect of our system. We encountered claim *000036 Red color for displaying urgent information* (Table 9), which states that red color implies importance, stands out, and is thus noticed at first glance. We realized that displaying irrelevant information in red would result in a loss in efficiency since users would initially focus their attention on the red field before discerning the information to be non-pertinent. Consequently, we decided to use red to highlight information relevant to users. This illustrates how useful the knowledge repository was for analytically validating

aspects of the artifact. Additionally, the ability to leverage previous work-products saved considerable time, as we were also able to reuse results from prior empirical user testing. Unfortunately, not all of the needed claims were stored within the knowledge library. This is to be expected as we worked with a small set of stored claims due to the prototyping nature of the repository. For example, a seminal claim to the problem scenario that was not in the Claims Reuse Library was the Online Reservation System. We are confident that this issue will resolve itself over time as the use of the Claims Reuse Library becomes streamlined and integrated within the notification-system design process.

Storing supporting theories and rationale with claims in the repository would be a valuable enhancement to the Claims Reuse Library. Currently, most of the stored claims do not have a field for supporting theories. Theories are more authoritative and less heuristics than claims *per se*. They add valuable resources for designers of systems and may strengthen the quality of work since designers can reference other research papers to support their argumentation or reasoning. Finally, design issues are a critical supporting point in favor of the systematic use of the Claims Reuse Library. In fact, they provide guidance as well as a valuable set of questions that have to be considered or addressed during the user-testing phase.

As the use of the system increases and gains additional claims, users of the knowledge repository will significantly benefit from this tool with their interface design. Although in its current state, the Claims Reuse Library did not suit all of our needs, we believe it has a great potential to become an exceptional design resource.

CONCLUSIONS AND FUTURE WORK
We are confident that the adoption a system like ExPT would drastically improve the efficiency of online ticket purchases thanks to its supported features, comprehensive interface, and customization levels. However, further user testing needs to be conducted for the system to achieve its full potential. We expect these empirical testing rounds to establish the optimal flashing speed of the system-tray icon as well as the suitable frequency for the price updates. Additionally, we anticipate these testing rounds might also expose the need for additional alert mediums such as sound to achieve the desirable high-level of interruption effectively and empower the user with enhanced notification customization ability. From a privacy perspective, issues also have to be investigated to address what type and how much information should be amassed by the system—tradeoff between security and efficiency.

As for the Claims Reuse Library, its degree of usefulness for the design of our system can hardly be argued. Browsing through the repository not only validated some concepts through both knowledge and test results reuse, but it also spurred new ideas that might have been disregarded otherwise. The explicit upsides and downsides dimension of the stored claims provided lots of guidance and allowed us to better estimate the tradeoffs associated with each functionality of the system. In addition, the design issues directly outlined what should be considered in the user testing rounds. Even though the Claim Reuse Library did not fulfill all of our needs, after it is further enriched with theory-supported claims, its usage will become, without a doubt, an integral part of a streamlined notification-system design process.

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