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# Investigating the Different Characteristics of Group Mirrors

**Sarah Tausch**

Media Informatics Group  
University of Munich (LMU)  
Munich, Germany  
sarah.tausch@ifi.lmu.de

**Abstract**

Group mirrors are systems that provide feedback to a group about specific aspects of their collaboration. One example is displaying quantitative information such as speaking times to the group members to regulate participation. In this note, I discuss possibilities of providing feedback about qualitative aspects of collaboration, for example the quality of arguments. I want to broaden existing research on group mirrors by evaluating group mirrors with regard to their social implications such as social acceptance of group mirrors.

**Author Keywords**

Group mirrors; social mirrors; feedback; co-located collaboration

**ACM Classification Keywords**

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

**Introduction**

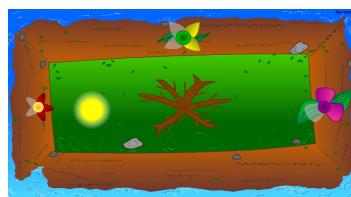
Collaborative tasks such as discussions or collaborative creativity meetings can gain from feedback that is provided on group processes [9]. However, feedback that is given in real-time during collaborative tasks may interrupt the group work. Group mirrors are a way to provide feedback to a group in a subtle way. Group mirrors (also

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**Figure 1:** Groupgarden [13] represents the number of ideas in a brainstorming session on a wall. The flowers represent individual participants while the tree shows the overall number of ideas and how balanced participation is.



**Figure 2:** A second version of Groupgarden is designed to be projected on a table.

called social mirrors) are systems that provide feedback to a group about specific aspects of their collaboration [7], for example by showing a visualization of speaking times of each group member on a tabletop display.

Previous research on group mirrors focused on mirroring quantitative informations of group processes such as speaking times, speaking turns or gaze direction (e.g. [1, 2, 5, 8, 12], for an overview see also [14]). Streng et al. [11] made a first approach of supporting collaboration through mirroring qualitative aspects. An example is mirroring the quality of a contribution instead of the amount of contributions. This can be done by a moderator or by peers. Bergstrom et al. [3] enabled qualitative feedback by giving peers the possibility to indicate anonymous agreement in a discussion. With my work, I want to investigate possibilities of providing qualitative feedback to co-located groups and evaluate the influence of such feedback on collaborative processes. Previous research could show that group mirrors can successfully regulate participation and increase performance. I want to add to this research by examining not only the effects of qualitative feedback on performance and self-regulation of groups but also by considering social factors such as the social acceptability of these tools.

### Approach and Research Questions

I think that including qualitative aspects in research on group mirrors can improve our understanding of the influence of these systems on group processes. In my research I want to use qualitative information to provide feedback to the group. I furthermore want to extend research on group mirrors by using a combination of quantitative and qualitative evaluation methods to analyze the effects of group mirrors. With this approach I want to address two research questions:

(1) What influence do different design decisions for group mirrors have on co-located collaboration processes regarding aspects of source of feedback, anonymity of the source of feedback, or concrete presentation of feedback?

(2) How can group mirrors be designed to improve performance but at the same time be socially acceptable?

### Work in Progress

*Supporting brainstorming with a metaphorical group mirror*  
Brainstorming [10] is a common creativity technique that comes with a number of rules such as 'focus on quantity' or 'withhold criticism' that participants need to consider to make it effective. However, problems such as 'free riding' and 'production blocking' [4] may occur. Groupgarden [13] is a metaphorical visualization on a wall to support rules and address problems of brainstorming with a combination of individual and group feedback. Individual feedback is realized in a way that each group member is represented by a flower that grows the more ideas the participant generates (see Figure 1). The tree represents the group and only grows when the participants generated enough ideas and the number of ideas is fairly balanced.

While the number of speaking turns would be a quantitative measurement, the number of ideas is a qualitative information as not every contribution can be counted as a new idea. In our study, we therefore defined what a new idea is and let a 'wizard of oz' control the visualization. We conducted a user study with 10 groups of each 3 participants and compared brainstorming sessions using Groupgarden to a baseline without any feedback. We could show that particular rules of brainstorming were supported and participation was more balanced with the feedback of the group mirror. However, participants had concerns regarding the seating

arrangement, as they either could sit side by side and focus on the wall or look at each other while having the visualization in their periphery.

*Evaluating Aspects of Group Mirrors: Table or Wall*  
 One aspect of group mirrors that could influence social dynamics is the location of the feedback. We therefore developed a visualization that was projected on a table and compared it to the wall version of Groupgarden in a second study [13] (see Figure 2). We could not measure significant differences regarding the number of ideas or the balance of participation, but the qualitative results indicate that group members felt more pressure with the table version but at the same time had a stronger feeling of working on something collaboratively.

*Supporting learning of argumentation in debates*  
 Professional debates that are practiced for example in debate clubs have specific rules and a jury provides feedback to the speakers after the debate. Our approach is to include this feedback already during the debate to enable immediate improvement of argumentation skills [6]. We designed a system consisting of a smartphone for the jury and a tablet for the speaker (see Figure 3). The jury can provide feedback about the quality of the argument structure. The current speaker receives the feedback and can adapt his or her argumentation in real-time, which aims at a faster learning of structuring arguments.

We conducted a preliminary study in two debates of a debate club. Video observations and results from semi-structured interviews indicate that feedback was perceived as helpful and supported direct improvement of argumentation skills. However, it was at the same time perceived as sometimes distracting and too inflexible.



**Figure 3:** Feedback is provided from the jury via smartphone. The current speaker perceives the feedback on a tablet and can integrate it in real-time in his or her argumentation.

## Future Plans

I am planning to investigate other aspects of group mirrors in more detail. One idea is to compare different modalities of feedback and evaluate other forms than visual feedback, for example auditory or tactile feedback. Another possibility of providing feedback may be using private instead of public feedback. In this way it might be possible to obtain positive effects of group mirrors such as an increase in performance but at the same time social pressure might be reduced.

## Expected Contributions

With my research, I want to contribute to the understanding of how group mirrors affect collaboration. I want to investigate specific aspects of group mirrors such as the location (e.g. private or shared displays) or type of feedback. My main focus lies on understanding how mirroring qualitative information can be successfully used to enrich group work so that performance increase and system acceptance are both supported.

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