Design Factors Influencing the Effectiveness of 'Groupware' Support for Collaborators' Joint and Individual Objectives

CM40149 Group Report

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ABSTRACT

This paper provides a description of a number of factors that may influence the effectiveness of computer-supported collaborative work (CSCW) groupware systems, presented in light of a brief investigation into the differing features supported by two contemporary groupware systems.

Keywords

Groupware, HCI, CSCW

1. INTRODUCTION

Virtual collaborative environments allow for users to work together without the need to be collocated. The effectiveness of these environments in collaborative tasks is often affected by the technology and communication channels being used. In this report we will highlight a number of issues that may affect collaborative team work, and present a brief investigation into the differing features provided by two environments that support collaborative working tasks. Using the results of this investigation as a starting-point, we present a discussion of the features that groupware systems should provide in order to facilitate effective collaboration for non-collocated groups.

2. BACKGROUND

Collocated communication is often viewed as a gold standard in communication because it provides rich information for interactions such as context and social cues [12]. When collaborating through computer mediated technologies much of this information is lost or has the potential to be misinterpreted in some way.

There are certain properties of the physical world that support communication between individuals and groups such as the visibility of activities and presence of participants. In digital systems these properties are not always apparent. Consequently, participants are unable to react to social cues and structure their behaviour to the social context – which can result in unsatisfactory interactions [7]. Socially translucent systems aim to provide more social information so that participants are more aware of the interactions and activities taking place within a digital space. This awareness can help make collaborative systems operate more effectively by affording more coherence to group activities [5].

Another important factor affecting the effectiveness of collaborative tasks is the existence of common ground between the participants. It is important that all collaborators are aware of and able to maintain shared knowledge and goals in order to facilitate effective group work. There are a number of potential channels whereby information about common ground may be shared and maintained, and the presence of this information can help avoid communication breakdown [11].

3. APPROACH

The investigation consisted of two lab-based experiments; One based in a 3D virtual environment called Second Life and the other in the 'Google Docs' web-based word processor. The first task involved communication and coordination of information, while the second was largely an idea generation and refinement task [13]. The investigation process is reviewed in this section.

3.1 Task 1: Second Life

The first CSCW task is a hidden-information experiment in using each participants' incomplete map to make up a complete map, and then adjust the blocks in the game to form the complete map.

Initial efforts were directed towards locating teammates and exploring how to use the software. In-game help was used to find how to play this game, and assistance was also provided by the tutor, who explained how to use it. Some essential information, such as team location, was provided in-game via instructions on the wall.

The team communicated using in-game chat and adjusted the blocks to form the final map. We used the chat box to describe our incomplete map. Initially, we typed out the

blocks' names one by one – e.g. "the first block on the first row is grass in my map". Later, we changed to input all the blocks' names one row at a time – e.g "my row is grass-rock-couple-blank". We identified the different blocks using the in-game properties and ensured they were placed in the correct order. One teammate who was familiar with adjust blocks put the blocks into the right position according to our decisions. Finally we checked whether all blocks in the right position with our own maps, excepting "blank" positions.

3.2 Task 2: Google Docs

In this experiment, we were asked to write a number of suggestions for Facebook's privacy settings using a Google document.

This time we found that it was not convenient to discuss in the chat box, because we needed to write longer sentences, some of which would be used in the final document. We discussed the task and typed into the Google document directly. Sometimes, we had to wait for others to finish typing in order to avoid splitting the focus of the discussion.

Some functions in Google doc are good for the group work. Each user has a different colour cursor in the documents, and the cursor flashes at the location where a user is typing. This helps us to know who are there and what are they doing. Once we discovered that some useful sentences were deleted, we used "history" to find it out again.

We were asked to guess who our teammates are. Usually, we can guess who is it via cues provided by the avatar, but this time the avatars were not created by ourselves. So they in this instance they did not provide adequate cues. We still got some clues from the typing speed, speech patterns and language ability.

4. RESULTS

The team completed both tasks, with varying degrees of success. This section notes some salient aspects of the outcome.

4.1 Task 1: Second Life

We finished the task. The blocks were put in the right position. Our approach to accomplish this task is efficient. We finished our work before the time out. The figure 1 is the screen shot of our result in this task.

4.2 Task 2: Google Docs

We partially completed this task. As the figure 2 shows below, we listed the task requirements and some suggestions for the Facebook privacy system. However, our word-count for the story is over the required limitation of 200 words. So that means we haven't provided our documents in the correct format, and we did not completely finish our task on time.

The reason why we did not finish it is due to the need for significant discussion of the existing systems, as not all participants were familiar with Facebook's privacy provision. In the absence of face-to-face communication, we spent a lot time to waiting for other teammates to finish expressing opinions and typing.

Figure 1: Screenshot of Second Life result

Task 1: summary of advice, 200 words - Improving the way Facebook allows users to define privacy.

What data do advertisers get - It is not clear how users data is used especially in regards to how it is sold to advertising companies. A facility that would allow users to view what data is used and acted upon by advertisers would help overcome this problem.

Data persistence - Users may want to limit the amount of time that their posts and photos are visible for privacy reasons. It may be useful to provide a facility to allow the user to determine this length of time for each individual post.

Limiting view into the past - One concern that many people may have is that as they transition through various phases of life, any new acquaintances that they add as friends are able to instantly see the full history of their profile, including any youthful indiscretions. It could be useful to introduce an intermediate initial connection level, whereby new friends have access to all of the traditional functionality such as messaging, invitations to events, tagging in photos etc, but have a (customisable) time limit governing how far into the past of a particular profile they are able to view.

What happens to your data when you die - There's also the issue of what happens to your account when you die - currently this process requires contact with their support team; it would be easier if pre-death users were able to specify another profile or profiles that would have the power to make decisions about the post-death future of a particular account.

-what about give different friend different identity? some people will not see some message that not share to their group? I think you can do something a little like this already - restrict what certain profiles can see you post

Task 2: short story about Marjory

Marjory has just graduated from university, and is about to enter the world of work. She's keen to continue using facebook as the powerful networking and organisational tool that she has so far found it to be, but is concerned about the impression her new workmates may form of her

Figure 2: Screenshot of the Google document

5. DISCUSSION

A number of aspects of the two groupware systems we used were relevant to the effectiveness of the tasks we undertook – as discussed below. The difference in nature of the task affects the functionality required in order to best support successful completion [13] – and not all helpful features of each platform were discovered during the course of each task.

5.1 Message Persistence

Text based communication through chat systems creates messages that are persistent; the exchanges can be revisited in the chat log after they have been sent. The advantage of this for collaborative tasks is that previously shared information is always available to participants [8]. In other channels of communication such as audio, previous utterances are ephemeral; participants must break the current flow of the conversation to repair misunderstandings because information cannot be casually revisited.

Second Life and Google Docs both include chat systems with persistent messages. During Task 2 it was found that the participants preferred to use the actual document to talk about the task instead of the chat box provided. This was most likely due to two reasons: it required more effort to continually switch from writing on the document to writing in the chat box; and it was also more difficult for the participants to relate the comment in the chat box to what it referred to in the document. Writing comments directly next to the section they apply to helped reduce misunderstandings and the effort required to repair them. The disadvantages of using this method are that the content of the document and comments relating to it get mixed up in the same space. One possible solution to this problem, which the participants didn't discover, is the use of annotations that exist alongside the document rather than within it.

5.2 Negotiation

The mediating technology that is available to negotiating participants has implications for the way in which they communicate during the negotiation. A text based chat system, such as that used in Second Life and Google Docs, can both help and hinder optimal negotiation and conflict resolution. One such influencing factor is the way in which information is presented; in a specific or condensed format [6]. A *specific* format refers to a sentence devoted to a single tile and a *condensed* format refers to a sentence devoted to more than one tile. This coding is especially relevant to the Second Life task when tiles are being discussed (see table).

Specific	
Rob - Team 3:	okay, I've set that up in the corner. Then oil station?
Toby - Team 3:	oil station to the right of creative building
Rob - Team 3:	then a blank?
Toby - Team 3:	yes - then blank
Toby - Team 3:	the next row starts with grass
Rob - Team 3:	second row
Rob - Team 3:	grass far left
Peter - Team 3:	the rock
Peter - Team 3:	then rock, after grass

Condensed	
Rob - Team 3:	Okay, fourth row: blank asian teahouse blank dinner hall
Peter - Team 3:	my fourth is :rock - asian teahouse - blank - dinner hall
Toby - Team 3:	my fourth is: rock - asian teashouse - blank -blank

At the beginning of the Second Life task the participants referred to tiles in the specific format, one by one, starting in the top left of the map and moving across. By the start of the second row the participants began to use condensed formatting to describe whole rows in one sentence. This approach may be a more convenient way to negotiate where each tile should be placed. It increased the efficiency of the task in terms of time because all the available information for each row becomes visible to the other participants in just one sentence. Decisions could be made quickly by comparing this condensed information.

The problem with using a condensed format for messages is that the quality of the negotiation may decrease. When a specific format is used a single tile becomes the focus of the conversation and so the more information about it is shared. In this task the negotiators have a common goal but in tasks where goals conflict a lower quality negotiation can may result in one side losing out to a greater extent due to the lower level of discussion (ibid).

5.3 Gaze

Gaze is an important part of human communication. Collocated interlocutors can use the social cues afforded by gaze to read each other's behaviour as well as signal their own. This is particularly relevant in terms of focus of attention, maintaining roles, turn-taking and signalling attitudes [1].

Second Life and Google Docs are both unable communicate the gaze of participants, however, they are able to provide features that help compensate for the loss of it. Second Life shows a line of sight from a avatar's head to the object of their focus. This allows for participants to know that a teammate is active in the task and which object they are actively working on – however this information may become 'stale' as it is only updated by explicit interaction.

Google Docs visualises the attention of participants by assigning each one a coloured cursor. This gives an indication of what they are currently working on and therefore where their attention is focused. Without this visual cue it would be very difficult to tell who was contributing to the different parts of the document.

The coloured cursor would not always be a completely reliable indicator and could be misleading at times because a participant could leave their cursor at one position while they read a different part of the document – as with the Second Life gaze indicator, above. The document could span multiple pages and so it was not clear which page or section a user was viewing. A solution to this problem could be to give some sort of indication of what part of each contributor is looking at; maybe a coloured frame indicating their current view space.

5.4 Accountability

In the Google Docs task, once a participant stopped working on particular part of the document they moved their cursor elsewhere. This meant there was no longer any indication as to who is accountable for each part of the document. The problem of *who wrote what* could potentially be solved by a number of methods; tagging, overlaying or highlighting each edit or section with the participants cursor colour.

If this information becomes visible it may have consequences for how participants build and edit the document. These coloured markers create associations between the content creators and their content. These associations alone are enough to justify psychological ownership of the content [4]. The perceived psychological ownership of objects can have both positive and negative effects on the owner's and non-owner's behaviour [3]. A positive effect of this visibility is that owners feel heightened responsibility for their content and will therefore spend more time and effort improving it and discussing it [9]. There may also be negative effects:

non-owners may be reluctant to edit and adapt (or 'violate') the owners' ideas; and owners are more likely to shut down and refuse non-owner contributions relating to their content [10]. It is possible that the lack of these ownership markers in Google Docs helps to maintain a feeling that the document belongs to the group as a whole.

5.5 Roles

People need to cooperate in collaborative work. Because of differing experience, personality, preferences and ability, different roles will emerge, even they are not agreed in advance [2]. Roles are good for organizing the group work, and appropriate roles assignment or development can improve the work efficiency.

In the Second Life experience, a special role emerged. One team member became responsible for controlling the arrangement of blocks. This action increased the speed of the process, and prevents the possibility that two players might attempt to move one block at the same time. This responsibility was not given in advance – it naturally formed during the experiment. This could cause trouble for bigger groups, as some participants may ignore the existing role. The reason why this role emerged during the process was not only because there were only three people in the game, but also due to differing prior experience with the games rules. So we cannot anticipate what kind of role will be helpful in this situation. According to this discussion, familiarity with the work environment and prior knowledge of appropriate roles will be useful for collaborative work.

6. CONCLUSION

In light of this discussion, we will try to provide some suggestions for the designers of groupware systems. All the suggestions below are dependant in some way on the task or environment, particularly the degree of interdependence between collaborators. Designers should carefully consider factors of the environment such as number of participants, task rules, participants' experience and personality.

Clarity and ease of communication is arguably the most important part of collaborative work. So sufficient quality communication space should be provided. Face-to-face is generally described as the most efficient method for communication. However in some cases, not all participants can be collocated. Technological alternatives to traditional communication channels should be considered. Text chat will not efficient when participants require real-time response times or need to type long sentences – however it is a basic and widely-understood method, and it is good for giving announcements and providing persistent records of communication.

In many cases, audio and video communication channels also could be considered – these provide additional non-verbal information such as tone or body language, though this comes at the cost of message persistence and asynchronicity. Common ground may be easier to maintain due to the communication of unconscious notifications that repair is needed, though certain impediments to collaboration (e.g. language barriers or time differences) may be amplified by the switch to real-time communication.

Appropriate system-supported organizational roles could improve the effectiveness of the groupware. Different level of authority could be defined according to different roles in the group work. The existence of a defined team leader could support the decision-making. But other participants (such as listeners) should also should be motivated. Specific task allocation within the system can avoid vagueness of ideas and misunderstandings between participants.

It is also important to support the development, maintenance and repair of common ground between participants. In collaborative work, a clear target is necessary. The organizer and main participants should have access to sufficient basic knowledge and task description. It is common to see that shared knowledge is updated or supplemented, and so the groupware designer should provide space to share common information and allow corrections and repair during the process.

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