

Running head: What do co-authors do?

**Empirical Study on Collaborative Writing:  
What do co-authors do, use, and like?**

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## **Abstract**

*How do people work when they are collaborating to write a document? What kind of tools do they use and, in particular, do they resort to groupware for this task? Forty-one people filled out a questionnaire placed on the World Wide Web. In spite of the existence of specialized collaborative writing tools, most respondents reported using individual word processors and email as their main tools for writing joint documents. Respondents noted the importance of functions such as change tracking, version control, and synchronous work for collaborative writing tools. This study also confirmed the great variability that exists between collaborative writing projects, whether it be group membership, management, writing strategy, or scheduling issues.*

## **Keywords**

CSCW: Computer Supported Collaborative Work; Computer Supported Collaborative Writing; Groupware; Collaboration; Collaborative Writing.

## **1. Introduction**

Writing is a long and complex task and many authors try to shorten the production time, lighten their workload or improve the final result by pooling resources. People can also be required to take part in joint writing

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projects because of their job (e.g., committees producing reports, scientists collaborating on a research project). Although there have been many attempts at building groupware tools to support collaborative writing (see Noël and Robert, in press), research suggests that these tools may be underused (Kim and Severinson Eklundh, 1998).

The goal of the current study was to investigate how people work together when they are writing, and in particular what tools they use to write and to communicate.

## **2. Collaborative writing**

Although the first attempts at creating collaborative writing groupware started in the early 70s (see Newman and Newman, 1992), it was only in the late 80s that researchers actually began studying the process of collaborative writing. Mackler (1987: see Beck, 1993) was among the earliest, and found that respondents thought a group's effort resulted in a better document than when they worked on their own.

Hartley and Branthwaite (1989) were interested primarily in discovering how productive writers work, although they did have a few questions about

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collaborative writing. Their participants were 88 academic psychologists who were judged to be productive writers. They found that the most productive writers rarely wrote collaboratively and rarely asked comments from colleagues. When they did write in groups, they chose longstanding friends as their collaborators and they were more likely to work in parallel, each participant working on one section, and these sections being put together at the end. Hartley and Branthwaite did not define what they meant by collaborative writing.

Couture and Rymer (1991) wanted to find out how collaborative writing is done in the workplace. They therefore surveyed 400 professionals from a wide range of occupations and organizations. The number of positive responses they got differed according to the collaborative writing activity described. Thus, only 24% of their respondents said they had written with a group, 37% said they had done the writing for a group, 76% said they had talked about the writing beforehand, 78% said they had gotten feedback after drafting and 81% said they had revised their text based on others' responses. This led Couture and Rymer to distinguish collaborative writing (where people actually write together) from interactive writing (where people solicit others' opinions about their writings), and claim that collaborative writing is not as frequent as had been claimed in the past.

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In contrast with these two studies, Ede and Lunsford (1990) found a much higher level of collaboration. They surveyed about 700 respondents from seven different professions (engineers, chemists, psychologists, city managers, linguists, professional services managers and technical writers). They used a broad definition of collaborative writing (which they called *group writing* to minimize confusion among their respondents):

For the purposes of this survey, writing includes any of the activities that lead to a completed written document. These activities include written and spoken brainstorming, outlining, note-taking, organizational planning, drafting, revising, and editing. Written products include any piece of writing, from notes, directions and forms to reports and published materials. Group writing includes any writing done in collaboration with one or more persons. (emphases theirs; Ede and Lunsford, 1990, p. 14).

Ede and Lunsford reported that approximately 87% of the documents produced had at least two authors. However, they also found that 82% of their respondents claimed they wrote alone. They believe this may have been due to participants interpreting the question as meaning the actual act of putting pen to paper. This may also explain Couture and Rymer's low

number for the question about writing with a group: perhaps their respondents thought they were referring to a group writing together synchronously.

Ede and Lunsford also found that 58% of their respondents thought that collaborative writing was productive. Among the advantages of collaborative writing, their respondents mentioned getting several viewpoints, getting different expertise, reducing error and obtaining a better, more accurate text. Among its disadvantages, their respondents mentioned integrating everyone's writing into a single style, longer time, dividing the tasks equitably, and a diffusion of responsibility.

Sharples et al. (1991) were among the first to try to describe how collaborative writing is done, with the ultimate aim of designing better Computer-Supported Cooperative Working (CSCW) systems for writing. However, rather than studying how writers collaborate, they based their speculations on previous findings from studies of single-person writing and small-group interactions. From these, they conceived two ways that groups could work together: longitudinal and parallel partitioning. In longitudinal partitioning, the work is divided into sequential stages, and each stage is allocated to a different person or sub-group. In parallel partitioning, the document is

divided into sections, and each person or sub-group works on a different section in parallel to the others. A few years later, Sharples and his colleagues (Sharples, 1993; Sharples et al., 1993) changed the name of the *longitudinal* strategy to *sequential*, and added a new strategy: reciprocal. In this last, group members would get together to work on the document, each member contributing when and what they wanted. While this attempt at categorizing writing strategies is interesting, it seems to be only partially supported by experimental studies (see below).

Rimmershaw (1992) was interested in finding out how technology was used to support collaborative writing. She interviewed 20 academics from several domains (computing, education, history, linguistics, philosophy, politics, psychology, sociology), using as broad a definition of collaborative writing as possible (“any piece of writing, published or unpublished, ascribed or anonymous, to which more than one person has contributed, whether or not they grasped a pen, tapped a keyboard, or shuffled a mouse”, Rimmershaw 1992, p. 16).

She divided her findings in three main categories: writing together, exchanging drafts, and meeting needs and circumstances. For the act of writing together, Rimmershaw found that strategies and technologies

differed greatly from one group to another. For example, in one case, a pair of writers would work in a synchronous manner when doing synthesis or working on difficult material, and they would use either a word processor or pen and paper. Another pair worked together using only pen and paper, while a third pair would share a word processor. Exchanging drafts was a more common activity than writing, and her respondents used all sorts of technologies for this purpose: post, email, fax, exchange of computer disks. Groups differed widely in how they worked. For example, one pair used email daily while another only exchanged drafts at agreed intervals. The needs and circumstances of a particular project would cause writers to adapt their work methods. For example, one respondent described how the group's members had written separately then tried to blend the pieces together; however, this approach proved to be difficult, and in their next collaboration, they wrote synchronously instead in order to avoid the same problems.

Rimmershaw also noted that her respondents could change the way they worked according to the available technologies, or they could change technologies in order to maintain their usual work practices. Thus, one writer adapted her working style according to her partners' access to a compatible word processor. Others reported using whatever tool they had at hand to do the job (paper and pencil or word processor).



Sharples' (1993) goal was to discover how a group writes together when its members do not have access to specialized CSCW tools. He therefore studied his own research group at Sussex University as they wrote an academic paper. The tools used by the group included text editors (Microsoft Word, Emacs), email, and the phone. There were also several face to face meetings which either involved the whole group or smaller subgroups. Sharples found that the group did not plan in advance how they were going to work, but that this evolved according to the group's needs.

Posner and Baecker (1993) were interested in determining the similarities between groups of collaborative writers. Their approach was to interview 10 writers from various backgrounds (science, journalism, freelance writing) concerning 22 joint writing projects. From these interviews, Posner and Baecker created a taxonomy of collaborative writing with four axes: roles, activities, document control methods, and writing strategies.

Roles concern the parts that members play in the group. Posner and Baecker identified four such roles: writer (writes the document), consultant (offers information but does not actively participate in the document creation), editor (modifies the document directly), and reviewer (suggests changes to

the document without modifying it directly). This list was later extended by Adkins et al. (1999) based on their own experiences of collaborative writing, who added the leader-facilitator (structures and controls the project), and the copy editor-typographer (polishes the final draft for publication). Adkins et al. also noted that a group member can play several roles during a project.

Activities include brainstorming, researching, planning, writing, editing, and reviewing. A project will not necessarily include all of these activities, nor is there a set order for these activities.

Document control concerns who manages the document and how, and can change during the course of a project. Posner and Baecker described four types of document control methods:

1. Centralized: one person controls the document during the whole project;
2. Relay: one person at a time controls the document but it is not always the same person;
3. Independent: each person controls the section on which he/she is working;
4. Shared: everyone has equal access to the document.

Writing strategies concern the way the members of the group cooperate together for the writing task. The chosen strategy can also change during a project. Posner and Baecker described four types of writing strategies:

1. Single writer: one person writes, the others play other roles in the group;
2. Separate writers: each person works on a different part; this is similar to Sharples et al.'s (1991) parallel partitioning;
3. Joint writing: authors work together synchronously in close collaboration on the text;
4. Scribe: based on group discussions, one individual writes the document.

Posner and Baecker found a relationship between document control method and writing strategy. For example, their respondents noted that the separate writers strategy was used with independent, relay, or shared control, but that the first method was the most effective for this strategy. When respondents noted using the single author strategy, their document control method was almost always centralized, except for two cases where access to networked computers gave rise to shared control. When respondents used the scribe strategy, the document control was centralized or relay. Finally, respondents doing joint writing used either shared, relay, or independent control, the last proving to be the least effective.

While this taxonomy is interesting, the small number of people interviewed by Posner and Baecker raises the possibility that they may have missed some characteristics and behaviors of groups writing together. In fact, this is the case, at least with roles (Adkins et al., 1999). Beck and Bellotti (1993) also question the utility of roles, which were derived from a post hoc analysis of activities rather than a deliberate choice by collaborators at the beginning of the project. This criticism can also be applied to writing strategies and document control methods, which may or may not be determined in advance and which are often modified during the course of a project.

Beck's (1993) goal was to describe how collaborative writing is done among academics. Not surprisingly, her 23 respondents felt that the main audience for their writing was the research community or their academic peers. She also found that groups tended to be small, most having two members, although a group's size could change during the project's life. Most often, the group either had a self-appointed leader, no leader at all, or someone they had agreed on beforehand. Discussions about the content and the structure of the document were mostly held during writing, while discussions about organizing the work were held before and while writing. There were few discussions about the relationships between members, and they were usually

judged as not adequate. Beck's respondents felt that the collaboration had been worthwhile.

Beck and Bellotti (1993) were interested in the real practices of academic collaborative writing groups, and presented three case studies. The first group was composed of three members, with one being at a short distance from the other two. The second group was composed of two members at a great distance from one another. The third group had two members who were co-located at first, then separated by a significant distance.

The researchers found that these groups used face-to-face meetings, personal computers and printers, phone, fax, email, and mail. They found no evidence of role allocation. Sometimes, a writing strategy was chosen, though the group did not necessarily adhere to the choice. Document control depended on the available technologies and work rhythms. None of the three groups had a leader. Changes were not always communicated, which could sometimes lead to problems. One group did make an effort at making changes visible through two techniques: (1) using italics and square brackets; and (2) describing them explicitly in a summary. Beck and Bellotti also found that group members tried to keep the others informed about competing activities; this helped members know what they could expect from the others.

Kim and Severinson Eklundh (1998) were interested mainly in how groups review documents, and also wanted to reveal common practices among collaborating writers, feeling that these would be of most help to designers who were trying to build a CSCW tool for collaborative writing.

Having interviewed 11 academics, Kim and Severinson Eklundh found that the most popular document control method is centralized, while most writing is done asynchronously. They also found that groups were small, with the majority having two or three members. None of their respondents used a CSCW collaborative writing tool. Only three tools were mentioned for the purposes of writing: Microsoft Word, FrameMaker, and LaTeX. Usually, commenting was done with pen and paper, though email could also be used. Word's commenting function (of the three software mentioned, the only one with this capacity) was not used by any of the respondents. When changes were made to a text, their respondents said that either group members did not tell each other about them or, if they did, it was in a general manner. Kim and Severinson Eklundh found three cases where their respondents said they had used the change representation function available in their word processing tool. The respondents noted that previous versions of a text were kept to be able to retrieve deleted parts later.

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As with Posner and Baecker (1993), the small number of participants limits the generality of Kim and Severinson Eklundh's findings, which is particularly problematic since their goal was to discover the similarities between collaborative writing groups.

Finally, Cohen, Cash and Muller (1999) studied collaborative writers editing documents. Their participants were part of a corporate legal group, whom they followed for three months. Cohen et al. found that the group members planned only a few steps into the future. Their participants needed to keep track of who had written what, who had seen what, and who they might need to collaborate with. When working together, participants grew frustrated while trying to find a document they needed even if it was easy to access, and had problems making sure everyone had the same version of a particular document. These problems were exacerbated when collaborators were not co-located.

In summary, collaborative writing groups are usually small and may be modified during a project's life. Group members can play several roles during a single project and do not normally decide the role they will play in advance. Planning seems to be limited in scope and subject to change

according to circumstance. For example, the group may select a particular writing strategy, but this choice can be modified at any time without causing serious problems to the group. Tools mentioned by collaborating writers include personal word processors, phone, email, fax, and mail.

There have been many attempts since the 1970s to build CSCW tools for collaborative writing, both for local networks and, more recently, for the Web (see Noël and Robert, in press), yet the research presented here suggests that these tools are not being used. While many reasons can explain this lack of popularity, we were still somewhat surprised that even the more recent studies showed an absence of groupware use, considering the recent improvements in available bandwidth as well as users' growing familiarity with networks (especially that giant network, the Internet). It must be noted, however that both Kim and Severinson Eklundh (1998) and Cohen et al. (1999) used a small sample size.

Our main goal in this study therefore was to verify whether CSCW tools were being used by collaborative writers and, if not, to discover just what technologies people prefer for collaborative writing. As a secondary goal, we also wanted to find out which tools these groups use to communicate together.



### 3. Methodology for the Empirical Study

Because we were interested in finding from as many people as possible which technologies collaborative writing groups can use, we decided to collect our data using a Web-based questionnaire.

Questionnaires present a certain number of limitations. First, using the Web to publish the questionnaire makes it nearly impossible to control cheating: people could fill out the questionnaire more than once, or they could participate even though they do not meet the criterion (having participated in at least one collaborative writing project). While it is possible to write a program that would limit a particular computer from submitting the same questionnaire more than once, this approach cannot stop cheaters who use different computers and has the unfortunate side effect of keeping users from accessing the questionnaire more than once from a public computer (e.g. students at a university library). However, we believe that the presence of open-ended questions makes it easier to spot cheating since it is simple to spot repetitive and nonsense answers in these types of questions, and, in our opinion, there were no cheaters among our respondents.

A second potential problem is that our subjects were self-selected, which may introduce bias in the answers. It may be that only people highly motivated

about collaborative writing filled out the questionnaire, and their input could potentially differ radically from that of people less interested by this activity. However, we believe this to be an advantage, rather than a hindrance. Highly motivated people would probably be more likely to use specialized tools. If it turns out that our respondents are not using groupware for writing, then it is even less likely that less-motivated subjects would be using this type of software.

Third, a questionnaire uses an “after-the-fact” approach which relies on people’s memory. Answers may be affected by recency or primacy effects, or by highly salient examples which may actually be atypical of a user’s experience.

However, we believe that the advantages offered by a Web-based questionnaire outweigh its disadvantages, at least for the purposes of our study. A questionnaire can collect data from numerous respondents both quickly and cheaply. It can cover issues that might not come up while observing a particular collaborative writing project. It is useful for obtaining respondents’ opinions. Using the Web gives potential subjects instant access to the questionnaire and reduces to a minimum the amount of work

necessary to submit answers, even compared to easily accessible email, which may increase the number of people willing to participate.

Therefore, we developed a questionnaire composed of 40 questions, which cover such issues as technology used, details about the group members and the document, schedule, communication, work plans, writing strategy, problems encountered during the project, satisfaction, advice to others and the ideal collaborative tool.

Questions are in the following format (see appendix 1):

- Binary choice (mostly yes/no): 15 questions
- Multiple choice with a single answer: 4 questions
- Multiple choice with multiple answers: 4 questions
- Statements to be ranked on a 7-point Likert scale: 5 questions
- Other ranking scheme: 1 question
- Short text answer: 9 questions
- Open-ended answer: 10 questions

In order to reach the greatest number of people, we placed two copies of the questionnaire on our laboratory's Web site, one in English and one in French. We then invited people to fill out this questionnaire if they had ever been part

of a collaborative project. Testing occurred during the month of May 2001. Participants were recruited from the Communications Research Centre (CRC), the CHI-Web mailing list, three newsgroups (comp.human-factors, comp.groupware and sci.psychology.misc) as well as part of the teaching staff at the Ecole Polytechnique de Montreal. Therefore, the following results may be more typical of scientific and academic group writing than of other domains, such as journalism or fiction writing.

## **4. Results**

### **4.1 General results**

The following results concern general aspects about collaborative writing projects (for the complete results, see Noël, 2001).

#### 4.1.1 Participants

In total, 42 people answered our request, but one person who answered only the first question was eliminated. Of those left, three filled out the French version, the rest answered in English. Not everyone answered every question, but if the number of people answering a question is not mentioned below, then it can be presumed that all 41 participants gave an answer.

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Respondents' experience in collaborative writing varies widely, ranging from 1 project to over 700! The majority of people who answered this question (29 of 39 or 74%) worked on at least 5 projects, which represents a fair level of experience (see figure 1).

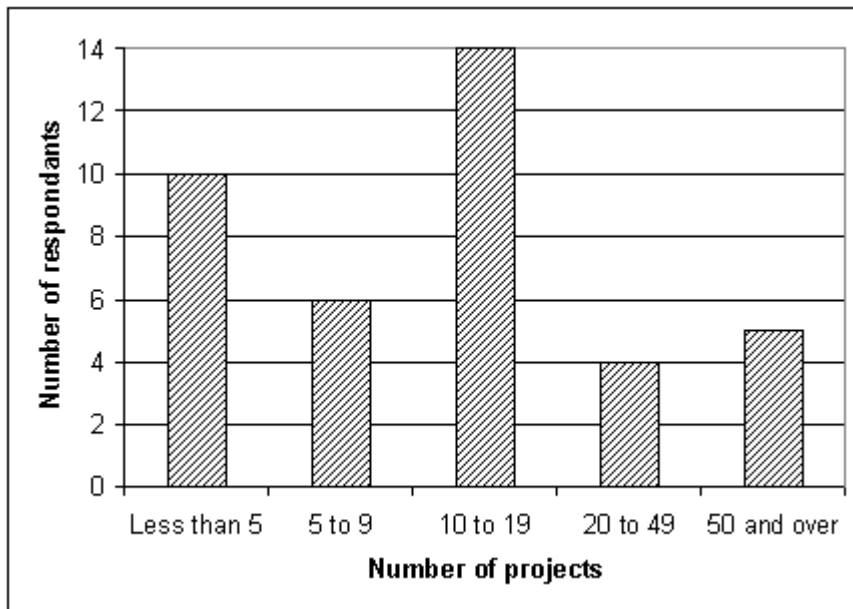


Figure 1. Distribution of subjects according to the number of collaborative writing projects they worked on in the past

#### 4.1.2 Software used for collaborative writing

We asked participants to list the software they use when writing in a group.

Participants could list more than one type of software. We were primarily interested in finding out if groupware tools are being used by collaborative writers. This is not the case. Only three participants mentioned using some type of groupware: *Collectio* (“a Web-based collaboration tool”<sup>1</sup>); *MOOs*

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(MUD<sup>2</sup> Object-Oriented); and */collab* (<http://www.du.edu/LIS/collab/>), a specialized collaborative writing tool developed at the University of Denver. */collab* is a 'common information space' where students can practice 'collaboration in chaos', testing different types of collaboration tools (Joanne Twining, private communication).

The technologies most often mentioned were personal word processors, *Microsoft Word*<sup>TM</sup> dominating (noted by 34 respondents or 83%), followed by *Corel WordPerfect*<sup>TM</sup> (6 answers), *xyWrite*<sup>TM</sup> (1 answer) and *WinEdit*<sup>TM</sup> (*LaTex*) (1 answer). Three respondents mentioned a word processor without specifying its name. Every other tool was mentioned by five people or less. Most people (35 of 41 or 85%) thought that the software they used supported collaborative writing well, which is not surprising; if it were not the case, they probably would not use that tool.

In an open-ended question, people were asked to write down the positive aspects of the software they used. Of the 40 people who answered this question, exactly half mentioned tracking changes (i.e. being able to view the changes made to the document by the different writers). The next three most frequent answers were version control (i.e. making sure everyone is working

on the same version of the document) (9 answers), adding comments (6 answers), and being able to identify the contributor (5 answers).

People were also asked to write down the negative aspects of these software. The 38 people who answered this question did not agree as much among themselves as in the previous question. The four most frequent answers were single-user access to the document at any one time (8 answers), version control (6 answers), functions offered (too many, too difficult...) (6 answers), and *Microsoft Word* in general (3 answers). Our respondents' answers suggest that users are not all equally familiar with their word processor's advanced functions. For example, one respondent wrote: "One person can use a feature that another doesn't understand and can't turn off".

#### 4.1.3 Positive and negative aspects of collaborative writing

We asked the participants to list the positive and negative aspects of collaborative writing. Participants could give more than one answer, which we then classified into categories.

In the case of the positive aspects (40 participants answered this question), the category that received the most answers was "obtaining a better product".

This includes having better ideas (15 answers), getting a better result (10 answers), having different perspectives (6 answers), a chance to learn (5), and obtaining input from experts from different domains (3). The second category was “helping with the task”, which includes brainstorming (5), good feedback (3), task division (2), improved motivation (2), shorter time to finish (2), and easier revision (2). The third most popular category was “group or social issues”, which includes social support (4) and creation of a team having a stake in the result (2).

In the case of the negative aspects (39 people answered this question), the category receiving the most answers was “making the task more difficult”. This includes having to reconcile different writing styles (8 answers), longer time to produce the document (7 answers), difficulties with following the schedule (4), unequal division of work (3), multiple editions (2), and more difficult coordination (2). The second category was “management”, including management issues (3) and managing people’s emotions (3). The third category was “group or social issues”, including more difficult communication (2), conflicts between members (2), and the difference in abilities between members (2). One person wrote: “Handling reams of successive handwritten changes is no fun, but handling emailfuls (sic) of successive electronic documents is no easier (...)”.



#### 4.1.4 Advice to others

Participants were asked what advice they would give to colleagues about to embark on a collaborative writing project. There were 39 people who answered this open-ended question, often giving more than one answer. These answers can be divided into different categories.

The category most often mentioned concerned the work method. This includes establishing and enforcing a good plan or schedule (10 answers), having good version control (4 answers), agreeing on appropriate tools (4), creating and using drafts (14), knowing the audience (2), agreeing on text modifications (2), and having several revisions (2). Next came group issues, including carefully selecting the members (5 answers), having good communication (4), and having regular face-to-face meetings (3). The third category was project management issues, which included having someone in charge, either of the project, the document, the editing, the schedule or even the style (8), and assigning and clarifying each person's responsibilities (3).

#### 4.1.5 Ideal collaborative writing tool

Participants were asked what an ideal collaborative writing tool should let its users do and 33 people answered this open-ended question. Participants could give more than one answer, which were then divided into different categories.

Synchronous access to the document was mentioned most often (5 answers), as was version control (5 answers), followed by easy communication (4), having comments that are distinct from text (3), easily seeing modifications (3), easily creating a schedule (2), being able to express one's ideas (2), adding notes (2), having a notification system (2), planning the project (2) and having face-to-face meetings (2).

There was a lot of variety in the answers. Some people wanted a tool that could cover several aspects of collaborative writing. For example, one person wrote: "Serve as a source control assistant, as a bulletin board for notes and ideas and glosses, as a calendar and deadline watcher, and as a 'traffic' person who knows where a document is at any given point and what form it is in." At the other extreme, some people thought there was no need for a specialized tool. One respondent wrote: "I've thought about this a lot and have even written some papers on the topic. In my old age, I've come to

believe that the system is not nearly as important as the people with whom one writes. I think a phone, a fax, or email are perfectly suitable for the kinds of projects that I work on with others.”.

#### **4.2. Specific results**

For the following questions, people were asked to consider a particular project before answering.

##### 4.2.1 The group

The number of people in a group varied from 2 to 80, with a mean of 5.9 and a standard deviation of 12.0. The 80 can be considered an outlier, as it is over 3 standard deviations from the mean. Taking away this outlier, the mean becomes 4.0 (s.d. = 1,9).

In 44% (18 out of 41) of the projects, group membership changed, either because a new member joined and/or an old member left. Group membership was almost exactly split between voluntary (19 or 46%) and imposed (22 or 54%). Groups had already worked together in 42% (17 out of 41) of the cases.

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#### 4.2.2 Leadership

Twenty-eight respondents (68%) noted that the project had a leader. The three most frequent ways that a group got a leader are the following: imposed by someone from the exterior (12 answers); naturally took the lead (5 answers); already group or project leader (4 answers).

Among the leader's tasks, the one most often mentioned was responsibility for the document (24 out of 28 or 86%), followed by determining the work schedule (15 answers), resolving conflicts between members (11 answers), selecting the group members (5 answers), and coordinating everything (2 answers). Other answers were mentioned only once.

#### 4.2.3 Project schedule

Projects varied greatly in length, going from 4 to 5 days up to a year. The most frequently mentioned lengths were between 2 to 4 weeks (16 answers) and between 2 to 4 months (12 answers). Time spent on the project also varied greatly between our respondents, from one hour per week up to 60 hours per week (!). The majority (30 answers or 73%) said they worked at least 10 hours per week on the project.

In most cases (38 answers or 93%), the project had a due date. A schedule was established 68% of the time (27 out of 40) in order to help members keep track of important dates.

#### 4.2.4 Communication methods

Posner and Baecker (1993) found that face-to-face meetings were an important way of maintaining contact; with the exception of one group, all the projects had at least one face-to-face meeting. However, these results are a decade old. Have bandwidth and software improvements made face-to-face meetings less important?

Among our participants, only 68% (28 respondents) noted having had a face-to-face meeting during the project, which suggests that other ways of maintaining contact may have increased in importance. Unfortunately, our questionnaire did not include a question concerning the location of group members (co-located or distant). It would have been interesting to see if location was correlated with preferred communication method.

Of the 28 participants who noted that they had had face-to-face meetings, 27 answered the question concerning how many such meetings occurred during

the project. This number varied greatly, from 2 to 160, for a mean of 19.8 (s.d. = 35.1) and a median of 5. Removing the 160, which is an outlier, the mean becomes 14.4 (s.d. = 21.6). Of course, the number of meetings possible depends on the length of the project itself. If we look then at the frequency of meetings during a project (length of project divided by the number of meetings), we find that this number varied from a meeting per day to a meeting every 60 days, for an average of a meeting every 9.6 days (s.d. = 13.5). Removing the one every 60 days, which is an outlier, the new average frequency is one meeting every 7.6 days (s.d. = 9.1), or approximately once per week.

The question concerning the amount of time spent in these meetings was answered by 26 people. These answers varied from a half hour to a maximum of 6 hours, for a mean of 1.8 hours per meeting (s.d. = 1.4). Meetings could occur almost equally at the beginning (22 answers), in the middle (21) and at the end (21) of a project.

Apart from face-to-face meetings, a collaborative group can use many types of technologies to keep in contact (e.g. email, phone, fax). Which ones do people use and how important are they? Participants were asked to indicate the frequency with which they used different methods of communication by

putting them in order (1 representing the most frequently used). If a method was never used, the person was to give it a rating of 0. Table 1 shows the mean rating, standard-deviation and number of people (out of 40 who answered) who gave a rating other than 0 to each communication method. The most popular ways to communication among our respondents were, by far, email, face-to-face meetings and the phone.

Table 1. Mean and standard-deviation of the frequency rating and number of people who reported using each communication method

<b>Communication method</b>	<b>Mean</b>	<b>S.D.</b>	<b>N</b>
Email	1.5	0.6	39
Face-to-face Meetings	1.6	0.8	28
Phone	2.6	0.8	26
Chat	2.8	0.7	8
Fax	3.5	1.0	4
Video Conference	3.0	1.4	2
Instant Messaging	1	-	1
Online Request Form	1	-	1
<i>Collectio</i>	2	-	1
<i>Versions</i>	2	-	1
Mail	3	-	1
Circulate drafts of sections of report	4	-	1
Knowledge Management System	4	-	1

When were these methods used? Participants were asked to associate one (or several) methods with different reasons for communicating. Because of the overwhelming popularity of email, meetings and the phone, it is not surprising to see that, in almost every case, these three methods were the

ones most often used. Table 2 presents, for each reason for communicating, the three most popular methods, with the percentage of times that method was mentioned and the number of people who answered. Apart from working on the text itself, email and face-to-face meetings are approximately equal in their popularity. Only when people are writing or editing the text does email come out as the primary way of communicating, with 50% of people using this method.

Table 2. The reasons for using the three most popular ways of communicating

<b>Reasons</b>	<b>N</b>	<b>First</b>	<b>Position Second</b>	<b>Third</b>
Discuss the document's content	38	Email (34%)	Meeting (32%)	Phone (25%)
Discuss the document's structure	35	Meeting (38%)	Email (35%)	Phone (19%)
Discuss the division of work	33	Meeting (40%)	Email (38%)	Phone (23%)
Write the text	31	Email (50%)	Meeting (21%)	Other (17%)
Edit the text	36	Email (50%)	Meeting (23%)	Other (14%)
Resolve conflicts	33	Meeting (37%)	Email (33%)	Phone (17%)



#### 4.2.5 Work plans

A work plan was established 85% (33 out of 40 respondents) of the time. This plan was followed in the majority of cases (24 of 33 or 73%) but it was also usually modified during the project's life (28 of 33 or 85%).

#### 4.2.6 Writing strategy

Participants were asked to select the writing strategy that their group had used during the project. The choices included parallel writing, sequential writing, single author, joint, and scribe (see section 2). Respondents could select more than one strategy and they could also describe a new strategy.

The most popular strategy among our respondents was the parallel writing one (23 answers or 56%), followed by the single author strategy (16 answers) and the sequential strategy (14). The synchronous strategies are much less popular : 8 answers for joint writing and 3 for the scribe. Of the other strategies described, only one was mentioned more than once (2 answers): the “two-author strategy”, in which two of the members write while the others play other roles.

#### 4.2.7 Reasons for participating in the project

Thirty-nine respondents gave various reasons for participating in a project. The three most popular answers were “expertise” (each member was an expert or the person answering was an expert) (8 answers), “work-related” (it was part of the person’s work or the person was the project leader) (7 answers), and “project too big” (the time or effort demanded was too great for a single person) (3 answers).

#### 4.2.8 Problems during the project

Sixteen respondents noted having technological problems during the project. The most often mentioned were a broken Internet connection (3 answers), an overly long document which made printing and email difficult (2 answers), corrupted Word documents (2) and version control (2). For example, one person wrote “Synchronization problems: when we added the fourth member, who made a large number of changes, she got an obsolete version.”

Twenty-one people reported encountering non-technological problems, but there was little overlap in these answers. Only two were mentioned by more than one person: version control (3 answers) and scheduling (2 answers).

#### 4.2.9 Word processor

Microsoft Word is the word processor most often used by our participants, mentioned by 93% (37 out of 40). It was followed by a distant Corel WordPerfect (3 answers), HTML (1) and StarOffice™ (1).

The majority of participants noted that the other members used the same word processor (34 out of 38 or 90%).

#### 4.2.10 Document

Of the types of document created by the 40 people who answered this question, the one that was most often mentioned was the technical report (6 answers), followed by the technical documentation (5 answers), scientific or technical article (4), book (4) and conference article (4). Seventeen people noted another type of document, including a Web document (4) and a series of technical reports (2). Others were only mentioned once.

The document's domain was most frequently computer science (12 out of 40), not surprising considering the type of people we recruited. This was followed by engineering (4 answers), business (3) and information and library science (2). Other answers were noted by only one person.

The document's audience was mainly the authors' peers (21 answers or 51%), followed by clients (18 answer), a superior (boss, professor...) (15 answers) and the public (9 answers). These answers are not surprising since our respondents were mostly academics.

The document's level of complexity for its intended audience was generally mid-level (28 answers or 68 %), with 10 people noting it was high and 3 that it was low. This result is not surprising as it is normal to try to produce a document that is neither too difficult nor too easy for its potential audience. Quality of the document was most often high (30 answers or 73%), with 10 respondents reporting middle and 1 mentioning it was low. Considering the types of audiences mentioned most often (peers, clients, superiors), it is not surprising that the writers wanted to produce a high-quality product.

#### 4.2.11 Satisfaction towards different aspects of the project

Participants were invited to judge their satisfaction towards different aspects of the collaborative writing project by using a scale from 1 (very satisfying) to 7 (very unsatisfying). Because this is an ordinal scale, non-parametric statistics were used on the data. Table 3 presents, for each aspect, the ratings median, mode, and range. The majority of participants were highly satisfied

with every aspect: 29 people out of 41 selected 1 or 2 for the final document, 28 for the collaboration, 28 for their participation, 23 for others' participation, and 21 for the writing process.

Table 3. Participant satisfaction towards various aspects of the collaborative writing project (1 = very satisfied ; 7 = very unsatisfied)

Aspects	Median	Mode	Range
Final Document	2	2	1-6
Collaboration Between Members	2	1	1-6
My Participation	2	1	1-6
Others' Participation	2	1	1-6
Writing Process	2	1	1-7

Is there a link between people's satisfaction with these different aspects of the writing project? To discover this, we calculated the correlations between people's answers, using Spearman's rho; these are presented in Table 4. All the correlations are significantly different from 0 ( $p < 0.0001$ ). When people are satisfied with one aspect of a collaborative writing project, they also tend to be satisfied with every other aspect.

Table 4. Correlation matrix (Spearman rho) for the satisfaction ratings

	Docu- ment	Collabora- tion	My Part	Others' Part	Writing
Document	X	0.69	0.79	0.77	0.78
Collaboration	0.69	X	0.63	0.85	0.69
My Part	0.79	0.63	X	0.71	0.71
Others' Part	0.77	0.85	0.71	X	0.73
Writing	0.78	0.69	0.71	0.73	X

## 5. Discussion

Our main goal was to find out whether collaborative writers are using specialized CSCW applications today. This is not the case, at least for our respondents; only three mentioned using a groupware tool (*Collectio*, *MOOs*, and *collab*). Writing was done mostly with personal word processors, Microsoft Word being the clear favorite among our participants.

When we asked them what they liked about their tools, people told us that their favorite function was the one that lets them follow the changes made to a document. Other popular functions were version control, adding comments, and being able to identify who wrote what. What people disliked about their tools was the absence of synchronous access to the document, the lack of version control, and the complexity of the tool.

How is it that people who reported using the same word processor (Word) could both love its version control and deplore the absence of such a function? It may be that the ones who complained owned older versions of Word, or it may be that they were unaware that the function was available. Considering the large number of functions in recent versions of popular word processors, it is not surprising to find that not everyone has the same level of familiarity with these tools.

The second main issue being explored in this research was how people communicate within collaborative writing projects. We found a lower use of face-to-face meetings than did Posner and Baecker (1993) a decade ago: 28 out of 41 of our respondents noted having such meetings, while Posner and Baecker found that these meetings were present in 21 out of the 22 projects they studied. Is this because email access has spread in that time? The fact that 95% of our respondents used email to communicate with their collaborators might support this hypothesis. However, there is no proof that email has actually replaced meetings. It may be, for example, that our respondents contained a higher number of distantly-located groups than did Posner and Baecker. Such groups would find sending email easier than organizing meetings. Unfortunately, we did not include a question concerning group location. This issue needs to be clarified with further studies.

Meetings and email were used approximately equally for discussions about different aspects of the writing project and social issues. However, when it came to working on the document itself, our participants preferred by far to communicate by email. This may be due to the fact that it is easy to distribute copies of the document (and include comments about any changes) by email.

This study also offered the opportunity of collecting other types of information about collaborative writing projects.

Results concerning the group were similar to those found in the past. Group size among our respondents tended to be small (four, on average). This is close to the numbers found by Beck (1993), Kim and Severinson Eklundh (1998) and Posner and Baecker (1993), who found that groups usually had two or three members. The percentage of groups that had a membership change was similar to that found by Beck (1993), both being around 40%.

Results concerning the leadership are somewhat similar to those found by Beck (1993). We both found similar levels of groups reporting having no leaders (around 30%). However, when a leader was present, our respondents noted most often that the leader was imposed from the exterior, while Beck found that the leader was most often self-selected.

How do people write together? We found, as did Posner and Baecker (1993) and Kim and Severinson Eklundh (1998) that the majority uses an asynchronous writing strategy. Is this because people prefer writing in isolation or is it because the tools used encourage asynchronous strategies? It



may also be that many people write when they can, and would find it difficult to coordinate a synchronous writing session with their busy colleagues. This subject needs to be explored further.

Collaborative writing is not an easy task. It can take more time than a single-writer project and it may require that the members' different writing styles be reconciled. So why would people want to participate in such a project? Many believe that the end product is better than that which could be created by a single author. We also found that several of our respondents brought a specific expertise to the project or that collaborative writing was part of their work.

How should people prepare for a collaborative writing project? Our respondents had many different suggestions. The two most frequent concerned making sure someone was in charge (either of the whole project, or of the document, or of the schedule) and establishing a good work plan. In fact, a majority of our respondents noted that a work plan was established, although that plan was modified most of the time.

We wanted to know if people had any suggestions concerning the design of an ideal collaborative writing tool. In fact, they had several. The two most

frequent ones were ensuring that the tool offers version control as well as synchronous access to the document. Synchronous access does not imply that our respondents want to write together synchronously; rather, they want to be able to access the document even when someone else is working on it.

In summary, writing with a groupware tool was the exception rather than the norm. Most people use personal word processors to write collaborative documents, and they communicate mostly by email, face-to-face meetings, and the telephone. Email is the preferred method of communication when people are working on the document. Newer communication technologies, such as chat or instant messaging, are hardly used. It seems then that people prefer using familiar tools which they can be sure their collaborating partners also use.

## **6. Conclusion**

This study examined several issues concerning collaborative writing, and in particular CSCW use. The only groupware tool that people use extensively in these types of projects is email.

In spite of the fact that many specialized collaborative writing systems have been developed over the past 30 years (see Noël and Robert, in press), they are hardly being used, as Dillon and Maynard (1995) and Rao et al. (1996) showed.

Dillon and Maynard (1995) wanted to know how people actually write, as well as the importance of collaborative writing, and had 31 participants keep a diary on the type of writing they produced for a week. They found that most writing was short and aimed at a very small audience (usually aimed at themselves or at one other person); they also found that writing was opportunistic, in that people wrote pretty much anywhere, not just at their desk, using whatever tools they found at hand. There was little collaborative writing (only 13% of the total writing acts), and the majority of it was done using paper. According to them, collaborative writing tools do not meet the needs of the majority of writers' activities.

Rao et al. (1996) studied the adoption pattern of a collaborative writing groupware during a short-term longitudinal study of students writing a term paper. The two groups they followed hardly used the groupware. Both tried it during the prewriting phase, during brainstorming, but found it confusing. Later, only one group used it during the penultimate phase of

merging/integrating people's writing, but even then, the members used it as though it were a single-user word processor. Rao et al. advance several possible explanations for this lack of use, which fall under the broader definitions of cost-benefit violations (students judged that learning the groupware was not worth the effort) or task-technology fit problems (the problems encountered during brainstorming resulted from a task-technology misfit at a local level, and the students extrapolated from that experience that the groupware was not suitable for the other activities).

Grudin (1994) also mentions how the members of a research lab, working on the usability of a collaborative writing tool, never used this tool outside the testing stage, in spite of the fact that they participated in many collaborative writing projects. While some members worked on incompatible computers, others refused to give up their favorite word processor.

CSCW systems in general have not been successful, and researchers have advanced several reasons to try to explain this. One problem is that adopting a new tool is expensive for experienced users, who must put aside all of their expertise with a familiar tool and learn a new software (Whitehead and Goland, 1999). Installing and using groupware can pose several problems (Grasso et al., 1997); the software must be correctly installed everywhere,

users need to accept this software and it must be usable by all users, no matter what their computer, operating system, and so on. Groupware also requires a minimal number of users, a critical mass, before the benefits of using the system are greater than its costs (Dix, 1997, Grudin, 1994). Beck and Bellotti (1993) suggest that many CSCW tools have been designed without taking into consideration how groups really collaborate; for example, collaborative writing tools that force people to select a role in advance exaggerate the importance of these roles, which were derived from a post hoc analysis by Posner and Baecker (1993).

Grudin (1992, 1994) advances several other explanations for CSCW's failure: (1) the person whose workload increases in order to make the groupware work is not necessarily the person who benefits from its use; (2) people have difficulty judging the real costs (in terms of time and work) of using these types of systems; (3) because of their complexity, it is difficult to learn anything from past attempts to implement these systems; (4) groupware can lead to activities that go against the group's social processes; (5) groupware does not handle exceptions well; (6) collaborative work is relatively infrequent, and so needs to be integrated unobtrusively with features that are more frequently used; (6) experience with development of single-user

applications is not applicable to groupware, leading to bad decisions; and (7) users' acceptance of groupware needs to be better managed.

Still, there have been successful groupware applications. Grudin and Palen (1995) report on the successful adoption of collaborative meeting schedulers in two large companies. Among the reasons they believe responsible for this success are an improved infrastructure (network, software, support, and behavior), an expanded application functionality, the ease of access of graphical interfaces, and widespread peer pressure from the bottom-up.

Grudin (1994) suggests that, instead of creating a collaborative writing system, designers should integrate collaboration features into existing software such as word processors. After all, most writing is done alone. And, in fact, recent versions of word processors do offer collaboration features. For example, with Word 97, it is possible to include separate comments (and show who wrote them), save different versions within the same document, and track changes, accepting or rejecting each change. WordPerfect 10 also offers collaboration functions, including comments, reviewing the text and tracking changes, comparing with another document, and emailing directly from the software.

However, there are limits to using a single-user word processor for collaboration. Sharples et al. (1993) suggest that adding collaboration features may force people to work in ways that are not natural to them or may increase efforts at using the software. Indeed, such an approach contributes to feature creep. Software such as Word 97 offers so many features, its users may never realize that certain features exist or, if they do know, they may find it difficult to find the one they need, especially if it is for an action they do not do very often.

Another problem with word processors' collaborative functions is that using these functions may have adverse effects. For example, Word's version control saves different versions of the same document in a single file, inflating the file size. This may cause problems with email, as many email systems put a cap on the size of files that can be sent or received.

Finally, groups who want to profit from these features must ensure that all members use recent, compatible versions of the same software. Yet Cohen et al. (1999) noted that collaborators from different organizations and those collaborating on an ad hoc basis rarely have identical or even compatible system infrastructures and tools. As well, although a majority of our respondents noted that their group all used the same word processor, 10%

did not. This is possible since recent versions of the major word processors can open files created with the other major word processors without losing the document's formatting. However, this is not the case with collaboration features. We did a quick, informal test of function portability by saving a document in Word, opening and saving it in WordPerfect, and then opening it again in Word. Version control did not survive the transfer to WordPerfect. Comments made it through the two-way translation, although they were no longer visible by the end.

What approach, then, should the designers of collaborative writing systems take? Is it worth the time and effort to build a new system from scratch, considering how past efforts have failed? Or is it better to integrate more collaborative features into popular word processors?

Since writing is usually a solitary task, even when a group of people are collaborating on a document, it is probably unrealistic to expect people to abandon their favorite word processor for a new tool. Therefore, even if a designer chooses to build a separate collaborative writing system, it would have to integrate seamlessly with those word processors.



Our respondents noted many key areas that can be problematic for a group writing together; among the most often mentioned were version control, reconciling writing styles, and synchronous access to the document. While a solution to synchronous access should probably be integrated into the word processor itself, version control and reconciling writing styles could be handled by external software. For example, version control could be controlled by a central server which all group members could access; this solution would require that one person be responsible for designating which version is the most recent, but then the server could “push” this version to all the group members. One potential problem with this approach is that it requires that members connect regularly with the server in order to obtain the latest version.

It may be, however, that the simplest way to support collaborative writing would be to offer a tutorial system that explains the different ways that people can collaborate, teaches how to use the collaborative features of their word processors, warns writers about some of the pitfalls and dangers of group writing, and shows them tricks in order to avoid those pitfalls.

## **Acknowledgements**

We are grateful to Thomas Whalen, Lew Stelmach and four anonymous reviewers for their comments on an earlier draft of this manuscript.

**Notes**

<sup>1</sup> We were unable to track down any information about this software.

<sup>2</sup> MUDs: Multi-User Dungeon/ Domains/Dimensions. MUDs were originally conceived as a text-based game in which people could interact. MOOs give their users the chance to create their own MUDs.

## Appendix A: Collaborative Writing Questionnaire

1. How many collaborative writing projects have you participated in (including any ongoing projects)? *If none, stop here. If 1 or more, continue.*
2. What software have you used or do you use most often to create these group-written documents?
3. a) Did the software make the collaborative writing process easier than if you hadn't used it?      *\_Yes   \_No*  
 b) What are the positive aspects of this software?  
 c) What are the negative aspects of this software?

Now think about a particular collaborative writing project - for example, the last project on which you worked - when you answer the following questions :

4. How many people, you included, worked on this collaborative writing project?
5. Was participation in this project:      *\_Voluntary   \_Imposed*
6. Had the group worked previously on another collaborative writing project?  
*\_Yes   \_No*
7. a) Did people join the group during the project?      *\_Yes   \_No*  
 b) Did members leave the group before the project's end? *\_Yes   \_No*
8. a) Was ONE person in charge of the project?      *\_Yes   \_No*  
 b) If yes, how did this person achieve this position?

"What do co-authors do?"

- Proposed him/herself*
- Chosen by the group*
- Named by someone outside the group (e.g. a boss)*
- Naturally took the leadership*
- Other - please specify: \_\_\_\_\_*

c) What were the leader's functions? (select more than one if necessary)

- Responsible for the document*
- Establish the work schedule*
- Resolve conflicts between members*
- Choose group members*
- Others - please specify \_\_\_\_\_*

9. a) How long did this project last (days, weeks, months, years)

b) How many hours did you dedicate to this project (on a weekly basis)?

c) Was there a due date for the document?       *Yes*     *No*

d) Was it necessary to establish a collaborative schedule to make sure everyone knew when they were supposed to finish their work?

*Yes*     *No*

10. a) Were there any face-to-face meetings (group or sub-group) during the project?       *Yes*     *No (If no, go to question 11)*

b) How many meetings were there?

c) How many hours were spent in these meetings (per meeting)?

d) When were these meetings? (select more than one if necessary)

"What do co-authors do?"

\_\_\_ *At the beginning of the project*

\_\_\_ *Towards the middle of the project*

\_\_\_ *At the end of the project*

11. How did you keep in contact with the other members of the group during the project?

Arrange these in order from most frequently used to least frequently used, where 1 stands for the most frequently used, 2 for the second most used, and so on. Type 0 if you never used a particular method

\_\_\_ *Email*

\_\_\_ *Face-to-face meetings*

\_\_\_ *Fax*

\_\_\_ *Online chat*

\_\_\_ *Mail*

\_\_\_ *Telephone (and/or phone conference)*

\_\_\_ *Video conference*

\_\_\_ *Other - please specify: \_\_\_\_\_*

12. Indicate your reason(s) for using the communication methods mentioned in question 11. In the box before each reason, type in the way you communicated (phone, email, etc.) with others in your group for this particular reason.

\_\_\_\_\_ *Discuss the document's content*

\_\_\_\_\_ *Discuss the document's structure*

\_\_\_\_\_ *Discuss the division of work among the group members*

\_\_\_\_\_ *Write the text*

\_\_\_\_\_ *Revise the document*

\_\_\_\_\_ *Resolve conflicts*

\_\_\_\_\_ *Other - please specify:\_\_\_\_\_*

13. a) Did the group establish a work plan at the beginning of the project?

*Yes*    *No (if no, go to question 14)*

b) Was this plan followed by the group members?  *Yes*

*No*

c) Was this plan modified during the course of the project?  *Yes*

*No*

14. There are several strategies for writing a document when working in a

group. Select all the strategies that your group used during this project :

*Each person (or subgroups) worked independently on a specific section of the document and, at the end, all these sections were joined to create the document*

*Each person (or subgroups) worked on the whole document and when that person was finished, she gave the document to the next person who worked on the whole document, and so on.*

*One person only wrote the document, everyone else had other roles (editor, reviewer...)*

*The group got together and everyone worked on the document at the same time.*

*The group got together, one person was chosen and that person wrote down everyone's ideas.*

*Other - please specify: \_\_\_\_\_*

15. What are your reasons for participating in this collaborative writing project?

16. a) Did you have any technological problems during the project?

*Yes*    *No (if no, go to question 17)*

b) Please describe these problems briefly

17. a) Did you have any non-technological problems during the project?

*Yes*    *No (if no, go to question 18)*

b) Please describe these problems briefly

18. a) What word processor did you use on this project?

b) Did the others use the same word processor?    *Yes*    *No*

19. What type of document was it?

*Book*

*Book chapter*

*Conference paper*

*Homework*

*Newspaper article*

*Technical documentation*

*Technical or scientific journal article*

*Technical report*



*Other - please specify:* \_\_\_\_\_

20. Who was the audience for the document? (check as many as necessary)

*Our peers*

*Manager, supervisor, teacher...*

*Client*

*General public*

*Other - please specify:* \_\_\_\_\_

21. What is the complexity level of the document's subject (for its intended audience)?      *Low*    *Medium*    *High*

22. What is the quality level required for the document?

*Low*    *Medium*    *High*

23. To which domain was the document associated (e.g. psychology, computer science, engineering, medicine, economy, literature, management, sociology, music, painting...)

24. Indicate your satisfaction level for each of the following elements, where 1 means you were very satisfied and 7 means you were completely unsatisfied :

*The final document :*

(very satisfied)  1  2  3  4  5  6  7 (completely unsatisfied)

*The collaboration between the group members :*

(very satisfied)  1  2  3  4  5  6  7 (completely unsatisfied)

*My participation in the project :*

*(very satisfied) \_\_ 1 \_\_ 2 \_\_ 3 \_\_ 4 \_\_ 5 \_\_ 6 \_\_ 7 (completely unsatisfied)*

*Others' participation in the project :*

*(very satisfied) \_\_ 1 \_\_ 2 \_\_ 3 \_\_ 4 \_\_ 5 \_\_ 6 \_\_ 7 (completely unsatisfied)*

*The writing process itself :*

*(very satisfied) \_\_ 1 \_\_ 2 \_\_ 3 \_\_ 4 \_\_ 5 \_\_ 6 \_\_ 7 (completely unsatisfied)*

25. Based on your experience, what are the positive aspects of group writing?
26. Based on your experience, what are the negative aspects of group writing?
27. What advice would you give colleagues who are about to embark on a collaborative writing project so that they have the best possible results?
28. What should an ideal collaborative writing system let people do?

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