Evaluation of Existing Group Awareness Mechanisms in a Real-time Distributed Collaborative Writing System

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Summary

Group awareness reflects the awareness of other people and their actions in a group while working collaboratively. Various facts (for example, where others are located) or issues (for example, what others are intending to work on a document) are known from this awareness.

Group awareness is very important for successful collaborative writing. Our research thereby evaluates some existing awareness mechanisms regarding their effectiveness in achieving group awareness. Accordingly, we formulate the research question of whether the existing awareness mechanisms are effective enough to obtain group awareness and what are the problems of these current awareness mechanisms. We evaluate these awareness mechanisms by conducting usability experiments using the CoWord collaborative document writing system.

Since CoWord is chosen as it leverages from Microsoft® Word, this research evaluates the awareness mechanisms already implemented in CoWord. These mechanisms include Radar View, Telepointers, Collaborative Highlighting and Collaborative Change Tracking.

We have conducted five experiments. This paper presents the details of these experiments and result gathered from these experiments. The results are about the effectiveness and user preference of the awareness mechanisms.

Key words:
Group awareness, awareness mechanism, collaborative document writing.

1. Introduction

Writing documents collaboratively is essential in many areas of document preparation (for example, where information from different sources are combined together in a document). These rapidly increasing areas of multi-user application seek well developed system to complete their writing task effectively and efficiently in a group. These applications can collectively be referred to as Real-time, Distributed Collaborative Writing Systems (RDCWS).

RDCWS allow users to author a document like other word processing systems. In addition, RDCWS allow users to work in a group, to be in dispersed locations and to work at the same time on the same document. That means, users located anywhere in the world can view, create and modify shared documents simultaneously. These documents include textual, graphical or multimedia contents. RDCWS are very helpful tools for groups who need to write collaboratively. Regardless of the type of writing document or the kind of author, the successful implementation of RDCWS always needs effective group awareness.

Group Awareness is defined as "an understanding of the activities of others, which provides a context for your own activity" by Dourish and Belloti (1992). In other words, group awareness means obtaining information about others' identities, locations in the shared workspace, their past and current actions and future intentions. Group awareness can be maintained by answering the questions such as who is in the workspace, where are they working in a shared workspace, what they have done, what they are doing and what they are going to do. Here, workspace refers to the virtual locality of the user in the document or the software where they are working.

The term, *awareness mechanism,* refers to software devices of the system that help the users to achieve group awareness. These mechanisms can be mounted inside the word processing software or can be outsourced and inserted into the system. In our case, the mechanisms are components of the software system which means they are implemented in the word processing system.

In direct interaction where people are working facing each other, it is straightforward to experience group awareness. People know who is present, what others' responsibilities are and what others are doing just by

being in the same place (for example, a board meeting). On the other hand, to achieve the same group awareness is much more difficult in the case where people are geographically dispersed.

Basic human interaction requires knowledge about tasks carried out by other members in a group. This requirement implies that supporting synchronous distributed collaborative writing requires RDCWS to provide group awareness (Tran, Raikundalia and Yang 2003). This is why providing awareness mechanisms is essential for a system that is used collaboratively.

To achieve group awareness in RDCWS, various awareness mechanisms have been developed and used in many RDCWS applications. Nevertheless, after a significant production of RDCWS, only a small number amongst them are widely used in real world. The reason for this low usage is the lack of usability and inability in meeting the desired user experience goals in terms of group awareness. In other words, the diversity and richness of group interaction is not coordinated with the existing RDCWS (Tran, Raikundalia and Yang 2003).

Therefore, group awareness is critical and indispensable for implementation in collaborative authoring systems. However, despite this necessity, a small number of mechanisms have been developed to acquire this facility. On top of that, these mechanisms have hardly been evaluated in real-life scenarios. Hence, this project is carried out to evaluate awareness mechanisms and this task is done by performing an experimental study with collaborative documents.

Therefore, there are two aims of this project, namely a primary aim and a secondary aim. The primary aim is to evaluate the effectiveness of available awareness mechanisms when a group of authors write a document collaboratively and simultaneously. The secondary aim is to study the usability issues (for example, whether a user can remember a specific awareness mechanism) for group awareness while writing the document.

We have chosen CoWord (Xia, Sun, Sun, Chen and Shen 2004) as an example of RDCWS to do our research experiment. Therefore, this research on collaborative writing focuses on the existing awareness mechanisms of CoWord. CoWord is a word processor based on Microsoft® Word where the principal difference is that CoWord supports multiple dispersed users working on the same document at the same time.

The rest of the paper is organized as follows. In Section 2, we shall briefly discuss the related work relevant to this research. Section 3 covers the methodology of the research and the design of the experiment, while section 4 briefly addresses the details of the actual experiments. In section 5, we discuss the analysis of the data gathered and address the result of the analysis. We conclude with section 6, briefly stating the future work found from these experiments in the area of evaluating group awareness mechanisms in RDCWS.

2. Related Work

This section contains related work in the key aspects of this research. These aspects include collaborative document writing and in particular, awareness mechanisms.

2.1 Collaborative Document Writing

Research works on collaborative document writing ranges from the technique and styles of writing collaboratively to the groups of collaborative writing. Some of the relevant findings from these research works are stated here.

Suchman and Trigg (1986) have revealed from their laboratory study that various way of organizing collaborative document writing exist depending on the agreement of the participants. They also addressed some document types that need collaboration and revealed some approaches to writing these documents collaboratively. These approaches are a combination of discussion, draft-passing and simultaneous work at a single keyboard.

Baecker, Nastos, Posner and Mawby (1993) reports on a study of how people write together, and explains their taxonomy of collaborative writing. They categorised collaborative document writing processes into four different components in order to define the taxonomy of collaborative writing. These categories are roles, activities, document control methods and writing strategies. Their research also reveals several key issues that affect collaborative writing. These issues are relative status of group members, individual working styles, writing technology and individual differences in group behavior.

Collaborative writing groups differ in their writing approach. These groups can be defined following notions such as, differences in culture, societies, different age groups, different professions, etc. Neuwirth, Kaufer, Chandhok and Morris (1994) described that different groups have different demands for their collaborative

writing project. They also discussed the dimensions along which collaborative writing groups vary. In another study, Ede and Lunsford (1990) established the relationship between social interaction and writing groups that different groups demonstrate different patterns of social interaction while writing collaboratively.

2.2 Awareness Mechanisms

Because of the importance of group awareness, providing awareness mechanisms is essential for a system that is used collaboratively. Various awareness mechanisms have been used to provide group awareness in real-time collaborative authoring systems. Some examples of these mechanisms include telepointers, radar views and multi-user scrollbars. There is a moderate number of awareness mechanisms present in the development of RDCWS over the last several decades. The different awareness mechanisms found in previous research are explained below.

Telepointers are an example of awareness mechanism that had been developed in the early stage of awareness mechanism development. Multiple cursors of users can be shown within the document using telepointers (Greenberg, Gutwin and Roseman 1996). If many users work in parallel on the same section of a document, this awareness mechanism shows multiple cursors in that section of that document. Users need to work in the same portion of the same document at the same time to get a view of telepointer. Therefore, when two people work on different parts of a document, they would not be able to view telepointers. Consequently, if any of the users does not view the same location of the document as other users, it is very difficult to gauge the location at which a remote user is working and how active is that user.

To display the portions of a document where all users are working, the *radar view* shows the overall view of the entire document. Gutwin, Roseman and Greenberg (1996) have proved in their work that radar views are useful in maintaining group awareness. Limited scalability is the main problem with miniaturization, the technique used behind radar views.

Using scrolling as a basis, the awareness mechanism called *multi-user scrollbars* supports group awareness in collaborative authoring. Different parts of a document of different users can be displayed by scrolling the multi-user scrollbars. In the literature there are two different alterations of multi-user scrollbars. In one implementation by Baecker, Nastos, Posner and Mawby (1993), the vertical region of every remote scrollbar is different. The other implementation by Gutwin, Roseman and Greenberg (1996) locates the vertical regions of all remote scrollbars in the same region.

To display both working and viewing areas of other members in collaborative writing, the *split window view* has been developed (Tran, Raikundalia and Yang 2002). If a user works on a particular part of a document and looks at somewhere else at the same document, then the user's working and viewing areas will be different. In this way, this mechanism allows a user to see both of working and viewing areas of all other users.

Another new awareness mechanism is *Modification Director* (Tran, Raikundalia and Yang 2002). In the document, this mechanism shows the changes made by other users and records the modifications. When someone's work is modified by other remote users, the information about the modifications brings important feedback regarding group awareness. The information includes conveying who the other users are and how they are altering the document.

On the basis of task allocation, the *dynamic task list* provides a unique form of awareness (Tran, Raikundalia and Yang 2001). A frequently updated list of group members' tasks allows the users to comment on other users' tasks by this mechanism. In addition, the author responsible for a task is informed of which other users are viewing their part of the document.

3. Experimental Methodology

3.1 Attributes

Variables

In this experiment, the independent variables are the use of different awareness mechanisms because this experiment aims at evaluating the change of using awareness mechanisms. The dependent variable for this experiment is the amount of group awareness achievement because the group awareness is the result of using awareness mechanisms.

Hypothesis

In this experimental study, one hypothesis is formed and tested to determine the result of one of the research questions. Considering the scope of this evaluation, the scientific hypothesis is formulated. The hypothesis deals with the choice of existing awareness mechanisms. This hypothesis allows us to find out the most effective awareness mechanism among the existing ones. Thus, the null hypothesis for this scientific hypothesis is that there

is no existing awareness mechanism that is better than any other existing awareness mechanisms.

Qualitative and quantitative data
This research seeks both qualitative and quantitative data from the open-ended and close-ended questions of the questionnaire and interview.

Statistical measures
We have done statistical measures with the quantitative data collected from the close-ended questions and for these measurement purpose, we only have discrete variables in this experiment.

To measure the trend of the discrete variables in this research, we have followed several tests. First of all, we have determined the relationship among the usage of awareness mechanisms and corresponding achievement of group awareness by measuring the percentage of response of the participants. These responses reflect whether the participants agree or disagree with statements about awareness mechanisms.

Secondly, a Chi-square test is conducted with the help of the measurement of preferences by the participants that represent the choice of awareness mechanism. In a Chi-square test, the differences between the observed count and the expected count are squared and the scaled versions of the squares are added together. The result of this calculation gives the Chi-square test statistic (Wild and Seber 2000). This test would help us to test the hypothesis that expresses the choice of a specific awareness mechanism.

Control
In our experiment, we have several controls. This research experiment has several extraneous variables and these variables can affect the observation of our dependant variable in many ways. Some of the notable controls of the experiments are controlled communication among the participants, exclusion of other mechanisms of RDCWS from awareness mechanisms, maximum collaboration, choice of document type, proper training and minimum distraction.

3.2 Experimental Design
Building the questionnaire
The questionnaire asks questions in several categories. Initially, to get some ethnological information, few questions are asked. After that, all the questions ask about awareness mechanisms and group awareness. These questions and answers are used to extract the percentage of participants' responses about respective awareness

mechanisms. Some general questions are asked about the overall experience of the awareness mechanisms. A last question directly asks the participants about their preference of a particular awareness mechanism. This question is used to do the Chi-square test analysis. In addition to all these close-ended questions, the open-ended questions of the interview are also included with the questionnaire to make the participant comfortable about the interview. The purpose of mentioning these questions in the questionnaire is to give time to the participant to think about those questions.

Matching the document type with the design
We have asked the participants to choose the document type that they used to work on collaboratively. Then we have asked to put some constraints (for example, maximum collaboration). This is to ensure the use of awareness mechanisms of CoWord to achieve group awareness while authoring their document.

Designing the time-frame
Because, our experiments allow different participant groups to have different kinds of documents, they are likely to need different amount of time to complete. However, in order to gather our intended data, we do not need the participants to complete a whole document in every instance. Therefore, we have set a fixed time-frame of 1 hour to 3 hours. The participants were free to take as much or as little break as they want.

Training
At the beginning of the experiment, a brief training was provided about the structure of the experiment, the use of the software and the methods to follow while writing the documents. The participants were allowed to divide their document into several parts to ease and organize their writing process. This division of document depends on the requirement of the participants. The division of the document was discussed during the training session according to the document type suggested by the organization or the participants. In addition, participants were briefed about CoWord and informed about the existing awareness mechanisms and encouraged to use all of them. They were shown the difference among general tools and awareness mechanisms of CoWord. We had suggested the amount and type of communication that they may use to communicate with other users. The training period would take roughly around half an hour.

Experiment
At this core part of the experiment, the writing tasks were performed. The writing needed to be performed with some instructions and within few constraints; such as with

and/or without online chatting. However, the main action was same for every experiment and that was writing document simultaneously. A writing task (part of a document) was estimated to last for around half an hour and the whole writing of the experiment was summarized within one and half hours to two hours.

Data collection

At the end of the whole experiment, the participants were requested to fill in a questionnaire with several open-ended and close-ended questions. This task was followed by a group interview. The time estimation for the questionnaire and the interview was one hour.

4. Experiments

We have done five experiments in total. The details of the experiment are stated in Table 1. The Table shows the experiment number, number of participants in the experiment, document type used in the experiment, whether the experiment is field or lab study and whether any communication tools are used in the respective experiment.

Table 1: Summary of experiments

Exp. No.	No. of Participants	Document Types	Time (hours)	Field/ Lab Study	Used Communication Tools
1	2	Essay	3	Lab	Yes
2	3	Phone card user manual	4	Field	No
3	2	Log file	2	Lab	Yes
4	3	Bank loan account record	3.5	Lab	No
5	2	Lab report	3	Lab	No

5. Results

5.1 Data Analysis

Qualitative Data

We have asked 10 open-ended questions. From the answers of these questions, we have gathered the qualitative data. Analysis of these data reveals several usability issues that affect group awareness achievement. Some open-ended questions of the questionnaire can be explained at this point (see Appendix):

- Question 1 compared the time consumption of a task in writing a document collaboratively. From the answer of this question, we can reveal the necessity of awareness mechanisms in a particular task and whether the existing awareness mechanisms help the users to do that task.

- Question 2 sought the problems that the participants have experienced regarding group awareness in collaborative writing. The answer of this question helps us to reveal the group awareness requirement for collaborative writing which may not met at this moment.

- Question 5 determined the technique that the participants have followed to combine their idea to write collaboratively (for example, when several participants are writing a specific part together at the same location of document).

Quantitative Data

There are twenty close-ended questions in the questionnaire that gives us quantitative data. For data analysis purpose, we have divided these questions into three categories which are awareness mechanism agreement questions, awareness mechanism preference question and ethnological questions. Some close-ended questions of the questionnaire can be explained at this point (see Appendix):

- Question 5 and 6 sought the answers of whether radar view is successful in showing where remote authors are looking and working at the document respectively. The answer of these questions reveals the success of radar view.

- Question 9 evaluated the memorability of radar view.

- Question 16 sought the information about the response of using telepointers whether the multiple cursors distract them while working collaboratively. This question reveals whether there is any difficulty using telepointer.

- Question 20 compared the existing awareness mechanisms in CoWord. This question asks which awareness mechanisms is preferred by the participants among radar view, telepointers, collaborative text inputs highlighting, and collaborative change tracking.

5.2 Results

We gathered the result by summarising and synthesizing the responses of the participants to the questions of the questionnaire. The result of this research experiment can be described from two different perspectives that match the research questions. One of these questions is whether the existing awareness mechanisms are effective enough to obtain group awareness. This question also includes finding out the problems in the awareness mechanisms if the result shows the failure of these mechanisms in achieving group awareness. The other question asks the usability issues in these awareness mechanisms that help to achieve group awareness. In addition, we have researched to relate the achievement of group awareness by awareness mechanisms with specific document type.

The answer of the first research question revealed some usability issues that hinder the awareness mechanisms from achieving group awareness. This answer in turns extracts the answer of the second question of usability issues.

Furthermore, we have related specific document type with awareness mechanisms and group awareness. In our experiment, we have evaluated five different kinds of document. We have included the document type to see firstly whether the existing awareness mechanisms are successful in these specific document types and secondly whether any of the document type needs any specific type of awareness mechanism. Accordingly, we have found some usability issues specific to a particular document type. For example, 'Bank loan account record' needs some awareness mechanisms to restrict the access of the users according to their position in the company or organizations.

In addition, we have done a comparison among the awareness mechanisms and established a hypothesis by using Chi-square test with the data gathered from the awareness mechanism preference question. We have established that among the existing awareness mechanisms, users have a preferred awareness mechanism which is best effective in achieving group awareness. In addition, our survey shows that radar view is the most successful awareness mechanism among the existing ones.

Some responses to both open-ended and close-ended questions from the participants that focus on major results are stated below.

Qualitative data (Open-ended questions)

As an answer of question 1, one participant stated that "Inserting by me took longer then I expected because I was distracted by other users' insertions". This case is happened when the users were working at the same area of the document. The participant stated that this problem is a major problem and need to be fixed.

From the result of question 2, one participant stated that "Lack of communication suffered me a lot. But, I don't think only communication can solve the problems of achieving group awareness". The participant also stated that "There is no mechanism that deals with absence of a particular user. And, it is very hard to adapt quick changes". This participant did not use communication tool (messenger chatting tool) in their experiment. Therefore, they experienced lack of communication.

Another problem mentioned by a participant is in the use of private mode, single-actor mode and single-view mode. The participant first mentioned the differences among these awareness mechanisms are not straight forward and therefore not intuitive. Second, when writing together collaboratively, forbidding another member of the group makes him feeling anxious that the other person does not know his writing and may not agree after finishing his work.

One participant answered question 5 that "I did my part first and let my other partner to modify that part. While that modification work done by my partner I observed the changes. Sometimes, we used other online messengers to communicate. A built-in messenger in the software would be helpful in this point".

Quantitative data (Close-ended questions)

With the data of the awareness mechanism agreement questions, we have compared the agreement of different awareness mechanism and obtain percentage of participants who agree or disagree with a particular awareness mechanism attribute. Some examples of the percentages are stated below.

67% of participants agree with the statement that radar view helped them to understand awareness information about where the other authors are currently looking at the document.

33% of participants are neutral about the statement that radar view shows sufficient information about the entire shared workspace in a high-level view.

58% of participants agree that telepointers helped them to understand others' intention by looking at the movement of their mouse cursors.

41% of participants agree that it is useful to view the corresponding location of others' text inputs in a document by clicking on the "Highlight Collaborators' Input with Colors" button on the CoWord toolbar

67% of participants strongly agree that they can notice when their text is modified by others by using the awareness mechanisms.

50% of participants strongly agree that radar view is easy to learn and easy to remember how to use.

With the data from awareness mechanism preference question (Question No. 20) we have done Chi-square test to test the null hypothesis of awareness mechanism preference. The answers of this question are depicted in the following histogram (Fig. 1). From the histogram, we can see that radar view is preferred by 67% of the participants, making radar view the most preferred awareness mechanism.
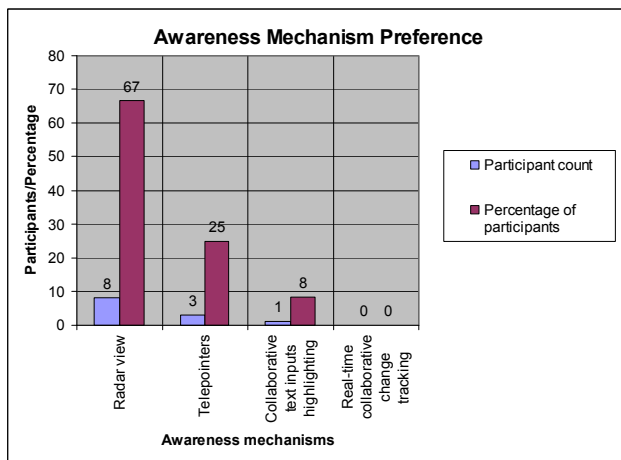

Fig. 1: Histogram showing awareness mechanism preference response

To do a Chi-square test, we follow a statistical method (Wild and Seber 2000, p469). According to the method, we need the degrees of freedom, number of categories, expected cell count, observed cell count, specified cell probability and the total number of count.

Table 2: Awareness mechanism preference response

Awareness Mechanism	Number of Participants	Percentage
Radar view	8	67
Telepointers	3	25
Collaborative text inputs highlighting	1	8
Real-time collaborative change tracking	0	0

From the data of the question (see Table 2),

Number of categories = 4
Degrees of freedom (df) = Number of categories – 1
= 4 – 1 = 3

Total number of count = 12
Specified cell probability = 1/Number of categories = ¼
Expected cell count = Total number of count × Specified cell probability
= 12 × ¼ = 3

Chi-square (df) = $\sum_{\text{all cells in the table}}$ ((observed count – expected count)^2) /expected count

= $((8-3)^2)/3 + ((3-3)^2)/3 + ((1-3)^2)/3 + ((0-3)^2)/3$
= 8.33 + 0 + 1.33 + 3
= 12.66

Using the Chi-square (df = 3) distribution, we obtain P-value very close to 0.005. This P-value is taken from the Chi-square distribution table where the Chi-square value of P-value 0.005 is 12.84 (closest to our answer 12.66) with the degrees of freedom 3. The P value is very small, so we have extremely strong evidence against the null hypothesis. This rejects the null hypothesis and establishes the scientific hypothesis as true.

6. Conclusion

This research presents an evaluation of awareness mechanisms used to achieve group awareness in real-time distributed collaborative writing systems. We have used CoWord as an example of these systems. To perform the evaluation, we have conducted five experiments and gathered data from the participants using a questionnaire in interviews. We have analyzed the data gathered from the experiments and found several usability issues.

The experience in this research about awareness mechanisms has provided further scope for performing future work on this topic. Future work can be done on different document types that are not evaluated in this research and in different environment settings. The

environment settings may include when different users are experiencing different environment (for example, some users are static and some are travelling). Future user requirement activity may also be carried out in order to reach the goal of building a real-time collaborative document writing system that can achieve fully successful group awareness with the help of awareness mechanisms.

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Appendix
Questionnaire
Open-ended questions:

1. Which task took the most amount of time (for example; editing, inserting, formatting, reviewing, updating, drawing, tracking changes etc.) while doing it collaboratively? Please state.
2. What are the problems that you have found during your experience in achieving awareness? Please state.
3. Have you found any benefits through your experience about achieving awareness while writing your document? Please state.
4. Have you come across any technique that helped you to write more effectively in a group? Please state.
5. How did you combine your idea with your group? (for example, when you along with others are writing a specific part at the same location of your document) Please state.
6. Have you found it suitable to use collaborative document writing software in your document? Why/ why not?
7. Have you found it difficult using MS Word collaboratively rather than using it as a single user? Why/ why not?
8. Do you consider using CoWord at your work/study? Why/ why not?
9. What is your overall understanding about collaborative document writing and group awareness on the basis of your experience? Please state.
10. Do you have any suggestion to improve the awareness mechanism of CoWord? Please state/ draw in the following panel.

Close-ended questions:

Ethnological questions

1. Occupation
   ☐ Student   ☐ Academic Staff
   ☐ Business Staff ☐ Government Staff
   ☐ IT Staff   ☐ Others
2. How long have you been authoring documents using Microsoft word?
   ☐ Less than 1 year   ☐ 1-5 years
   ☐ More than 5 years
3. Have you worked with any collaborative document writing software before?
   ☐ Yes   ☐ No

Awareness mechanism questions

4. Radar view shows sufficient information about the entire shared workspace in a high-level view.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree
5. Radar view helped me to understand awareness information about where the other authors are currently **looking** at the document.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree
6. Radar view helped me to know the exact locations of where remote authors are **working** at the document.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree

7. Radar view needs some improvement to make it usable.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree
8. I can interpret awareness information provided by radar views.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree
9. Radar view is easy to learn and easy to remember how to use.
   ☐ Strongly Agree ☐ Agree ☐ Neutral
   ☐ Disagree   ☐ Strongly Disagree
10. I can notice when my text is modified by others by using the awareness mechanisms.
    ☐ Strongly Agree ☐ Agree ☐ Neutral
    ☐ Disagree   ☐ Strongly Disagree
11. 'Real-time collaborative change tracking' feature helped me to keep track of changes in the document.
    ☐ Strongly Agree ☐ Agree ☐ Neutral
    ☐ Disagree   ☐ Strongly Disagree
12. It is useful to view the corresponding location of others' text inputs in a document by clicking on the "Highlight Collaborators' Input with Colors" button on the CoWord toolbar.
    ☐ Strongly Agree ☐ Agree ☐ Neutral
    ☐ Disagree   ☐ Strongly Disagree
13. 'Group undo scope' feature is useful in having more control over the document by the group.
    ☐ Strongly Agree ☐ Agree ☐ Neutral
    ☐ Disagree   ☐ Strongly Disagree
14. When writing my document, it is useful to view remote users' mouse positions using Telepointers.

☐ Strongly Agree ☐ Agree ☐ Neutral

☐ Disagree   ☐ Strongly Disagree

15. Telepointers helped me to understand others' intention by looking at the movement of their mouse cursors.

    ☐ Strongly Agree ☐ Agree ☐ Neutral

    ☐ Disagree   ☐ Strongly Disagree

16. Other peoples' cursors are distracting on my working area.

    ☐ Strongly Agree ☐ Agree ☐ Neutral

    ☐ Disagree   ☐ Strongly Disagree

17. The collaborative tools in CoWord (single view mode, single actor mode, private mode, message history etc.) are helpful for group awareness.

    ☐ Strongly Agree ☐ Agree ☐ Neutral

    ☐ Disagree   ☐ Strongly Disagree

18. The existing awareness mechanisms are enough to gain sufficient Group Awareness in writing my document type.

    ☐ Strongly Agree ☐ Agree ☐ Neutral

    ☐ Disagree   ☐ Strongly Disagree

19. Since I have experience with MS Word, it is easy for me to learn the collaborative tools and features in CoWord quickly and effectively.

    ☐ Strongly Agree ☐ Agree ☐ Neutral

    ☐ Disagree   ☐ Strongly Disagree

20. Which of the awareness mechanism helped you most to achieve awareness of the group?

    ☐ Radar view

    ☐ Telepointers

    ☐ Collaborative text inputs highlighting

    ☐ Real-time collaborative change tracking

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