Progressional Awareness: Designing a Co-authoring Tool to Support the Planning Process

Ilaria Liccardi
University of Southampton
B32 University Road
SO17 1BJ, Southampton
il05r@ecs.soton.ac.uk

Hugh C. Davis
University of Southampton
B32 University Road
SO17 1BJ, Southampton
hcd@ecs.soton.ac.uk

Su White
University of Southampton
B32 University Road
SO17 1BJ, Southampton
saw@ecs.soton.ac.uk

ABSTRACT
Effective planning is essential to any collaborative activity. However, in practice, the co-authoring process can become derailed from an initial plan of action due to unforeseen circumstances. To be effective, the process must be capable of adapting in ways that are efficient and avoid conflict.

We analyze the experiences of users involved in fifteen separate group writing projects, specifically examining the role of planning within the collaborative process, the techniques used and the problems that may arise. From this, we propose the concept of progressional awareness related to the planning process, and propose novel user interface designs that may help to avoid common problems.

ACM Classification Keywords
H.5.3 [**Group and Organization Interfaces**]: *Asynchronous interaction*, *Computer Supported Cooperative Work, Web-based interaction*.

General Terms
Design, Human Factors.

Author Keywords
Progressional awareness, planning activity, co-authoring.

1. INTRODUCTION AND MOTIVATION
When designing a collaborative system, several aspects of collaboration must be taken into account. Users collaborate on numerous tasks, which require different levels of information [4]. When collaborating in collocated environments, users are aware of the events taking place in the world around them, but when collaboration takes place either partly or completely in an online environment, this information can be lost unless the environment attempts to reproduce it.

In both scenarios it is common for a plan of action to be formalized in which coordination between authors can be optimized. Nevertheless, schedules and work habits can be contradictory. While in collocated environments the status of other contributors can be determined by direct inquiry, this is not feasible when contributors are not all working together simultaneously at the same location. Hence detailed information about user status is hard to track in both scenarios [1].

Planning a collaborative activity does not mean that users will necessarily follow the plan, as various possible events can occur to introduce delays or otherwise derail the plan. Plans can break down due to lack of information related to progress of users' assigned planned tasks.

In this research, we aim to investigate the effects of planning on the writing process, and specifically the role of awareness on planning. Past research has examined the effects of awareness on collaborative authoring activities. Various types of awareness have been identified, such as personal, informal, group and workspace awareness [2].

2. EXPERIMENT SETTINGS AND METHODOLOGY
2.1 Study Settings
2.1.1 Set of user participants
This research gathered the experiences of fifteen groups (12 groups of six members, two groups of five members and one group of four members) engaged in collaborative writing activities. These groups consisted of 2nd year computer science students engaged in a group project in which they had to perform a programming task and collaboratively produce three documents. Each group had previously worked together in an earlier study course. Information about the experiences of each group was gathered over a period of 17 weeks.

2.1.2 Collaborative tasks
The first report was delivered in the first two weeks of the course. This consisted of a project outline (5 pages) describing the different tasks assigned to each user. This was followed by group dynamics reports (15 pages plus Appendix) and a project overview (20 pages plus Appendix), due in the last week of the semester (week 17).

2.1.3 Tool used
Different groups used different tools to write their documents. Eight groups used Microsoft Word (one group of four, one group of five and six groups of six members) one group (of six member) used MediaWiki and seven groups

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used CAWS[1] [3]. The MediaWiki users added one feature to their MediaWiki installation: the ability to identify when another user is editing a page, to avoid conflicts.

The CAWS system is an experimental system designed to provide awareness information, such as the ability to see who is currently logged in, where they are, recent activity within the document, the ability to lock sections and know who is editing them, and the ability to view what other users are writing [3].

2.2 Study Methodology

2.2.1 Semi-Structured Interviews

Seven semi-structured in-person group interviews were conducted with the participants. The interviews consisted of 15-20 minute interviews in which we inquired into the approach taken to writing. In particular, investigations focused on how the groups divided their work to produce a coherent document. This included the activities they were involved in, the responsibilities of group members and their communication mechanisms.

2.2.2 Observational Study

We observed stages of development by examining the draft versions of document though the process. We had access to the different versions produced in CAWS and in the MediaWiki installation. Microsoft Word users stored their documents in version control systems such as CVS and Dropbox. We enquired about the stages of development and who had contributed to them. Comments from group members and their opinions on the activity were collected.

2.2.3 Survey

Following the conclusion of the project, we gathered information about the experiences of users with an online questionnaire. Particular attention was given to the activities of each member. Group dynamics were examined, specifically the planning activities and how those activities reflected the original plans. Where problems occurred, the reasons were queried, in order to gather the information needed in order to avoid those problems in future.

3 FINDINGS

3.1 Effect of document structure on the planning process

From the semi-structured interviews and the observational study it was found that all groups of users produced a detailed plan of actions for the activity ahead. All groups drew up a written plan, regardless of the tool used. Planning was typically done separately, documented either online (in the case of MediaWiki) or distributed by email or version control.

There was a strong consensus that the planning of the document is linked to the process of designing an initial document structure. Typically the structure is first outlined, with authors then assigned to each section. Assigning a user to each section allows the group to know the responsibilities of each author within the writing process. This was deemed an essential stage in the process, without which collaboration would be impossible. Additionally, planning of various other tasks is intrinsically connected to the document structure. The following planning tasks were identified:

1) Roles: Users (58%) reported that each section needed different roles attached to different users. Several participants reported the need for an editor to ensure that a section was completed (37%). Others (21%) reported that a section might need an author and separate proofreader

2) Hours: Users (42%) reported the usefulness of knowing the number of hours needed to write each section so that effort could be estimated: to quote one user, *"we know that everybody is doing more or less the same amount of work"*. 21% of participants believed that a time estimate helped to indicate the depth of the detail required for a section.

3) Word requirements: 45% highlighted the importance of estimating the required word count for each section. This was judged important for two major reasons. Firstly for *'overall estimation'*; 23% of participants believed it important in order to gain an overall estimate of the completeness of the work. Secondly for *'detail estimation'*: 22% believed that a per-section word count is useful when judging the detail required for a section.

4) Deadline: 44% of participants believed the defining of deadlines for sections to be important. 23% of participants pointed out that setting the deadline for each section is needed to coordinate group efforts where one section must be completed before another can be written. Secondly, 21% of participants commented that a deadline is useful to monitor progress, as it is possible to know if sections should be reassigned if not completed.

5) Short Section Description: 30% of the users attached short descriptions to the sections when defining the initial structure. This helped to clarify the intended content and to ensure that there was no repetition in the document.

3.2 Causes behind breakdown in coordination

From the observation study and survey this research found that although defining an initial structure for the document helps to provide a framework for development to occur, it is important that a project plan can adapt as the work progresses. Several problems were identified related to this.

Participants highlighted problems when maintaining planning information in a separate document, requiring that the plan be checked in conjunction with the document in order to see who was assigned to each section.

36% of participants reported experiences where they did not believe the project plan to be up to date. For example, one user reported *"our plan was done three weeks ago, so I was not sure if [xx] was supposed to write it, so I did"*. 27% of participants reported writing sections that they believed were overdue. 17% of those participants wrote sections not assigned to them because they believed them to be related to their own work. For example three users reported that they *"knew someone else was assigned to the section but as it was related to the one that they were writing, they started writing it themselves"*. In some cases this behavior led to duplication of effort, with two participants writing the same section. 10%

[1] http://caws.ecs.soton.ac.uk

of users noted mistakes in the version of the plan they looked at, two users commenting *"my document headings were not in sync with the plan"*.

43% of users reported time spent in order to maintain an updated plan to avoid duplicated effort. Some users annotated the document headings to identify the authors assigned to those sections.

17% of users reported that as editors they were responsible for deciding when the document was complete. In this role it is necessary to read the entire document in order to check for duplication. Editors would therefore wait until the last possible minute before reading the document. 11% of participants identified the need to ask other participants when sections were deemed complete, in order to know when to begin proofreading the document.

The features of the CAWS system were found to be useful in some situations. Several participants not using the CAWS tool reported "panic" when approaching the deadline due to uncertainty over whether their colleagues would complete the sections assigned to them. One user reported *"[…] did not reply to my emails, so I did not know if he was working on it. I could not wait and I wrote it"*. These concerns were not present amongst CAWS users, as the centralized design ensures that the current status of a document is immediately accessible. In fact 52% of users agreed that people will not necessarily write a section simply because it is assigned to them.

Similarly, users reported that an inability to see each others' work until it was complete contributed to a slight delay in their plan. 44% of users reported dependencies between sections, such that they were forced to wait for someone else before writing their own contribution. Similarly 27% of these users reported agreed that the ability to see work progressing in real time would have helped. These concerns were not present amongst CAWS users.

CAWS includes features designed to assist the planning and management of the document development. These features are designed to track the authors assigned to individual sections However, these features were not used by the participants. It was identified that users did not want to use the planning features as they were not directly accessible from within the editor, only from a separate page.

4. DISCUSSION

From analyzing the responses of participants, it is clear that the process of defining a document's structure is key to the initial planning stage of the document. Not only does this provide a useful skeletal framework in which writing can begin, but the process also serves as a foundation for division of labor between the participants. The list of section headings acts as a natural list of tasks to be assigned to participants.

In order to support this process, a planning tool should therefore be centered around the document's skeleton, allowing users to plan based on assignment of sections to participants. Planning does not simply consist of assigning authors to sections, as multiple participants can be involved with the writing of a section, in different roles. Planning also includes other information, including section summary time and effort estimates, expected word count and deadlines.

For effective management, it appears crucial that planning information is attached directly to the document and not maintained separately, as this can lead to multiple issues. If the plan is maintained separately it may not be kept up to date, leading to it simply being disregarded completely. In the case of CAWS, planning features were present but ignored as they were not directly integrated into the editor.

The ability to see work progressing and to know that necessary sections have been written is also important. Without this form of awareness, participants can be tempted to disregard the work plan and duplicate work that they believe has not been written. These issues were avoided in the CAWS system, where it can immediately be seen if section has been written or is in the process of being written. Users of MediaWiki reported having written their document sections in a separate word processor, only updating the wiki page for few minutes at time. This was due to the fact that conflicts would arise if multiple authors were editing simultaneously.

For the final stages of authoring, it would be useful to provide features to assist the editor, so that the status of a particular section can be flagged and so that it is clear when the document is complete. This also has the potential to assist coordination between multiple members contributing to a section.

5. IMPLICATIONS FOR SYSTEM DESIGN

To model the effects of awareness on planning of collaborative activities, we introduce a form of awareness called 'progression awareness'. This concept is linked to the previously-identified concept of document writing and planning awareness.

Progression awareness relates to the connection between planning activities and up-to-date knowledge of the status of other users. It concerns the knowledge that users maintain of how the document is planned and how the document is progressing with relation to that plan. As has been discussed, the lack of this type of awareness can lead to problems relating to the organization of the activity, including duplicated effort, "panic" as to how the document has progressed, or to the plan itself simply being disregarded completely.

We propose that this type of awareness can be supported by presenting relevant planning information within the collaborative authoring tool used by the authors. However, it is important that this information is presented in a way that is properly integrated with the tool; as it has been found that the information will be ignored if not properly presented.

To investigate these concepts, the CAWS system used in this study is in the process of being extended to add new features designed to support progression awareness. The following is a discussion of the new features along with the reasoning behind their design.

5.1 Who is assigned to edit which section?

Planning a collaborative writing process is crucial to its success as users coordinate their efforts according to the plan. This includes explicitly dividing up a document into sections, assigning roles to users and assigning users to write specific sections of the document, and estimating time of completion.

A *"structure"* mechanism allows the group members to design an initial structure for the document (figure 1(a)), defining the sections into which the document is to be divided. Users can be assigned roles in relation to sections (for example, "writer" or "editor"). Users can estimate the time needed for the completion of the section and set a deadline, target word count, section summary (figure 1(c)). This information can be amended as the details of a section can evolve during the process (figure 1(d)). Permission must be granted for this action.

The information entered is shown within the editor in a summarized form under each heading within the document (collapsible so as not to interfere with the text). By integrating the planning information with the document, it is readily available to users while they are working.

In order to give a visual indicator for deadlines, section headings are colored; sections with a deadline within a week are shown red, while sections with a deadline within two weeks are shown yellow. Similarly, the users assigned to a section are shown along with their roles. These features provide an overview of the section status. The same information is also displayed in a summarized form in the document structure editor, providing an overview of the document plan.

5.2 Who is editing which section?

While an author is editing a particular section, that section is locked and cannot be edited by other authors, to avoid duplication and conflicts. While this is happening, the user's name is displayed next to the section heading. In this way, it is possible to see that work on necessary sections is progressing as required. It is also possible to know that the author assigned to a section is the author writing the section.

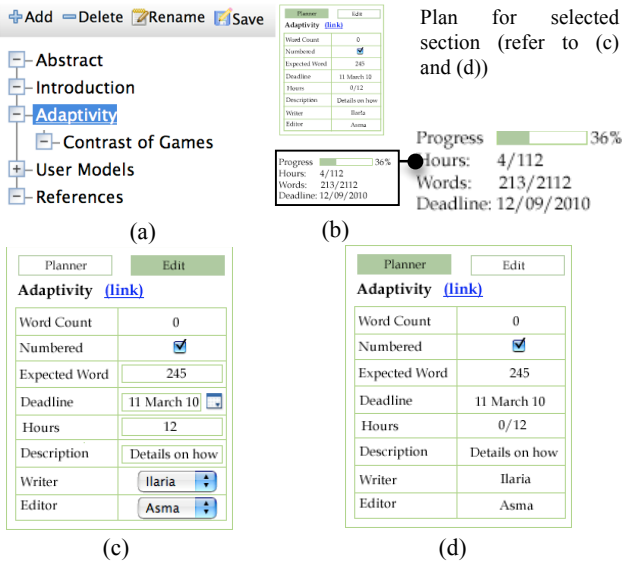

Figure 1: (a) Document structure; (b) document progress; (c) Editing plan for a section; (d) summary of the plan for a section

5.3 What are they writing?

Knowing what other members are doing is crucial to coordinating efforts. However, understanding in detail what is going on can be difficult. CAWS allows users to view in what other users are writing in real time. This is used to give a deeper understanding of other users' contributions to the document. Users being watched are informed, with a message displayed to show who is viewing.

5.4 What is complete?

It is useful for authors to be able to judge how far a document is from being completed. For this purpose, users assigned to sections can estimate the progress of that section. This information is shown next to the section heading and the section can be flagged as complete or ready for review.

6. CONCLUSION

Planning is important for any collaborative authoring activity in order to ensure proper coordination between authors. However, that plan can be rendered ineffective or inefficiently realized if authors cannot easily judge how the work has progressed according to the plan. It is important that information regarding the progression of the document is presented in a clear form so that contributors can adapt their work as necessary.

We have shown the detrimental effects that uncertainty over the progression of a document can have on its contributors. However, by augmenting the collaborative environment to present users with information regarding progression, it may be possible to avoid these problems.

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