Using qualitative research methods for the improvement of collaborative information searching tools design

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Abstract: Regarding the change of information seeking to a collaborative activity, DLs as dynamic information systems, have to adopt collaboration searching tools. This study investigates the degree of collaboration in information retrieval and the extent of collaboration tools usage in DLs. The collaborative tools of a prototype digital library are assessed through a qualitative study by the aspects of usefulness, usability and usage. Results show that information search transforms to a collective form, while they prove that usefulness and usability have a significant effect on usage and on user satisfaction. The results also show that collaboration tools evolve into indispensable design parameters for modern digital libraries.

Key words: Information seeking, Collaborative Information Searching, Collaborative tools, Qualitative Evaluation

1.0 Introduction

Nowadays, due to the explosion of information, users are unable to handle the volume of knowledge provided. Therefore, information seeking process has changed dramatically and it is not further characterized as an individual activity, but as a collaborative one. Collaboration aims at the communication and exchange of ideas and it has been observed that people work efficiently in a social mode when they seek information (Karamuftuoglu, 1998; Soininen & Suikola, 2000).

During the past few years an important amount of research has been conducted around collaborative seeking, collaborative workspaces and tools. The social character of Web 2.0 reinforces collaborative activities and pushes digital libraries (DLs) to adopt new ways of information searching and retrieval. According to Fichter (2005) these tools provide the opportunity of information sharing, knowledge exchange and communication among a scientific community. Integrated spaces of collaborative work are created to offer information exchange and elaboration, through editing, commenting, tagging documents and co-

authoring papers, as well as to enhance the communication among scientific societies' members.

This paper affiliates the utilization of collaboration tools within the DLs environment and investigates the hypothesis whether such tools constitute a significant requirement for the development of new DLs. The research provides an indication of the usage degree of a set of collaboration tools, namely the common working space, the instant messaging and the annotating functionality, and focuses on exploring the user satisfaction in terms of usefulness and usability. The followed methodology is qualitative aiming to track how DL user-teams work, to mine the reasons for the acceptance of such tools and to define the main parameters for designing acceptable collaboration tools.

2.0 Background

Defining the term *"collaborative information searching"* Hansen and Jarvelin (2004) stated that collaborative information search is an activity dealing with the solution of a particular problem, which directly or indirectly includes the interaction among people through text, images or meetings. Up to now collaboration was exalted to discussions taking place in real time, but it is clearly viewed that people collaborate despite distance through editing and exchanging information.

A very important parameter that should be taken into consideration for a successful collaboration is activity awareness (Carroll et al., 2005), which has four characteristics: the common ground, which is the communication protocol among community members, the communities of practice referring to the collaboration among community users and the ideas exchanged, the social capital, which is the interaction network that is created towards fulfillment of common targets and finally the human development, which happens through collaboration and interaction among community members.

The sense of the term *"team"* has changed due to the electronic environment, and is related to the virtual context wherein a group is active. Virtual workspaces are becoming extremely popular in scientific communities, pushing Nandhakumar and Baskerville (2006) to conduct a research about trust among community members. They reached to the conclusion that trust is extremely important in the proper operation of a team, especially when collaboration is on the long-term, emphasizing the need for personal contacts.

Collaboration tools in various domains have a common division between synchronous and asynchronous. Synchronous collaboration tools are those used in real time environments, like Instant Messaging, while asynchronous are those that support self-paced interaction in different time frames, like e-mail, forum posts etc.

Instant Messaging (IM) is one of the main tools of the first category. According to Hu and Wei (2007) IM is broadly used for communication through Internet and local networks. The prime reason for using was for fun and communication among friends, but several developments, like exchanging files functionalities, communities' creation and multimedia supported chat, changed the reasons for using it.

In regard to asynchronous tools, the existence of common spaces is very important for a successful collaboration. Common information spaces are virtual places created by a team where their members can store relevant to their work documents and electronic sources, having the ability to process them (Davis et al., 2001). They serve as information tanks, which contain filtered information adjusted to the tasks of the team members and provide organization (e.g. classification) and administration (e.g. tagging) functionalities.

Annotations, the assignment of a tag on a link or a file, which characterizes or comments it, is one of the most important collaboration tools. Annotations are a new form of information allowing the users to comprehend easier information sources and have triple hypostasis (Agosti et al., 2004). Firstly, they can be used as metadata giving descriptive information about an electronic source. Moreover, due to the fact that annotations are self-sufficient content, they create new relations among the content and the metadata. Finally, annotations

are conceived as communication acts, which strengthen team's bonds. A problem mentioned by Golder and Huberman (2005) lies in semantic base, due to the differential substances in individuals or social teams, while tagging problems of polysemy and synonymity occurs. Problems like this can be resolved with the establishment of a common ground among co-workers (Mohammed & Dumville, 2001).

3.0 Experimental setting

3.1. Aims of the research

The current qualitative evaluation of collaborative information seeking tools aims to give answers to the following questions:

1. to define the degree of collaboration tools' usage,
2. to mine the aims of these tools' usage, and
3. to explore the effect of usefulness and usability on usage and satisfaction.

3.2. Tools under investigation

Daffodil is a prototype DL system, which targets at the aggregated information search in heterogeneous DLs for a particular scientific community (Fuhr et al., 2002). The system is addressed mostly to users with specific search strategies (Fuhr, Govert & Klas, 2000). Daffodil can not be described as a DL per se, but can be called a specialized DL search service providing federated search functionalities and supporting collaboration among members of a scientific team. Furthermore, Daffodil gives the opportunity of creating a personal DL where the user can store queries and results while hyperlinks to documents can be saved, tagged and processed. Collaboration is fulfilled through tools, such as the common folder, the chat service and the annotation tool (Hansen & Klas, 2007). Every team can create its own common folder to store queries, search results and links to documents although it doesn't save the full document. Apart from storing in the common folder, the members of a team can collaborate in a synchronous mode by using the chat service, which is saving time and overcoming distance barriers among the team members. Finally the users can annotate search results by choosing a given tag, making comments and viewing other users' comments.

3.3. Participants' profile

The selection criteria of the sample were their knowledge on usability and usefulness of electronic services issues and their familiarity with DLs. Due to the qualitative evaluation of Daffodil's collaboration tools the participants were very experienced on surveys and human computer interaction (HCI) issues. The research sample consisted of nine persons, seven doctoral students of the Department of Electrical and Computer Engineering, University of Patras, Greece and two postgraduate students of the Department of Computer Engineering and Informatics of University of Patras, Greece.

All doctoral students had an expertise in HCI and especially on web usability and computer supported social activities. The participants used DLs at a great extent and were very familiar with the services provided for research purposes. Their experience and their scientific background gave the certitude of results solidity in order to establish a more in depth future research.

3.4. Experimental process

After presenting the Daffodil's functionalities and applications, the participants were asked to answer a questionnaire consisted of eighteen questions and concerned the usage degree and awareness of the services, the ways and the extent of their collaboration in their daily

work activities and their level of knowledge about synchronous and asynchronous ways communication. Then they were divided in three teams of two persons and one team of tree, according to their research interests in order to achieve the highest degree of collaboration among them. Each team undertook a paper-writing task consisted of sub-tasks that aimed at the close collaboration among the team members as well as the intense use of Daffodil's collaboration tools. The tasks were designed to cover the whole work area of these tools and integrated aspects of collaborative literature search on a topic of common interest using Daffodil's search engine. Furthermore they included aspects of collaborative organization and editing of the retrieved information.

After two months, wherein the participants have familiarized with the offered tools and completed their tasks, a second questionnaire was given to them consisted of thirteen questions and targeted at measure the reaction to Daffodil's collaboration tools over usability, usefulness and use. Twelve questions addressed the usability, usefulness and usage parameters of each collaboration tool, as well as Daffodil in general. Four questions corresponded to each evaluation parameter while the thirteenth question was open to the users to make their own suggestions about adding more collaborative tools.

The next stage included interviews with the members of each team. The interviews were semi-structured; they had an average duration of fifteen minutes and were recorded by a video camera. This stage resulted to the collection of rich data that could not be gathered through the questionnaires and allowed a detailed analysis of participant's views, as they were initially given in the second questionnaire. Moreover the participants were encouraged to engage discussions on the problems they confronted and to suggest further requirements and improvements.

3.5. Data analysis tools

The data collected after the fulfillment of the tasks, the completion of the questionnaires and the interviews were analyzed using Activity Lens (http://www.hci.ece.upatras/activitylens) software (henceforth AL), which is a tool designed for ethnographic and qualitative research studies. AL offers the opportunity to the researchers to analyze data collected from different sources such as videotapes, documents, log files, etc. In this research, AL was used for the analysis of the participants' opinions as they have been recorded in the interviews videos. Subsequently, data analysis was assisted by information gathered by the questionnaires.

4.0 Results

4.1 Pre-task data analysis

Data analysis of the pre-task questionnaire highlighted the fact that participants were frequent users of DLs. Table 1 shows that the majority of them (60%) consider that DLs play a very significant role in information searching and retrieval, adding that the main reason using DLs is the accomplishment of an in-depth topic research. The reliability and quality of the search results provided by DLs is the main reason for searching information.

In addition, the participants were very familiar with synchronous and asynchronous communication channels, although their opinions are divided, as far as the importance of collaboration in information search and retrieval is concerned. The sample uses e-mails, exchanges files and information through web, chats, takes part in discussion forums, and participates in blog authoring almost daily. Although all these could be described as ways of collaboration, only the half of the participants agreed over the importance of collaboration while searching for information. The rest think that information retrieval is an individual act.

The participants appreciated the idea of using a unique platform, providing them the adequate tools for retrieving and managing information related to their work tasks, such as organization, sharing and collaborative creation of new information. They clearly stated that it

is very useful to manage information without using a number of different applications. Therefore they suggested Daffodil to be a web application.

Table 1: Participants' opinions on collaboration and collaborative searching tools

	Collaboration importance in IS	DL with collaborative searching tools perspective
None	1	1
A little	3	1
Enough	4	6
Very much	1	1

The preferred DL services, the reasons using them and the grade of collaboration among the users were also examined. According to table 2 the users that monitor a topic prefer to use mainly search services, while on the other hand those that need an in-depth research of a topic use more services. Two of the participants using the document search service are monitoring a topic, while the other three use it to make a research.

Table 2: Services and reasons for using DLs

	DLs' services.				
	Document search	Alerts	Popular articles	Chat	Journal title search
Monitoring a topic	2	0	0	0	0
Research in a topic	3	2	2	1	1
Review of a topic	0	0	0	0	3
Other	0	0	0	0	1
Total	5	2	2	1	5

The number of the used services increases following the demand for a more in-depth research in a topic. For instance, the users that want to perform a deep research over a theme use alerts, popular articles, conferences search and the communication services, besides the document search service. Three of the participants that rarely collaborate are only interested in monitoring a topic, while the other six think that collaboration is extremely important in research use DLs for reviewing a topic. Observing these results, we conclude that the reasons for using DLs set the breadth of services used and the grade of collaboration among the users. Users that tend to do an in-depth research use as much services as provided, trying to extract more accurate results, and are willing to collaborate in order to achieve it.

4.2 Post-task data analysis

During the post-task data analysis, the Daffodil's collaborative searching tools as well as Daffodil in general were evaluated in relation to usefulness, usability and usage.

Referring to the common folder, everyone acknowledged that it is a very useful functionality for team members working on a common task. This allows them to create and share a common space and to add new information items or any other files that would be interested to share with the rest team members.

However, judging its usability, they stated their inability creating their own common folders and assigning/inviting other collaborating team members. They also declared their preference to add whole information items, instead of links to them that, in combination with the annotation functionality, would help the users to label the results. Moreover they requested history-recording mechanisms that would help them to see the evolution of their common task. The platform is designed in that way so every member of the team has the

right to delete files from the common folder making collaboration according to the participants extremely difficult. They argued that there should be safety valves assuring the “democracy” within the teams and safekeeping every member’s rights in contribution.

All participants were frequent users of chat tools in their daily activities, either for work reasons, or for fun and communication with friends. They believed that such tools are very useful and they prefer them either for the accomplishment of emergent tasks or when they want to share something immediately. However seven out of nine users stated that would not use a chat tool to collaborate for work matters, reporting as reasons the loss of time typing and the distractive nature from work. Only one participant admitted that would use only the Daffodil’s chat tool - given that the usability problems would be solved - while all the others would use it in combination with other applications already used. Participants emphasized the inability to see who is online, to create a personal profile to check their status, select contacts to communicate with and blocking all the others, while one of them raised questions regarding the security, considering the vulnerability of the service.

Table 3: Usefulness and usability of the collaboration tools

Rate	Common Folder		Chat		Annotation	
	Use.	Usa.	Use.	Usa.	Use.	Usa.
None	0	0	1	9	4	0
A little	0	1	4	0	4	2
Enough	4	2	2	0	1	5
Very much	5	6	2	0	0	2

The whole population of the experiment believes that making annotations is the most important collaboration tool. Making comments, suggestions and questions helps the advancement of their research and supports collaboration. Also more than the half of the sample declared that it would use it in combination with other tools, such as e-mail. During the use of Daffodil’s annotation tool a lot of problems occurred. Six out of nine participants expressed their discontent about the extra tabs that are created every time they make an annotation, which overloads even more the platform’s interface. In addition to this, the participants complained about the lack of creator information and creation timestamp, making difficult to identify detailed metadata of an annotation. They thought that this diminishes the grade of collaboration and the personal relations among the members of a team and requested more metadata about the user and the time of annotation. Finally, two of the participants stated that they feel bounded due to the obligation to select one of the available annotation tags offered by the system and the inability to name a tag of their own. Last but not least, all the participants did not appreciate the idea of annotating links adding that it is a *“skin-deep”* approach. Instead, they suggested providing the ability to make annotations inside the text of a document making a more profound study.

The general opinion of the participants about the platform was that it cannot be easily used from inexperienced users and that a certain amount of training hours is required. They stated that the Daffodil interface is overloaded by functionalities, which are repeated and at the same time it is difficult for someone to distinguish their aim. Furthermore, according to the sample, Daffodil’s terminology is very technical, making it hard to be comprehended by inexperienced users. Participants called for stability in the operation of certain functionalities and requested the improvement of awareness mechanisms. For example they stated their preference towards the provision of information about the availability of other users who are on-line and the ability to call them into synchronous discussions with the chat tool. In conclusion, eight participants expressed their general dissatisfaction with the collaboration tools as they are applied through Daffodil. While they find the concept of an integrated suite of information searching and collaboration tools appealing, they were discouraged by the design and the overall usability.

In spite of the importance of the pre and post-tasks data analysis, it is extremely interesting to combine data so that to explore user-behaviours and see how they are related with collaboration tools. The fact that Daffodil provides communication among users with synchronous and asynchronous ways pushes seven of the participants to express their appreciation over a DL that would accommodate and enhance their communication. A DL with such features seems to promote collaborative information seeking behaviour, especially for users employing synchronous and asynchronous ways of communication.

Concerning the usage of a service, it is affected by the degree of usefulness and usability. For example, eight members of the sample who characterized annotation service useful were less satisfied with their overall interaction with the system. The participants thought that the common space and annotation services were extremely useful for the collaboration among team members. Contrariwise, the chat tool was characterized less useful, as far as collaborative information searching is concerned, mainly because it is used mainly for fun and for file exchanging, while only a small amount of the participants used it to collaborate. Although the common space and the annotation tool were described as useful collaborative tools, their problematic interface had as consequence the users' satisfaction decrease. The design also increased users' dissatisfaction with the chat tool, which was also not regarded as a useful collaborative service. They reported that their satisfaction was strongly affected -mainly- by the usability of the system; despite their acknowledgement of the useful aspects of some of the examined services and tools. This may be however a biased conclusion, as the participants of our sample had a strong HCI background and at the same time were very positive towards new tools. Concluding we assume that users' satisfaction of a service is totally affected by its usefulness and usability, which in consequence affects the usage of a service.

5.0 Conclusions

The collaboration among members of scientific teams does exist, but until now this occurs independently of integrated information services. The members of a team participate in private discussions, conferences and meetings among them. They usually exchange information through e-mails making comments on documents and arranging private meetings. While information seeking is becoming a social activity, there are not any collaborative tools integrated in information seeking systems. In specific, DLs must assert their role during this change in information seeking behaviour and maintain their dynamic and adaptive nature. DLs do not only give access to information, but also provide to individual users the opportunity to use several personalized services. However they should promote collaborative information retrieval and provide the appropriate services that would allow researchers from distant places to work together. The current study showed that users collaborate and were really satisfied from the perspective using a DL that would allow them not only gather information, but also exchange, tag, comment and discuss it with their colleagues.

The current study extracted several results that should be taken into consideration, as far as collaboration, evaluation of collaborative tools and their enhancement is concerned. Due to the expert sample it was possible to gain solid knowledge of the topic, but in order to confirm them the option of designing a new experiment should be examined. Improvements on selecting a bigger sample and including interaction issues with services of social collaboration and networking would allow to view spherically and properly collaboration in DLs.

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