Connecting Usages with Usability Analysis through the User Experience Risk Assessment Model: A Case Study in the Tourism Domain

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Abstract. Web usability evaluation methods have been traditionally considered as detached from the analysis of the actual usages of a web applications. While the former is typically delegated to web engineers or web designers, the latter seems to be a concern only for online marketing experts. Based on our previous research results, in this paper we present a holistic evaluation model that seamlessly integrates usability and usage analysis in the assessment of the communication quality of a web application. Specifically, we apply this model to the analysis of BravoFly website (a Swiss Online Travel Agent) and we illustrate how the results of this integrated evaluation can shed new light in intelligently prioritizing re-design interventions. Implications for online tourism communication managers and researchers in this area are discussed.

Keywords: usability evaluation, usability inspection, usability testing, usage analysis, log files, design dimensions.

1 Introduction

Tourism is an information-intensive domain [1] which has been completely reshaped by the advent of the Internet [2]. In general, companies in the tourism business are using and exploiting the Internet with two main goals: (1) to market themselves online [3]; and (2) to sell tourism products through the Web [4]. At a closer look, the tourism online domain [5] is composed by different players (such as different online travel agents) trying to compete for the user attention [6] to market and sell tourism products (e.g. flights). In this process, the quality of online communication [7] [8] in terms of usability at each level (from content quality, navigation quality, transaction quality and overall usability) has become a fundamental issue in the field. To complement usability, it is also important to consider the role of usage analysis within the domain: different researches in the last years are trying to devise techniques to make sense out of the huge amount of usages data (e.g. coming from log files) generated by tourism websites [8]. In this respect, there is an increasing effort in focusing on the analysis of

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communication issues related to usages and online behavior [9]. Traditional usability and usage analysis, however, are not yet recognized as part of a meaningful and coherent theoretical framework. In our previous research [7] [8] we have laid the foundations for the User Experience Risk Assessment Model, an attempt to connect usability analysis with usage analysis through the unifying notion of risk. On the one hand, usability problems identified though usability methods can be considered significant risk factors for a detrimental user experience. On the other hand, results from usage analysis identify the probability for users to be actually exposed to those usability problems, thus mitigating or worsening the overall risk for negative experiences. Based on this theoretical elaboration, a proper analysis of the user experience risk would inform project managers, communication and web designers in making decisions concerning questions such as: what parts of the application require immediate attention for re-design or improvement? Are my users exposed to potentially negative experiences? How can I optimize the good experiences on my site? Our innovative contribution is the elaboration of few, basic constructs to analyze and characterize such hurdle of risk issues by holistically leveraging current approaches to usability analysis and usage studies. More analytically, our research proposes to see the user experience risk as composed of three main elements: (i) threats as usability problems inherent to the design; (ii) vulnerability as the exposure to usability problems and (iii) resilience as the user's ability to overcome usability problems.

A case study approach has been used to investigate and validate the model. We chose Bravofly.com as a representative case of information-intensive web application in the Tourism domain, and specifically on the online travel/flight business. BravoFly is a Swiss based company which mainly operates as Online Travel Agent in south Europe (7 countries + international version) for low cost flights. BravoFly is strongly devoted to innovation seeking competitive advantages and its unique aspects could be seen in the possibility of combining low cost carriers on different destinations to get price advantages for customers.

2 Related Works

According to Garrett [10], "user experience is not about how a product works on the inside (although that sometimes has a lot of influence), but it is about how it works on the outside, where a person comes into contact with it and has to work with it". The same author described the website as a "self-service product", where no instruction manual or seminar is provided: the user faces the website alone, only with her/his experience guiding her/him [10]. Furthermore, Kuniavsky [11] investigated the concept of user experience identifying three main factors that positively affect user experience, namely (i) functionality, which considers the websites' usefulness with regard to the users, (ii) efficiency, which considers the time needed by the users to accomplish specific tasks, and finally (iii) desirability, which considers the users' feelings of surprise and satisfaction with regards to the web application. ISO (International Organization for Standardization) defines usability (ISO 9241) as "the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments". The various aspects of this definition are also

supported by Cantoni and Tardini [12] which define usability according to the Website Communication Model (in short WCM) as "the adequacy of contents/functionalities (pillar I [of the Website Communication Model - WCM]) and accessibility tools (pillar II), between themselves and with respect to the users (pillar IV) and the relevant context (world). However, this adequacy has to be measured taking into consideration the goals of people who commission, project, develop, promote and run the website (pillar III)" (Cantoni and Tardini, 2006: 129-130). Besides, usage analysis (or log files analysis) is one of the most interesting studies to be performed on a website if there is no possibility of involving users during the usability analysis [13]. In general terms, log files are the traces left by the user while visiting the web site; this specific group of files are server side files that record users' activities while they are visiting the website. The study of the log files is not an engineering activity as such: log files analysis can give interesting information at a communicative level [9] such as the study of the users' paths along the website [14] by which it is possible to optimize the communication flow within the website. Tourism websites and moreover Online Travel Agent websites host and offer services or products (or in other words, gives visibility to third party websites). This websites should be well-designed and have great performances in order to satisfy both investors and the product/services providers and end-users. Moreover performance and conversions are critical success factors for eCommerce websites such as Online Travel agents websites. Good website usability normally leads to a good website performance; therefore usability performance is a key success factor for a website [15], [16].

2.1 Theoretical Framework

Understanding the user experience with Online Travel Agent websites is a daunting and multifaceted task. The theoretical and methodological foundations developed by the community of scholars and design professionals in many fields (human-computer interaction design, usability, interaction design, marketing, software engineering) to tackle various aspects of the user experience have remained very isolated and self-contained. The consequence of such conceptual fragmentation has been a proliferation of methods and techniques that lacks a comprehensive, holistic perspective on the issues at stake. In particular, there are two areas which have seldom dialogued with one another: the study of usability and the study of usages. On the one hand, usability studies have typically focused on the empirical evaluation of the efficiency and effectiveness of the website to support user goals and tasks, with the aim of improving the quality of the design [17,][18]. On the other hand, the study of usages has mainly addressed the analysis of website traffic, aggregated user's paths and ecological factors (referrals, in coming and out coming websites), with the purpose of informing marketing actions and visibility [13]. The common, unifying factor among these two areas of concerns is the study of the user as a person exposed to a complex, articulate – and oftentimes unpredictable – communication artifact. Interestingly, this type of situation is not at all exclusive or uniquely distinctive of electronic communication. The study of analyzing, evaluating and predicting the consequence of a person's exposition to potentially adverse events is common to many other disciplines, including – just to name a few – public health, security engineering, emergency

management, and finance [19], [20]. In their theoretical frameworks, these disciplines have always leveraged a basic construct: the notion of risk. The relevant components, and formulae, defining risk vary from discipline to discipline, given the different type of problems to solve and analyze. We therefore do not review all the possible combinations and variants of conceptual constructs defining risk in the abovementioned disciplines. For the sake of our theoretical elaboration, however, we have identified some important, common factors determining risk which are readily applicable to the study of the user experience in interactive communication. The design and deployment of a destination website can be considered an enterprise which is subject to some degree of risk: actual users are often unknown (although possibly predicted during design), the actual behaviors of the users on the site is often unknown from the outset, and the actual effect or outcome of the experience with the site on the user is difficult to predict. Most importantly, the complexity of the design features of large web applications (and their emergent properties due to their interconnectedness) poses additional levels of unpredictability to such factors, augmenting the risk of negative user experiences. A proper analysis of the user experience risk would inform project managers, communication and web designers in making decisions concerning questions such as: what parts of the application require immediate attention for re-design or improvement? Are my users exposed to potentially negative experiences? How can I optimize the good experiences on my site? Our innovative contribution is the elaboration of few, basic constructs to analyze and characterize such hurdle of risk issues by holistically leveraging current approaches to usability analysis and usage studies. Overall, the risk of negative user experiences with the site is determined by 3 basic factors: threats, vulnerability and resilience (see Fig. 1), which are explained in detail in the following paragraphs.

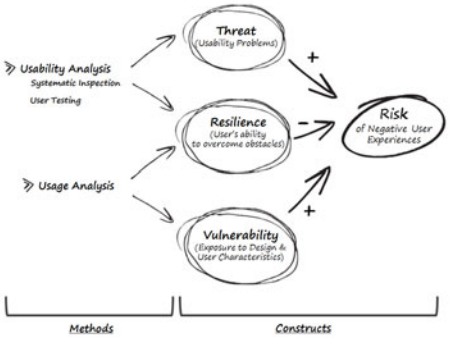

Fig. 1. The synergy of usability and usage analysis to capture user experience ris

"Threats" as Usability Problems Inherent to the Design. The design complexity of large destination websites is often prone to usability problems. Although there are many definitions of usability problems, for the purpose of our framework, we define a usability problem as a design defect that is a potential threat to an optimal user experience. Usability problems of varying severity are typically inherent to how the application has been designed and, therefore, eventually lie at one or more of the following design dimensions:

- Content: the core information messages of the websites, from text, to multimedia. An example of potential threat, or usability problem, at this level is the presence of non obsolete content, or the absence of contact information.

- Information architecture: the overall organization of the content in chunks and sections. An example of potential threat at this level is the classification of the content using a limited set of criteria (e.g. only by geographical location) which do not correspond to the user's natural reasoning in exploring information (e.g. I want to go skiing, no matter the specific location).
- Navigation and interaction: the strategies by which users can use and move around the information architecture through links and interact with content. An example of threat at this level is the lack of intuitive mechanisms to use an interactive map, to navigate to in-depth information from it and to print the desired information.
- Services & transactions: the strategies by which specific operations and services are organized, structured and made accomplishable by the user.
- Search functionality: the way an internal search engines supports accurate and efficient retrieval of information.

Labeling and interface semiotics: the way in which all the above mentioned aspects are conveyed at the interface level through naming conventions, layout strategies, metaphors and labels. This analytical modeling of the threats reveals critical areas of the site that do not necessarily determine a risk of negative experiences, but need to be carefully and jointly considered with respect to the vulnerability that our users may manifest.

Vulnerability" as Exposure to Usability Problems. An area of the site (a list of hotels) with severe usability problems (out-of-date or missing contact information) may not be considered a too dangerous threat if, for instance, no user ever bumped into it (because it was completely buried in the site architecture). The fact that the list of hotels is very difficult to find mitigates the potentially destructive effect of the threat because the actual exposure of our users to it can be considered very low or null. This simple example shows that user's vulnerability to a threat can be defined as the exposure of the users to it, identified in terms of actual traffic or potentially accessible pathways. Of course, the fact that few users access the list of hotels has to be carefully analyzed: is that in line with overall website goals or that should be the most important website area? Are there usability problems (most probably in the navigation layer) that prevent users from reaching it? Are promotional activities bringing the most appropriate publics to the website? In addition, vulnerability also depends on the specific characteristics of our users, which may be more or less sensitive to a threat. For example, web-savvy users may find no problem in downloading an additional Flash player to enjoy a video. Senior citizens new to web technology, on the contrary, may have a hard time in figuring out what to do in this situation. The consideration of these elements determines important factors that influence the degree of vulnerability of our users.

"Resilience" as the User's Ability to Overcome Usability Problems. Whereas vulnerability identifies the danger of a potential or actual exposure to a threat, risk can be highly mitigated by considering how and whether users actually overcome – or "survive" to (in virtual sense) – a threat. Let's assume that users often visit the section to subscribe to the newsletters, and they go through a cumbersome set of poorly organized pages to create an account, necessary to subscribe to the newsletter. The fact that 90% of the people accessing the newsletter section are eventually able to

complete the task is a clear sign of high resilience, which is the capability of the users to overcome obstacles posed by existing threats. And this mitigates the overall risk of negative user experiences. As the user population changes, however, this resilience may radically and suddenly vary, causing a high level of risk.

The Synergy between Usability Analysis and Usage Studies. In this perspective, the existing methods and approaches to usability analysis and usage analysis can work in concert to address the key issues outlined by our user experience risk framework. Usability analysis (through systematic inspection and user testing) can unearth the threats for the user experience. The main outcome of usability analysis is, in fact, an organized set of usability problems inherent to the design. On the one hand, user testing can also uncover an important aspect of resilience (observing whether and how users are affected or overcome usability problems). On the other hand, structured inspection methods such as scenario-based inspection and cognitive walkthrough (common practices in interaction design and usability engineering) can reveal other interesting aspects: the characteristics of the user profiles identified and considered throughout the inspection process enable to reason about vulnerability to the usability problems identified. Usage analysis perfectly works as a complementary analytical toolkit to determine vulnerability in terms of intensity of traffic to poorly designed areas. Moreover, the study of usages can be applied to reveal episodes of resilience, as the analysis of the full paths of the user and their conversion rate is taken into consideration. The following sections articulate the application of our approach to the evaluation of the user experience risk analysis of an online travel agent website (i.e. www.bravofly.com). The purpose is to show how this conceptual framework can translate into an analytical instrumentation which can be organically used to inform new discoveries in the study of the user experience and to enable better designs.

3 Research Design

Bravofly.com and Online Travel Agency has been investigated over the course of 1 year by investigating its website using the following methodologies: heuristic driven evaluation, scenario based user testing (n=16) and usages analysis (1 year time frame). While (i) heuristic driven evaluation [16] is a methodology that evaluate possible usability drawbacks thanks to the efforts of one expert evaluator (also called usability inspector) and to a set of given heuristics (i.e. usability guidelines), (ii) user testing [19] is a methodology that involves possible real users confronted with the live application facing with real scenarios, goals and tasks to accomplish. These two analysis were based on MiLE+ (Milano – Lugano Usability Method – [21] [22] [23]). Finally, the (iii) usages analysis, which is not only an engineering activity but could give interesting insights also at communication level [9], have been studies thanks to the Google Analytics software installed by the company. Following MiLE+ methodology [21] an Usability Kit (Ukit in short) was elaborated in order to guide the heuristic evaluation and the user testing. The Ukit was composed by 5 user profile, 5 goals, 66 tasks and 33 heuristics divided into (i) content, (ii) navigation and (iii) graphic. The evaluator was asked to check the website against the heuristics; in order to make an ex-post reconciliation and to confront the results of the two analysis the results of the user testing were also associated where possible to the heuristics.

Finally, results (i.e. heuristic evaluation, user testing and analytics analysis) have been mapped on a light reverse design of the application. Thus the main goal that has been investigated within this research is the composition of user experience of three main elements: (i) threats as usability problems inherent to the design; (ii) vulnerability as the exposure to usability problems and (iii) resilience as the user's ability to overcome usability problems.

4 Results

Results have been divided following the main methodologies used within the research.

Expert Review: the expert review found 75 usability breakdowns grouped as follows: 28 issues referred to content aspects (number of heuristics 7), 17 referred to navigation aspects (number of heuristics 12), 30 referred to graphic aspects (number of heuristics 13). The three most recurrent usability breakdowns are:

- Content: Accuracy (frequency 14/75).
- Navigation: Accessibility (frequency 6/75).
- Graphic: Font (frequency 7/75).

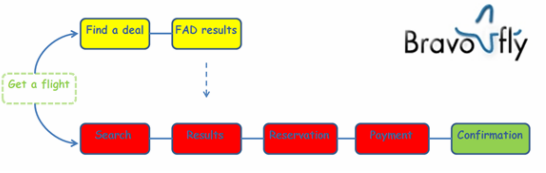

Fig. 2. Expert Review Reverse Design

This picture (Figure 2) shows the distribution of the 75 usability errors found with heuristic evaluation within the light reverse design of the website.

Sections errors frequency: Search (11), Results (19), Reservation (17), Payment (11) Confirmation (3) Find a Deal (10) Find a Deal Results(6).

User Testing: 16 users have been involved in the user testing. Demographically they were divided in to 10 males and 6 females, aged from 19 to 36 with 5 different nationalities (Italian n= 7, Swiss n=5, German n=2, British n=1 and Byelorussiann=1). These prospective users were tested against 3 scenarios (48 situations and 61 tasks) with the methodology of thinking aloud. The study found 54 usability breakdowns grouped as follows: 19 issues referred to content aspects, 21 referred to navigation aspects, 14 referred to graphic aspects. The three most recurrent usability breakdowns are:

- Content: Accuracy (frequency 11/54)
- Navigation: Accessibility (frequency 6/54)
- Graphic: Icon Consistency (frequency 4/54)

This picture (Figure 3) shows the distribution of the 54 usability errors found with user testing within the light reverse design of the website.

Sections errors frequency: Search (11), Results (12), Reservation (9), Payment (7) Confirmation (3) Find a Deal (4) Find a Deal Results (8).

Fig. 3. User Testing Reverse Design

For what concerns the time in accomplishing the tasks (figure 4) it is possible to note that the task related to luggage rules information along with the ones about bravofly special combination (i.e. flight combinations only available on bravofly website) are very demanding for the end users. This is due mainly to the accuracy of the description within the sections.

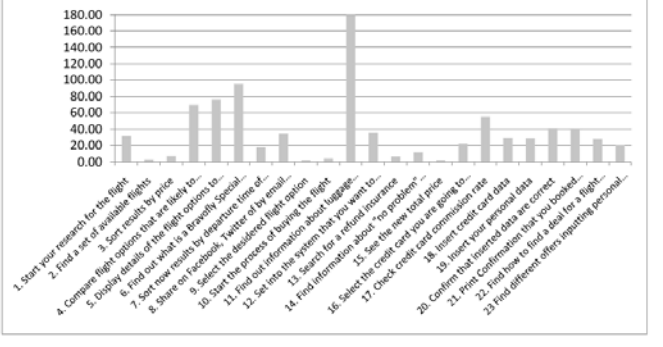

Fig. 4. User Testing task and Time

Log Files Analysis: the considered period is from December 14, 2009 - September 14, 2010. The website got 31,327,866 visits and 125,656,872 page views. Each user viewed 4.01 pages with a bounce rate of 24.34%; the average time on site was 00:05:14 per visit. Before going deeper in the log files evaluation had been necessary a process of data classification. In order to study the effective usages of the website, the research considered the measure of the website top contents as relevant. Thus, data coming from all the visits in all the sections were analyzed. Top contents (figure 5) are: flight results (45.8% of the total visits), home page (20.5% of the total visits) and passenger details (8.6% of the total visits).

Table 1. Confront usability issues and usages (NED= not enough data)

Sections	Heuristic Evaluation	User Testing	Usages
Search	11 issues	11 issues	20.5%
Results	19 issues	12 issues	45.8%
Reservation	17 issues	9 issues	NED
Payment	11 issues	7 issues	8.6%
Confirmation	3 issues	3 issues	NED
Find a Deal	10 issues	4 issues	NED
FAD Results	6 issues	8 issues	NED

Usability Risk Assessment. All the risk assessment detections have been compared and the conclusion is that crucial problems within the Bravofly's usability regard the "Results" section, followed by the "Search". This result totally reflects the log files analysis trends, and hence it is possible to assume that it is because those are the sections where the users spend at most the time in order to carefully decide if buy, or where and when to fly thanks to Bravofly.com. Combining the three analysis (table 1) it is possible to assess the risks connected with the user experience for the Bravofly website. Usability analysis highlight that form the expert point of view the threat are mostly in the results, reservation and search sections, while from users seems to have less problems within the reservation section, overcoming some of the problems highlighted in the heuristic evaluation. Finally, vulnerability as reflected by analysis of the usages is mostly in the results page and in the search/home page. Thus risks are high for these sections (i.e. results and search/home) as they are the ones in which there is an high concentration of threats (results expert evaluation), low resilience (results from user testing) and high vulnerability (results of the usages analysis).

This picture (figure 6) shows the distribution of the website visits within the light reverse design of the website.

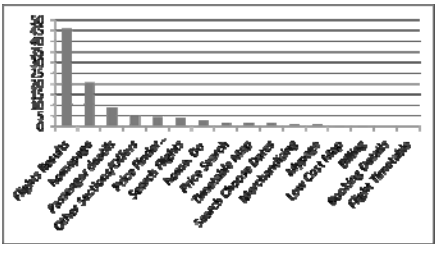

Fig. 5. Distribution of the visits to the website

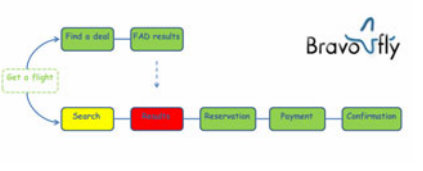

Fig. 6. Distribution of the visits to the website reverse design

5 Conclusions and Limitations

Results show how the use of the User Experience Risk Assessment Model and the systematic connection between usability and usages properly inform website redesign by well balancing business and user experience goals. Starting from this analysis, the implications for company managers are clear: it is possible to invest a fully application redesign informed by the usability analysis (both heuristic inspection and user testing), but it is also possible to concentrate efforts and resources within those sections which are the most visited. Limitations might be listed on two different areas: (i) technical: the usages analysis only considered the most visited pages due to the limitation of the tool used (i.e. Google Analytics) and (ii) structural: the model does not really considers the sales or management objectives. In order to overcome the first limitation log files raw data should be used in order to have a wide spectrum of actions to be performed on the usages (e.g. most frequent paths, advanced IP filtering etc.). In order to overcome the second limitation managers' semi structured interviews might be added to the model to better focus on sales objectives. Actually the percentage of visits of a given section could also be influenced by the promotional activities performed on the website.

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