An investigation into the application of Claims Analysis to evaluate usability of a digital library interface

Suzette Keith

Middlesex University

Bramley Road
London, N14 4YZ, U.K.
+44 20 8411 5098

S.Keith@mdx.ac.uk

Ann Blandford

UCL

26 Bedford Way

London, WC1E 6BT

U.K.
+44 20 7679 7557

A.Blandford@ucl.ac.uk

Bob Fields

Middlesex University

Bramley Road
London, N14 4YZ, U.K.
+44 20 8411 2272

B.Fields@mdx.ac.uk

Yin Leng Theng

Nanyang Technological University

31 Nanyang Link, Singapore 637718.

tyltheng@ntu.edu.sg

ABSTRACT

There is a need for tools that help developers evaluate the usability of digital library interfaces. The potential for using Claims Analysis to help developers in this way has been investigated in three linked case studies. The first explored the design rationale of an existing design with its developers. This showed that they had considered positive consequences for novice uses but that they found it difficult to identify negative effects. The second study explored the detailed design of an add-on feature. A scenario and sample claims were introduced to evaluate exploratory use within an action cycle of planning, execution and evaluation. This framework provided an effective stimulus to enable the developers to evaluate the design and explore opportunities for redesign. Finally, some novice users explored the digital library and the findings from this were used to validate a user scenario and claims.

Keywords

Claims analysis, usability evaluation, HCI

INTRODUCTION

Users find digital libraries hard to use, not just because the task of information seeking is difficult, but because the interfaces are difficult to use [1,2]. This study investigates the potential and practicalities for developers to use claims analysis to evaluate and improve the usability of a working digital library.

Claims analysis [3,6,13] is one of a number of usability inspection methods, including heuristic evaluation [14] and cognitive walkthrough [16], which examine the intrinsic features and principles of usability. Inspection methods [11] can be used to predict usability problems during the development process, often early on, while it is easier to make changes. As Gould [7,8] notes, an iterative design-test-redesign cycle is essential to effective usability engineering. Both inspection methods and empirical evaluation techniques contribute to this cycle. In parallel with the work reported here, we are investigating a range of techniques; however, in this paper, we focus only on claims analysis.

Claims analysis

A claim is a hypothesis "about the effect of the features on the user activities" [13]. Claims analysis enhances reflective design [5], identifying the positive and negative consequences that may affect usability. The developer can reason about this explicitly described trade-off between the beneficial outcomes and adverse risks, and consider what action is needed to improve the design [6].

Scenarios have a vital role in describing how and why the user interacts with the system [6]. A scenario, which is a story about the user and their activities can "focus designers on the needs and concerns of people in the real world" [3], and provides a flexible representation of the system [4]. Claims may be generated and analyzed by the developers or evaluators simply scanning or questioning a scenario for obvious effects on the user in order to identify issues and possible problems [3,6].

Carroll suggests that claims are stronger when grounded in social and behavioral science [3]. For example, Norman's [12] action cycle is used as a framework for questioning the user's stages of action when interacting with a system, including goals, planning, execution, interpretation and evaluation [6]. In addition, Carroll [3] proposes the reuse of previous scenarios and analyses, the development of theory based on past claims and the refinement of claims from usability performance data. Sutcliffe and Carroll [15] suggest that the reuse of claims within specific contexts may make HCI knowledge more accessible to software developers.

Applying claims analysis to the digital library

The design of a digital library interface is very complex, affected by the information content and the design of the search engine and the needs of the user. [9]. It is important that developers have access to information that helps them to reason about the design and usability of the interface. It is useful to be able to use scenarios to describe the context of use at different levels, including high level goals and detailed elements [4]. Additionally the introduction of new features within digital libraries such as collaborative filtering creates the opportunity for users to develop new

ways of working, as described by Carroll's task-artifact cycle [6].

The developers may sometimes have to make decisions that could adversely affect some other aspect of usability – for example, when simplification of the interface causes frustration to expert users. Carroll describes these design trade-offs, and uses claims analysis to assess the risks by reasoning about decisions, predicting likely consequences for the user and offering a flexible environment to consider alternatives. This raised the question of whether claims analysis could be specifically adapted to the needs of the developers of a digital library.

In the first of three case studies, we explored the design decisions made by a development team following a major redesign, to determine whether they had considered any positive or negative effects on users. As described below, the first study highlighted severe limitations with the relatively unstructured approach to claims taken initially; this was followed up by a second study that used a more clearly structured analysis. A third study, a user trial with novice uses provides a more solid basis for generating scenarios and claims for future use.

Description of the digital library
All case studies were conducted with a corporate digital library created approximately seven years ago. The team of three developers are all experienced librarians who had special training in development. The current version, accessed through the organizational Intranet, offered a common search interface to a number of resources including two commercial abstract and index services with a full-text download service. One feature that had been significantly redesigned was called the 'Information Spaces' which offered browsable links to 80 different topic-based collections. Users can register their interest in specific topics for the purpose of monitoring new additions.

CASE STUDY 1 - EXPLORING CLAIMS ANALYSIS
The purpose of this study was to explore the decisions made by the development team in a recent redesign of the interface and particularly to find out whether they could identify any positive or negative claims affecting the usability of the redesigned features.

Method
The three developers were interviewed individually, exploring a number of themes: the developers' knowledge and understanding of the user group, their identification of the most critical scenarios, and the design of selected features. They were asked to identify any positive claims and describe the aspects of the design with which they were most pleased, and identify any negative claims that were a cause for concern. The interviews were video recorded for later analysis

General findings
From their day to day contacts, the developers could identify a range of users including novices, intermittent users and power users of the digital library. They were pleased with progress towards the goal of increased

awareness by novices and intermittent users, as indicated by an increase in the number of registered users and level of activity within the library. However they expressed continuing concern that "people have trouble" looking for information and had poor understanding of the search support features.

The information space feature was included in one of the critical scenarios used in the pre-launch user trial. The developers "wanted people to be able to see what was there" and to give "a subject focussed area". They identified positive benefits for the users: allowing them to view the latest developments in their preferred domain, search more effectively for specific information within the specified collection, and receive notifications of relevant additions to the library. In order to improve awareness of this feature, links to named topics were included on the home page.

Another feature that was developed to improve awareness, was the 'popular journal' feature which revealed what other people were reading; this could also be accessed from the library home page. In addition the search feature had been simplified.

Claims analysis
The design of the information spaces and inclusion on the opening page brought a number of positive claims, for example:

"New users benefit from seeing what the library has to offer from the home page"

"Spaces give a subject-focused area, which gives more information about what is in the library, and gives novice users a better start".

"Showing a random, changing sample of topics would increase awareness of the topics available"

The developers indicated a number of improvements and new features to increase awareness and encourage exploration. However, it was much more difficult for them to generate negative claims, for example the last of these three claims conflicts with a general usability principle of consistency. They expressed a broader concern for the users' success when searching, suggesting a possible negative claim, for example:

"Users have difficulty searching for information, and a poor understanding of search features".

Lessons learned
The developers had considered the specific problem of exploratory first time use and were able to account for their design rationale and indicate positive goals for the redesign. However, understanding the consequences of a design decision in order to articulate positive or negative claims was much more difficult. This suggested that the developers might benefit from having a more systematic framework to assess risks of problems and threats to usability. In particular the study suggested that users' goal directed activities needed to be better supported. An important source of usability problems identified by Norman [12] are the gulfs of execution and evaluation – that is, the difficulty for users of working out what to do

next and the difficulty of understanding the resulting system state. This provides a framework for understanding goal directed activities for which Carroll offers a number of questions to stimulate the creation of claims [3,6].

A second study was planned that would investigate the effect of providing the developers with a more structured framework for scenarios and generating claims.

CASE STUDY 2 – APPLYING CLAIMS ANALYSIS
The results of the first study suggested the need for a broader description of different users with a wider range of tasks and goals. The starting point for this was richer scenarios.

According to Carroll & Rosson [6], scenarios should be 'grounded in current activities', and typically include a setting, actors, task goals, plans, evaluation, actions and events. Creating user profiles and activities is an important part of developing the scenarios of use.

To expand and enrich the scenarios, a small group of users were interviewed about their use of the digital library to gather information, and the findings were used when creating the second set of scenarios.

Introduction of a new feature to the library
The addition of a new collaborative feature provided an opportunity for further investigation. The feature enabled users to share information about useful websites and documents, making use of a profiling feature to monitor for new additions and creating a searchable database. Discussions with the developers identified two critical design problems: a form filling dialogue where users contributed details of an interesting site and nominated an interest group to notify, and a profiling page where each user indicated their preferences.

Following a briefing meeting, the researchers developed two user scenarios of one interaction to share web-site information, a description of the system, and a sample set of claims. The claims were constructed using the simple construct: "desirable consequence of feature or system *but* negative consequence". The sample claims were generated using just three of the phases of the action cycle: planning, execution and evaluation. This focussed attention on progression from exploration to goal directed use, and enabled a minimal introduction of the method to the developers [5,10].

Method
The development team was given a brief introduction to claims analysis, the sample scenarios and a sample set of claims in a project review. The system and user actions were described using a user-system scripting approach[3]. As outlined in Table 1, the user needed to enter information that would enable the system to capture a web address, and distribute it to other users and interest groups.

Table 1: description of target interaction

User action	System response
Click link to Share a link	'Share a link' page displayed
Fill in web address and optional comment	Echo text entry
Select distribution	Drop down list; default is current interest group
Press 'share' button	Capture web address, create summary, keywords and distribute to interest groups
Action unknown	

Sample scenario

Two users were described, one was experienced with the system, but a first time user of the feature, and 'Natasha', who is introduced below:

Who: Natasha, is a recent graduate and new team member.

Task: Natasha is exploring the resources of the library as she begins a literature search in support of a new project.

Activity: Natasha completes a form filling dialogue with the web address and some comments, and selects the distribution list.

Outcome: On completion, the details are immediately distributed to colleagues and profiled users by email.

Sample claims

The developers were introduced to the sample set of claims structured around the action cycle of planning, execution and evaluation:

Planning: The user shares relevant information by pasting the web address into a form filling dialogue *but* the user exploring the feature cannot proceed with this activity until they have a web address and details.

Execution: The web address dialogue box is labeled to show the user what information to enter *but* the link will fail if the address is inaccurately reconstructed from memory.

Evaluation: The action is completed quickly and automatically *but* the user has no opportunity to edit the entry or correct errors.

Results
The developers used the scenario and description to discuss the claims. They considered a number of changes to the wording and layout of the page to make it clearer and resolve ambiguities. The planning claim suggested that it would be important that the page was explicit and memorable. In considering evaluation, it was noted that there was no explicit feedback, and no opportunity for users to guess what would happen next, as the subsequent actions were automatic.

The developers considered the need for feedback and the disadvantages of an additional step, and the effect of any changes on other parts of the design. After some discussion around the whiteboard, the developers suggested a practical solution to overlay an improved page to collect the required information and which would lead the user to a preview page.

The developers had initially expressed some general concerns for the design of the page, and about how the user would know about the feature. The planning claim highlighted a significant knowledge gap whereby the user would need prior knowledge of the feature when finding a relevant website. There was a similar gap at the execution stage when the user needed to insert the web address. The scenario was extended backwards in order to consider a number of different options in which the user formed the goal to share the result of a search. This suggested the need for further exploration of the issues affecting the higher-level design requirements.

Lessons learned

By setting the page in its context of use and by providing a simple analysis framework, the developers were able to make progress in defining a problem and examining solutions. By providing a simple and more systematic framework for applying claims analysis the developers were able to explore the consequences for the user of a specific feature, propose a solution and investigate a higher level problem. This successful unpacking of a design problem suggests that claims analysis would be a useful technique for the developers.

The discussions identified some of the real world constraints faced by the developers, in particular, that the responsibility for some aspects of the user interface was divided between the technical developers of the system and the librarians who had responsibility for implementation.

CASE STUDY 3 - USER TRIAL

Following on from the success of using scenarios and a simplified analysis framework, a further study was proposed to evaluate novice and first time use of the digital library. This provided an opportunity to validate the novice user scenario and explore the claim relating to the difficulties faced by novice users.

A new scenario was devised in which Natasha, the post-graduate researcher had a poor set of results but was able to expand the search using the feature that analyzed descriptor terms. This scenario was discussed with the developers who indicated that the uncertainties and unpredictability of term frequency, size of results set and relevance made it difficult for inexperienced users to proceed. This third case study briefly reports on novice user interaction.

Method

Five students on engineering placements were asked to use the digital library to find information relevant to their current project. During the brief trial of 30 minutes the users were encouraged to think aloud as they used the library, and prompted for further explanation. Towards the end of the trial period they were encouraged to view one of the descriptor features. The interaction was video-recorded and analyzed for themes and patterns. This report only considers interactions affecting query reformulation.

Results

Even in the brief time allowed to use the digital library these first time users were able to identify some relevant material and access abstracts, downloadable full text, or

book summaries. Four of the users spent at least some of the search time looking at one of the abstract and index services, the fifth wanted a book and made it clear he did not want journal articles.

Two of the users found 'no matches' but these were due to syntax and typographic errors and were easily corrected from the on screen prompt. One user experienced a low results set and made use of the 'find similar' feature to identify documents having the same set of descriptors. He subsequently made changes to the query string, to be more generic.

Two of the users experienced very large results sets of 20,000 and 400,000 which they indicated might contain relevant material, and which they attempted to improve. One particularly wanted to know how to search within the results, and tried adding terms. Although this strategy could improve the ranking which puts those results matching all terms first, the 'OR' syntax of this search engine also causes more results to be returned. This action was not completed because it took too long, and the user remained unaware of this problem.

Another user tried adding terms to a phrase that had given a large result set, but found only one result to this exact match search. This user tried the same strategy in a second search. When he did not get the expected results he put the phrase in speech marks to indicate it was a phrase but this search engine does not accept that syntax.

Only one user found the keyword browser while searching and only looked at it briefly before closing it. This user, who was more exploratory in his strategies than the others, also looked for an Information Space but was not able to find one relevant to his project. Towards the end of the trial, he and three others who had used the abstract service were directed to link to the keyword browser and asked to identify any descriptor terms that matched what they were looking for. They were all picked out some descriptor terms, and commented that the subsequent results appeared more relevant.

Discussion

The results showed that the users had some difficulties searching but were able to find results using simple keyword or phrase search. They were able to evaluate the results of a search in terms of relevance to their project using the results and to select abstract and full text. All experienced difficulties in trying to improve the search in some way. One wanted to stay with his goal of looking for a book, and when he could not do this in the library catalogue followed links to a number of other resources. Four out of five showed that they wanted to make the results more specific either by expanding limited results or more often by limiting large sets.

These findings differed from the expected scenario for Natasha. Instead of just wanting to expand a poor set of results, several at some point wanted to select more specific results. The scenario for one user was specifically to find a book and not journal articles.

These novice users did not make use of the search support features using frequency term analysis, or change syntax. One successfully used the 'find similar' feature but then looked at the keyword browser and the Information Spaces features but without success.

Claims analysis
The earlier claim made by the developers that "users have difficulty searching for information and a poor understanding of search support features" is partially supported. The users were able to successfully find some information, but only one explored the search support features or made use of the Information Spaces.

The users showed they had a goal to refine the search but the results suggest that they lacked an understanding of features and strategies needed to achieve this goal. The 'find similar' feature was easy enough to understand. When directed to the keyword browser, they were able to select some descriptors however they would have needed more time to explore this feature and to understand its subtleties.

This user trial suggests that the developers have had some success in facilitating exploratory use, and first time use of the digital library. While there was some support for the initial scenario, there appeared to be a need for a new critical scenario to examine the provision of search support features including considering planning to use the feature, execution and evaluating the results of the action.

CONCLUSIONS
The design process for the development of this digital library is evolutionary and informal. The first study showed that the developers had focussed on design solutions that could resolve a pre-established problem regarding awareness of the resource. They expressed some concerns at the detailed level, about the effectiveness of the descriptions and prompts, but it was difficult for them to articulate negative consequences and trade-offs. Their intention and hope was that the changes made would be helpful to the users. It appeared unlikely that they would be able to identify negative consequences by simply considering cause and effect.

In the absence of experience and knowledge of principles of usability, it was difficult for the developers to distinguish the consequences for the users. Once these were grounded in simple principles developed from the action cycle, it became possible for them to explore solutions. Using only a limited part of the cycle as a framework, it was found that they were able step outside the immediate page design to consider the context of the interaction. This enabled them to reason about the wider implications for usability and alternative design opportunities.

The final case study reports on a usability trial that found partial support for a proposed scenario and claims concerned with novice use. The study revealed the need for a further critical scenario to evaluate the search support features, thus indicating the opportunity to refine and reuse the scenario and subsequent claims in future developments of the interface.

As part of an on-going program to identify and specify usability inspection methods as tools to support the design of digital libraries this study has explored the use of claims analysis with the developers and users of a corporate technical digital library. So far the results have highlighted some of the conflicts faced by the developers and difficulties of identifying usability issues. The claims analysis technique was adapted to offer a simple framework for describing the users activities and goals, framing them in a way that supports the design reasoning. A user trial helped to validate and suggest improvements to a novice user scenarios and claims. Further research will continue in order to improve the scenarios for the difficult task of information seeking and to pursue the development of reusable scenarios and reusable claims to inform the detailed design.

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