Survey Study on Collaborative Writing: Concepts, Problems, Infrastructure, and Software Tools

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Abstract

Writing is a complex process, and noformula can guarantee a good document. Writing is also a form of communication; it isused for the transfer of information, ideas and concepts from one individual to another, orwithin a group. Working with a group on a project can be a pleasure: responsibilities are equitably divided, the tedium of work is punctuated by conviviality and commiseration, and large problems dissolve under scrutiny from a variety of perspectives. The increase in the spread of collaborative writing in the workplace and in the classroom as well and the dependency of writers on computer systems and technology to support their writing work, were motivated the interest in this study. This study showedthe general concept ofcollaborativewriting and the most important problemsit face, identified theirmost importantfeatures,listedsomeofspecialcollaborativewritingsoftware tools, andstudied the most important features of collaborativewritingsoftware tools aginest the generalfeatures of thecollaborativewriting.

Introduction

Although published work would seem to indicate that most writing is produced by a single author, "Most authors of documents work collaboratively from time to time; many write together with others most of the time"[1]. Writing is a complex process, and noformula can guarantee a good document. Writing is also a form of communication; it isused for the transfer of information, ideas and concepts from one individual to another, orwithin a group. In the sciences, throughout the century Fish et al. [2] notes, the amount of jointly authored articles has been increasing steadily. In some science fields, more than 65% of articles are collaboratively written [3].

Many authors work collaboratively; in fact, approximately 85% of all business and academic documents are written by several authors [4]. "Working with a group on a project can be a pleasure: responsibilities are equitably divided, the tedium of work is punctuated by conviviality and commiseration, and large problems dissolve under scrutiny from a variety of perspectives. Working with a group can also be frustrating, the seemingly indirect and digressive, as well as anxiety-ridden and inconvenient. But still, the product of group work has better odds for success than does the product of an individual" [5].

Posner and Baecker [6] are fond in their research that most of authors participant in joint projects believed that a group-generated document is superior to one generated by single author. The authors also believed that working as a team improves the final product, ideas are more refined and bad ideas are removed or reworked. Group decisions are demonstrated to be generally superior to the individual decisions for four reasons[5]:

Members of groups make the pooled knowledge greater than the sum of its chunks by their added information, perspectives, and opinions.

The presence of others with/without interaction encourages us on to think harder and more creatively than we do alone.

In the teamwork, the member with more confident, conscientious, and creative tends to succeed.

Mistakes made by the group members are to be detected by them than individual mistakes are to be detected by an individual.

According to Fish et al. [2], coordination and information sharing is one of the major problems confronting collaborators. Collaborative writing is a communication task between the co-authors as much as it is one between the authors and their audience. For joint writing and joint authors, information sharing means that all information that would have implicit

throughout an individual writing project should be explicated so that it can be communicated to co-authors.

In collaborative writing, mutual understanding of changes of text among the collaborators is essential to make their writing task successful. The more co-authors are aware of each other's changes of text, the more and better they can communicate about the writing task [7]. Kim and Eklundh noted, when the computer system the used in the joint writing has some feature that can visualize any change happened in the text and the locations as well, this feature called a change representation function, it may increase the co-authors' knowledge of the changes and the text history, which help in the negotiation about work

Cadiz et al. [8] wrote, highlighting and writing comments as we read is a natural activity. These are personal notes used as subsequent reference, and it can used when work shared among co-workers. Annotations are support communication and collaboration co-authors. Annotations in the computer-based systems can be used for a diversity of tasks. Annotations are an important factor in collaborative writing computer systems, where "collaborative writing" indicates to fine-grained exchanges among co-authors creating a document [1].

Problems with Collaborative Writing

There are several known problems regularly arise in collaborative writing. Some of these problems are:

Access control: collaborative writing groups have varying access requirements. Most often, only authorized authors are allowed to edit the document. Sometimes fine grained protection is required; for example, an author may have edit privileges over only one section in the document [9].

Version control: If two authors check out version X of the document and, after some period of time, submit edited documents back to the system, there is a chance one version could overwrite the other. Even if both versions are saved, which of the two versions would be the latest? [10].

Lack of coherence: The team leader is often burdened with the task of collating the sections that have been independently authored to produce a consistent, coherent document [11].

Variation in quality: some of the group members are better prepared to accomplish their tasks than are others [12].

Some of the group members do not carry his or her load: Each group member should make constructive contributions to the group's efforts [13].

Misunderstanding of commitments: roles that individuals play on projects Roles that individuals play on projects which define their contributions and commitments to the project are not explicit [12].

Criticism: relative status of group members can influence the ease of criticizing someone's work [1].
Time Consuming and Error Prone: Incorporating the changes by comparing different paper versions [6].
Drawbacks of Writing Tools: The use of conventional editors in a joint writing project posed problems [6]. Technology can have positive effects on the collaborative writing process, but if the technology is not appropriate for the particular collaborative situation, it can also further complicate the process [14].

Groupware

It is widely believed that work in organizations is increasingly becoming centred on collaborative work in groups [15]. Groupware will lead to improve and increase collaboration among individuals in workplaces through the creation of networks of shared spaces that facilitate common understanding and a basic for enabling people to collectively understand key concepts and issues.

Groupware is a term first coined in 1978. Groupware is technology designed to facilitate the work of groups. It refers to real computer-based systems. According to [16], Groupware is defined as "Computer-mediated collaboration that increases the productivity or functionality of person-to-person processes." Bock [17] has defined groupware as "a computer based system

that supports people in the execution of common tasks (or the achievement of a common goal) and that provides an interface to a shared environment." [18] have defined Groupware as "a computer based system that supports groups of people engaged in a common task (or goal) and that provides an interface to a shared environment."

Two taxonomies for viewing groupware, the first taxonomy is based on notions of the time and the space, the second is based on application level functionality. These time and space considerations suggest the four categories of groupware [18].
Face to face interaction at the same place and at the same time.
The asynchronous interaction at the same place but at different times.
Synchronous distributed interaction at different places but at the same time.
Asynchronous distributed interaction at different places and at different times.

Groupware can be classified according to three different criteria [19]:
Where the participants are located?
If they are working at the same time.
What functions are supported by the groupware?

Magnusson [19] puts the first two classification criteria mentioned above into a time/space matrix. The time/space matrix (Figure1) consists of two axes: the geographical dimension and the time dimension. The geographical dimension is divided into co-located participants and remote participants, when the participants are working together in the same room, they are co-located and when they are not, they are working remotely. The time dimension is divided into synchronous and asynchronous. The synchronous is when the participants are working on something at the same time and the asynchronous when they are not. Three main kinds of computer groupware systems are proposed:

Computer-mediated communication groupware systems.

Meeting and decision support groupware systems.

Shared applications and artifacts groupware systems.

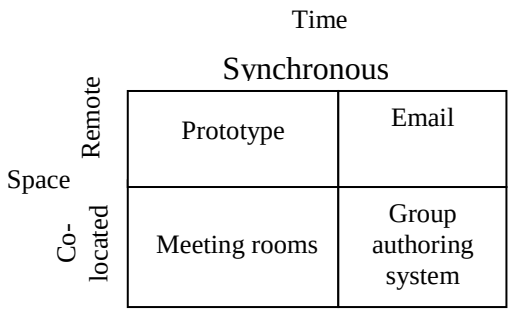

Figure 1 Time/space matrix

Tools to Support Collaborative Writing on the Web

Many systems support group work working at various levels and on different tasks by allowing members to view and modify shared information from their workstations. These systems include, task lists [20], shared documents [21], co-authored reports [22], and discussion servers [23]. Such shared information provides group context that is needed to start tasks, coordinate group activities, aid asynchronous brainstorming, maintain document records, and provide a record of group activities. There are a number of systems that have been developed over the past decade to support collaborative writing on the web. Noel and Robert [24] have divided the systems that he uncovered in his research into two global types:
Infrastructure-modifying systems.
Web-based collaborative writing applications (WCWAs)

Infrastructure-Modifying Systems

Three systems that modify the Web's infrastructure, as they differ greatly in the features they offer from the WCWAs. They are [24]:
VTML (Versioned Text Markup Language).
PIÑAS (Platform for Interaction, Naming and Storage).
WebDAV (Web-based Distributed Authoring and Versioning).

VTML was meant for storing information concerning the different versions of a document, which it did by adding its own

special markup language to HTML. PIÑAS and WebDAV are both aimed at supporting collaborative writing by adding new features to Web browsers and servers [25].

Web-based Collaborative Writing Applications

The following are some of the Web-based Collaborative Writing Applications (WCWAs):

Alliance

Alliance was originally developed for a LAN network and then modified to use the Internet. Alliance used the Web to propagate document modifications and to support group awareness. It allows group of individuals located on different web sites to produce documents in a structured way cooperatively. To the local editing functions made available on each site by a structured editor, the application provides these basic functionalities as management of documents storage and remote access to the distributed documents. For more details see [25].

AllianceWeb

Alliance has been modified and renamed AllianceWeb. It uses the Web to propagate off-line modifications, as well as to support on-line editing and group awareness. The goal of AllianceWeb project is to extend the Web environment to support cooperative authoring of documents. It provides several

features such as user identification, document and resource naming, document sharing and management, document replication and consistency, storage management. For more details see [22].

BSCW

BSCW (Basic Support for Co-operative Work) uses the Web to help group members maintain contact, manage the group and its activities, and serve as a storage area for documents. It is not aimed specifically at collaborative writing, but can be used for that purpose. For more details see[26].

COARSY

COARSY (COllaborative Asynchronous Review SYstem) uses the Web for supporting document reviewing through comments and for on-line editing. COARSY system was developed using the Java programming language which allows for the application to be executed in several platforms. The system is executed in computers that are connected to the Internet. For more details see [27].

DHS

The Domain Help System (DHS) project started in 1996. The original idea was to develop a new help system that could present information according to an iceberg model of

information. The idea of this approach was that initially only a minimum of information is presented, namely that information which an experienced user could request for, and consecutively more information is available on demand. For more details see[28].

Col•laboració

Col•laboraciò uses the Web mainly to allow group members to write and review a document through comments. Once a new project is begun, users can create a new document. The document is divided into different sections, which are displayed as links in a frame. Users can create, edit or delete sections, or even change their order. Group members can also write comments about the different sections. For more details see [28].

DReSS

DReSS (Document Repository Service Station) used the Web as a document storage area. A project would begin when a member uploaded a new document to the server. DReSS is a tool that turns a WWW server into a document repository service station, enabling authors to move documents to the WWW server, and to update documents on the server, without compromising the server's or client's security. For more details see [29].

EquiText

EquiText uses the Web to allow group members to write and edit on-line, as well as to review the document through comments. The Equitext is a tool used for production of cooperative/collaborative texts. This tool works with concept of paragraphs, to facilitate the visualization of the individual contributions, allowing the inclusion, alteration, new exclusion or paragraph proposal. For more details see [30].

Office 2000 Annotations

Microsoft Office 2000 can use the Web for document revision through comments, which are called annotations. Microsoft Office 2000 includes a feature called "web discussions," which allows team members to make annotations to any web page. For more details see [8].

REDUCE

REDUCE (REal-Time, Distributed, Unconstrained Collaborative Editing) uses the Web to allow group members to write and edit documents on-line. Users can work synchronously on the same document and see almost immediately what the others have written. REDUCE stores the shared document on each local site, which introduces the problem of controlling concurrency in order to maintain

consistency within all distributed documents. For more details see [31].

Sparrow Web

Sparrow Web is a lightweight editing technology for the web is designed to support minor editing, such as adding a new link or a new item in a to-do list. It is aimed at helping a community maintain a shared Web site. A Sparrow web page is created by a single author, who defines its initial content and scope. After the page is put onto the web, others may contribute to the page in ways the original author has defined. For more details see [32].

U-DL-A

U-DL-A Zeus and Poseidon: The Universidad de las Américas-Puebla in Mexico has been developing an initiative called University Digital Libraries for all (U-DL-A). Zeus and Poseidon both use the Web to support document revision through comments.Zeus is a web-based cooperative environment designedspecifically to support the process of reviewing,annotating and publishing a thesis in a digital library. For more details see [33].

Wiki Wiki Web

Wiki Wiki Web is a piece of server software that allows users to freely create and edit Web page content using any Web

browser. Wiki supports hyperlinks and has simple text syntax for creating new pages and cross links between internal pages on the fly. Wiki is unusual among group communication mechanisms in that it allows the organization of contributions to be edited in addition to the content itself. Like many simple concepts, "open editing" has some profound and subtle effects on Wiki usage. Allowing everyday users to create and edit any page in a Web site is exciting in that it encourages democratic use of the Web and promotes content composition by non-technical users. For more details see [23].

DocReview

DocReview uses the Web for reviewing documents through comments. Its main goal is to encourage collaboration between scientists. DocReview was created to overcome the shortcomings of programs for reviewing documents. It is designed to facilitate general-purpose reviewing of documents. It finds use in reviewing reports, memos, specifications, meeting minutes and many other types of documents. It is also used to build annotated bibliographies, specialized glossaries, and to critique essays. For more details, see [34].

Summary of Some Features Available on the WCWAs

This section presents a summary of some of the features related to some of the design suggestions available on the WCWAs [24]. These following features are:

Sharing documents (Uploading/Downloading): Creating a document for a Web-based application can be done in two ways:

It is created on the user's personal computer and then copied (uploaded) to the Web server.

It is created directly on the Web server through the browser (or a special application)

Accessing documents can also be done in two ways:

Directly within the user's browser.

Copying the document to the user's computer (downloading) and then opening it with the appropriate application.

Table 1 shows the Sharing documents Uploading/Downloading (U/D) feature on the WCWAs.

Table 1 Uploading/Downloading feature

Alliance	U/D
AllianceWeb	U/D
BSCW	U/D
COARSY	U
Col•laboració	No
DHS	U
DocReview	U
DReSS	U/D
EquiText	No
MS Office 2000	No
REDUCE	U
SparrowWeb	U
U-DL-A	U
Wiki Wiki Web	No

Comments: A commenting function in a WCWAs not only reproduces the paper-based commenting strategy, but it can also be used to support communication. Some applications do offer commenting, it may let users attach the comments either to the whole document or to sections. Summary of the comments feature shown in Table 2.

Communication: The WCWAs are almost meant to support the activities that require the least interaction between collaborative writers (writing, editing, and reviewing). When changes have occurred some applications offer a communication function in order to notify group members. The communication feature in the WCWAs is summarized in Table 3.

Table 2. Comments feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	Wiki Wiki Web
No	No	No	Document	Document	Document	Document	No	Section	Section, Document	No	No	Yes	No

Table 3. Communication feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	Wiki Wiki Web
No	No	No	No	Email	Email	Email	No	No	Email	No	No	No	No

Awareness: Dourish and Bellotti [35] define awareness as "an understanding of the activities of others, which provides a context for your own activity". Among the factors that contribute towards awareness are sharing of information, knowledge of group and individual activities. Table 4 presents the awareness feature in the WCWAs.

Co-ordinating actions (Locking): If more than one person can work on a document on-line simultaneously, then there exists a potential for conflicts. There are several ways of solving this problem:

Locking: occurs when the application limits work to only one person on part of or all of the document at any one time.

Improving awareness: is a social solution to this problem, where members can see that a document has been downloaded but can still download it.

Conflict resolution: uses software to decide which of any simultaneous changes to the document will be propagated to every version of the document.

Table 4. Awareness feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	Wiki Wiki Web
No	Yes	Yes	No	No	No	No	No	Yes	No	No	No	Yes	No

Some applications would lock down fragments while other applications locked down the whole document. "Soft lock" is used by some applications, where members can see that a document has been downloaded but can still download it. The locking feature in the WCWAs is presented in Table 5.

Table 5. Locking feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	Wiki Wiki Web
Section	No	Soft	No	No	-	-	Document	No	-	Manual resolution of conflicts	resolution of conflicts	No	No

Roles: Group members can assume different roles during a collaborative writing project, such as writer, consultant, editor, reviewer, leader/facilitator, or copy editor/typographer. Some applications support four different user roles (Access) while some other applications base its roles specifically on collaborative writing research, which lets members be either a writer, or a reviewer. The types of roles that played by users in the WCWAs is shown in Table 6.

Table 6. Roles feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	Wiki Wiki Web
Access	Access	Access	Writer Reviewer	No	No	No	Access	Access	No	No	No	No	No

Protection: a groupware application should offer some sort of protection for the work that has been done. If one member's contributions are erased, accidentally or deliberately, by another without the first person's consent, this may lead to conflict within the group. One way of protecting collaborating writers' work is by letting users save different versions of the document. This lets users have the assurance that deleted sections can always

be recuperated later on. Some applications follow this strategy. Another approach is to have the application save the work on a regular basis. Some applications back up its pages automatically, making it possible to recuperate an old version if necessary. Some other application keep track of all the changes done to the text, thus permitting users to 'undo' these changes and go back to a previous version if necessary. The different types of protection offered by the WCWAs are presented in Table 7.

Table 7. Protection feature

Alliance	AllianceWeb	BSCW	COARSY	Col•laboració	DHS	DocReview	DReSS	EquiText	MS Office 2000	REDUCE	SparrowWeb	U-DL-A	WIKI WIKI Web
No	No	Version	No	Version	No	Version	No	Version, Undo	No	No	No	No	Backup

Conclusion

The study surveyed an existing literature on collaborative writing, groupware, and tools to support collaborative writing on the web. The section of tools to support collaborative writing on the web is a study of some Web-based collaborative writing applications (WCWAs) it is important features. The survey will have a significant impact on any proposal in the future in designing of models or building collaborative writing system tools.

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