Designing Group Mirror Systems for Collaboration

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Abstract

This position paper explores how technology for collaborative work can be applied in an educational context. An important aspect of education is to provide and to obtain feedback. This feedback is mostly given by a teacher or tutor but can also be provided by automated mirroring and guidance systems. These so-called "group mirrors" can give feedback to a group in a subtle and unobtrusive way and can thereby for example regulate group behavior and guide the learner's activities. In previous work of our research group, we have already carried out preliminary experiments in using group mirroring systems for scripted collaboration sessions in classrooms. In this paper, a classification of existing group mirror systems is developed. Based on the insights about these systems, the potential for future research on group mirroring systems is outlined. We will specialize on support for group discussions targeting a good balance between coverage of thematic issues and well-disciplined structure.

Author Keywords

CSCW, education, feedback, group mirror, discussion

ACM Classification Keywords

H.5.3 [Group and Organization Interfaces]: Computer-supported cooperative work.
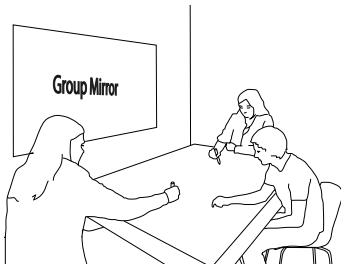
Introduction

Feedback plays an important role in education, on an individual as well as on group level. Here, we concentrate on feedback for collaborative group work. In case of collaborative work, feedback can either address the processes of the group work itself or the discussed topic. The feedback can not only be provided by a teacher or tutor but may also be given by a "group mirror" (see Figure 1). These "group mirrors" or "mirroring systems" reflect the actions of a group by displaying certain aspects to the collaborators [9], for example by showing speaking times, speaking turns or content-related aspects.

Systems can be used for remote and co-located collaboration. Remote collaboration can be supported by "awareness tools" that provide information about persons who are not present at the same place (see for instance [8, 5, 11]). In contrast to these tools, "group mirrors" are geared toward co-located collaboration. In particular, a promising application scenario is a classroom situation, in which students are learning about how to carry out an effective and well-structured group discussion.

In the following, a classification of existing group mirrors is presented and the fields with a potential for further research are outlined.

Classification of Group Mirrors

Existing group mirror systems can be classified according to different criteria. The classification that is presented in this paper is based on the three characteristics introduced by Streng et al. [13] (1) Type of Information (2) Placement and (3) Type of Visualization. Mirrored information can be either quantitative or qualitative. An example for quantitative data is speaking time. Quality of collaborative processes includes for instance the quality of ideas or contributions. Another aspect is the placement of the feedback. It can be displayed either on shared or on private displays. Shared displays can be walls or tables while laptops, tablets or smartphones can be used as private displays. The third aspect is the type of the visualization. Streng et al. compare a metaphoric representation with a diagram visualization. In a metaphoric visualization, the processes of the group are represented by metaphors that can easily be related to the aspects that are illustrated. A flower that grows and gets more and larger petals for example can signify an increasing number of contributions of one group member (see Figure 2). The discussed classification can be enhanced by the time, when the group mirror is displayed. This can either happen during the group work or as a replay after the collaboration.

In Figure 3, seven tools have been classified according to these characteristics. Second Messenger [7] captures speaking times in co-located discussions and displays them on a shared display. Different visualizations are used. One shows a histogram mirroring the speaking times of the collaborators in different colors. Another visualization, called timeline, is designed specifically for replay. Sturm et al. [14] developed a tool that measures and visualizes speaking time and gaze behavior and projects these information as colored circles on a table. Conversation Clock [3] also displays contributions from audio input and uses the metaphor of concentric rings on a tree for its visualization. Conversation Votes [4] is a tabletop system that adds an anonymous back-channel to discussions. Another tabletop mirroring system that displays the duration of contributions is Reflect [2]. Meeting Mediator [10] uses sociometric badges for capturing group dynamics and mirrors the information on mobile phones.

Figure 1: Scenario of a group mirror environment.

Figure 2: Example of a metaphoric group mirror.

	Information		Display		Visualization		Time	
	Quan.	Qual.	Shared	Private	Ab-stract	Meta-phoric	Real time	Replay
Second Messenger [7]	•		•		•		•	•
Sturm et al. [14]	•		•		•		•	
Conversation Clock [3]	•		•		•	•	•	
Conversation Votes [4]	•	•	•		•		•	
Reflect [2]	•		•		•		•	
Meeting Mediator [10]	•			•	•		•	
Streng et al. [13]		•	•			•	•	

Figure 3: Classification of group mirrors

The group mirror developed by Streng et al. [13] uses qualitative as well as metaphoric feedback. The evaluation of this system shows that the metaphoric visualization was more popular, had a better effect on self-regulation and that deficient behavior was corrected faster than in the diagram version.

Potential for further research
Considering the classification of existing group mirror systems, there seems to be a potential for future research in providing qualitative feedback, examining the effects of private displays in group mirror environments, analyzing the differences between real-time feedback and replay, and using metaphoric visualizations.

Teachers often provide qualitative feedback to students. In case of collaborative work, this feedback can interrupt the process. With the help of group mirror systems, teachers can provide unobtrusive feedback. Additionally, feedback on private devices can affect the processes of collaboration in a different way as feedback on public displays. Furthermore, the use of metaphoric visualizations seems to be a promising approach. On the one hand, the results of the study by Streng et al. [13] reveal the possibilities of metaphoric feedback and on the other hand, this type of visualization is underrepresented in research about group mirror systems by now. The time aspect can make a difference in scripted collaboration with several phases. The impact of continuous feedback can differ from displaying feedback after each phase.

Another important issue is the use case a group mirror is designed for. Current systems already support a broad range of group discussions. However, there is little work up to now on enhancing the coverage of diverse thematic items in a discussion. When learning how to carry out a discussion, it is important to get aware of the various kinds of contributions (like praise or criticism, objective or emotional contributions) and of the number of alternative viewpoints possible for a certain topic. In order to support diversity of discussion contributions, well-known brainstorming techniques can be used and adapted appropriately.

Group mirror systems are a possibility to support these techniques. This is especially interesting in the educational context. Discussions can be used to deepen the knowledge of a topic and leading a well-structured discussion needs to be learned. A feedback system can for example mirror different kinds of contributions and make aware, if a viewpoint is over- or underrepresented. The compliance to rules that are obligatory for a specific technique can be facilitated by a group mirror system, for example by issuing a warning if collaborators interrupt

each other. Metaphoric visualizations can be used to make the group mirror effective and easy to understand. Thereby, the kind of metaphor used for different forms of feedback plays an important role that has to be considered carefully.

Conclusion

There is a great potential to use computer-support for collaborative work in the educational context. Feedback can for example be provided by group mirrors. In this paper a classification of existing group mirror systems is presented. Based on that classification, the possibilities for further research are outlined.

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