

NGTool - Exploring Mechanisms of Support to Interactivity in the Group Process

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Abstract

This paper provides a pictorial description of a synchronous tool that implements a particular behavioral science technique, called Nominal Group Technique, for group generation of ideas and consensus forming. The objective of the tool is to explore computer-based interactivity support mechanisms that establish a relation between natural and non-computer settings. This paper backs up a demo presented at the CRWIG '95 workshop.

1 Introduction

The authors' domain of interest falls in the technical systems design for group interaction in cooperative processes guided by behavioral science techniques [1]. The general term is group decision support systems [8]. Furthermore, our focus is on the support for synchronous operations [10] over large scale networks under reduced bandwidth, such as the Internet. This particular setting excludes well established solutions for group interaction, like asynchronous operations over large scale networks or the use of continuous media over high bandwidth networks, e.g. audio and video teleconferencing.

The effects introduced by this class of systems in the group processes are not only related with the lack of a face-to-face environment but do also reflect different modes of communication promoted by the limitations of the media [9]. The goal is to search for computer-based techniques that improve users' awareness of cooperative tasks under limited possibilities for information sharing, coordination and control, and explore different ways of interactivity in group processes.

Two generic problems are at hand: 1) The mapping between the natural (non-computer supported) setting and the computer application that supports a similar group process; and 2) To effectively embed information sharing, concurrency control, feedback and awareness in the computer application.

The paper describes the design and implementation of a particular behavioral science technique called Nominal Group Technique, which is adequate to draw group ideas and judgments when group consensus is the desired outcome [15]. The technique per se does not involve any computer support and is structured in the following steps:

- Introduction of the meeting (by the moderator).
- Individual and silent generation of written ideas.

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- Round-robin feedback of ideas, which means going around the table asking for one idea from one member at a time, and writing it on a flip chart.
- Group clarification of each recorded idea.
- Individual voting on ideas.
- Discussion of results.

A prototype implementation, with a comparable functionality of the non-computerized NGT, has been developed to explore the necessary mechanisms of support to interactivity in the group process. The prototype is named NGTool and is described in two steps. First, we define the basic design elements that perform the mapping between natural and non-computer settings. Second, we define and illustrate the structure of the NGTool, highlighting the functionality of the proposed design elements.

2 The NGTool design elements

This section describes the NGTool basic design decisions and the developed techniques to support information sharing, coordination and control in synchronous group meetings.

We will discriminate two different types of users, the participants in the decision/negotiation meeting and the moderator of the meeting.

The user interface approach to information sharing in the NGTool is based on the support to both shared and private spaces [14, 16, 17].

Two different types of components allow to map the natural setting into the computer-based one: *items* and *teleassistants*.

2.1 The items

The *items* are visual objects manipulated by users as in the natural setting. According to our analysis of the NGT, the participants generate *Ideas*, *Comments* and *Votes* during the group process. The moderator attaches *Clarifications* and *Scores* to Ideas. The Clarifications and Scores are assembled from the Comments and Votes delivered by users. These objects are depicted in figure 1.



Figure 1: The items manipulated by the NGTool.

Any item can be organized on the tool with links and is represented by an icon and a data element. The icons are kept visually consistent in the shared space (strict WYSIWIS [16, 7]) but the data elements are individually opened and closed by any participant without interfering with the other participants (relaxed WYSIWIS [6, 2]). The strategy is to maintain only a minimum consistency and preserve shared space.

2.2 The teleassistants

Unlike the items, the *teleassistants* do not have a counterpart in the natural setting. They break down group interaction into elementary processes which can be composed to assemble the overall

group process.

The teleassistants are based on an extension of the notion of telepointer [5, 11]. The basic characteristic of the telepointer is that its positions and movements are equally seen by all the users (WYSIWIS). Telepointers are also moderated by a concurrency control mechanism in the systems where only one telepointer is available.

A teleassistant draws from the above functionalities of the telepointer and extends its functionality in several ways:

Teleassistants have types. Each teleassistant has a specific type which is identified by a particular icon. Several operations can be requested to the teleassistants using associated popup menus.

Teleassistants can be public or private. Public teleassistants manage the interactions with the group. They also handle concurrency control and manipulate items in the shared space. On the contrary, private teleassistants manage interactions with one single user, manipulate items in the private space and do not have a concurrency control mechanism.

Teleassistants allow more complex interactions with the user. Besides positioning, movement and concurrency control, which are handled by telepointers, the teleassistants also allow item creation, acquisition and display. This type of interaction is performed by linking the teleassistant to an empty space (creation) or linking one item to the teleassistant (acquisition and display).

Teleassistants have associated popup message windows. These windows are used for communication with the group, if the teleassistant is in the shared space, or with the user if in the private space. The public teleassistants manage the window popups and popdowns such that a consistent view among the several users is maintained. Usually, the message displayed in the window is acquired from an item in the way previously described.

Teleassistants provide expanded feedback to users. The public teleassistants do not only provide information from users but also information about users' activities. More specifically, teleassistants provide feedback on concurrency control operations, making users aware of locks, unlocks, lock requests and acceptances [3]. They also provide feedback about unreachable users (due to network partitions [12]) and temporary inconsistencies of the shared space due to communications delays. The feedback information appears just under the item's icon. An example of how this information is presented in the NGTool is shown in figure 2.

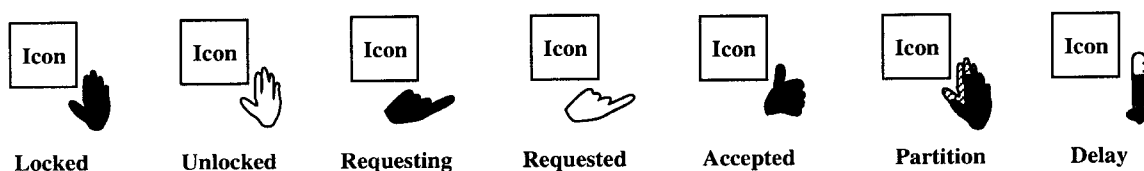


Figure 2: Expanded feedback provided by teleassistants.

3 The NGTool structure

The NGTool's group process is structured by the coordination of public and private teleassistants according to the rules of the NGT.

We identify several sub-processes in the technique. Four of them are public: round-robin proposal of ideas, discussion for clarification, polling of votes and final discussion. There are other four sub-processes which are private to each participant: silent generation of ideas, comment writing, voting, and final comment writing. Finally, two other sub-processes are run privately by the moderator: acceptance of ideas and generation of clarifications.

For each sub-process, the teleassistants will assume a particular identity and functionality. This

functionality will be described with the help of several reproductions of the NGTool's user interface.

Idea generation Each participant sees a teleassistant in the private space for generating ideas (pencil and lamp shown in figure 3). As described previously, an Idea is created by a link movement out of the teleassistant into the private space. After creating the item (small lamp), the participant can state the idea by writing down some few lines of text in the associated data element (also shown in figure 3). The participants can link and move the items freely within the private space, to organize their ideas, as well as opening and closing the data elements.

According to the NGT, after a sufficient time for private creation of ideas, the moderator announces the beginning of round-robin idea proposals and opens one public teleassistant on the shared space for accepting idea proposals (lamp switched on in figure 4). A private teleassistant is also opened in the moderator's private space for picking proposed ideas.

The participants can then select some of their private ideas to be exposed to the group. A participant links one Idea from the private space to the public teleassistant. The linked Idea is then acquired and displayed to the group in the teleassistant's message window and removed from the private space (figure 5).

If the teleassistant is locked by another participant, a "requesting" symbol is fed back to the requester (see figures 2 and 6) and the idea proposal is deferred. The lock is automatically released by the system after a time sufficient for receiving and reading the idea by all users and results in the delivery of the deferred one.

Notice that the idea is only made public to the group. It is a task of the moderator to pick the idea, re-phrase it if needed, using the data element, and place it on the shared space. The ideas in the shared space are automatically numbered by order of proposal (figures 7 and 8).

The spatial and hierarchical organization of ideas in the shared space is a role of the moderator.

Discussing ideas After finishing the round-robin proposal of ideas, the moderator switches to discussion of ideas and clarification.

The private creation of Comments and the act of turning them public are handled similarly to the operations described previously (figures 9 and 10). Unlike the previous example, however, the public teleassistant can be linked to an Idea, which moves the teleassistant near the Idea and gives the notion to the group that the comment is associated to that particular idea (figure 10).

If the moderator gives relevance to the comment, he/she will acquire the text into a clarification by linking the comment to the private assistant and the assistant to the idea (figure 11). There is only one Clarification item per Idea, which collects information from several comments.

Voting on ideas The next step to discussion is voting on ideas. Therefore, voting teleassistants are shown in the participants' private spaces (pencil in figure 12) and one public polling teleassistant appears in the shared space (box). As expected, votes are associated to ideas and, therefore, are created by linking an Idea from the shared space to the voting teleassistant in the private space. Then, the private teleassistant generates a Vote item. The participant must fill-in the item's data element (figure 13).

The polling teleassistant in the shared space is dedicated to deliver votes. To deliver a vote, a user only needs to link the vote item to the teleassistant. The teleassistant automatically identifies the idea being voted and appends the vote to a Score item associated to the idea (figure 14).

Final discussion The final discussion is, in terms of functionality, analogous to the discussion of ideas which has been previously described.

4 Implementation details

The NGTool was developed as an extension of a single-user graph editor running on X Windows Systems and Un*x workstations. Information sharing, coordination and control were implemented with a replicated approach based on a group management platform which provides wide area group communication protocols and replication management [3, 4, 13]. This platform has been extended in several directions, in a joint effort that uses the NGTool as a basis to essay and demonstrate innovative solutions for synchronous cooperations over wide area networks. Due to the limitations in current networks (long delays, limited bandwidth, failures) synchronous cooperations require extensive awareness of network conditions. The platform is able to detect and report network partitions and makes local measurements over communication delays. The user interface is designed to adapt constantly the users expectations to the performance of the system.

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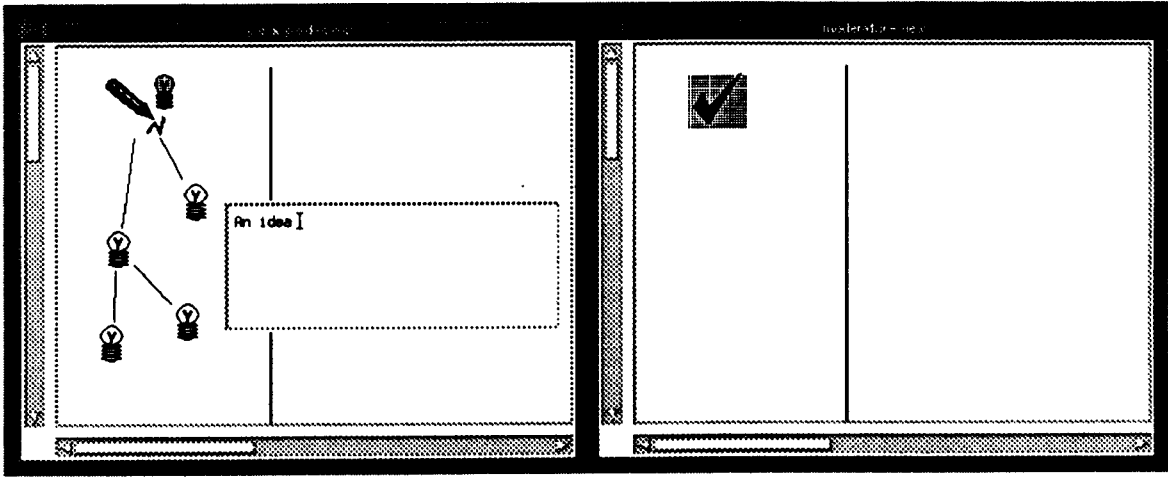


Figure 3: Participant writes an idea (participant on the left and moderator on the right).

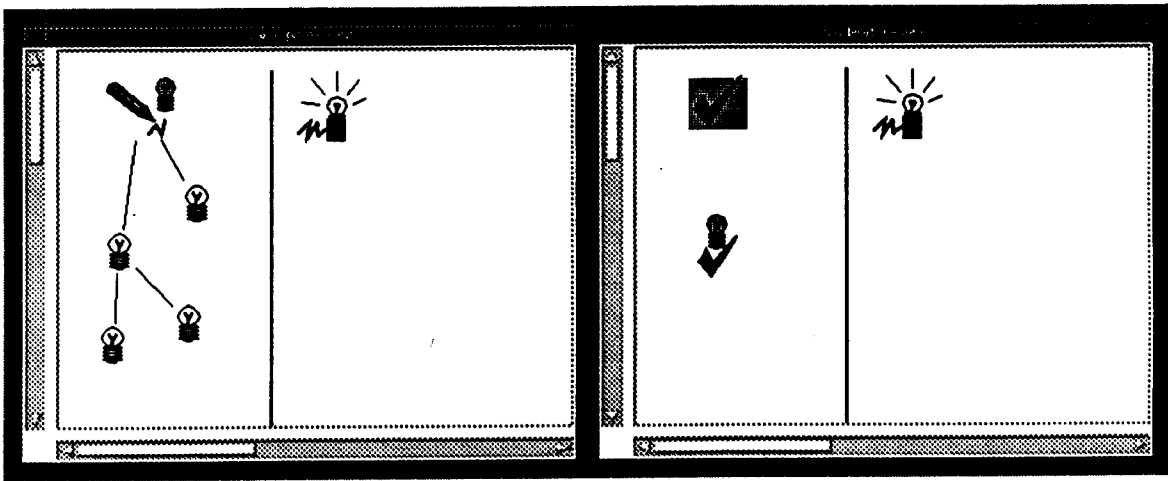


Figure 4: Round-robin idea proposal.

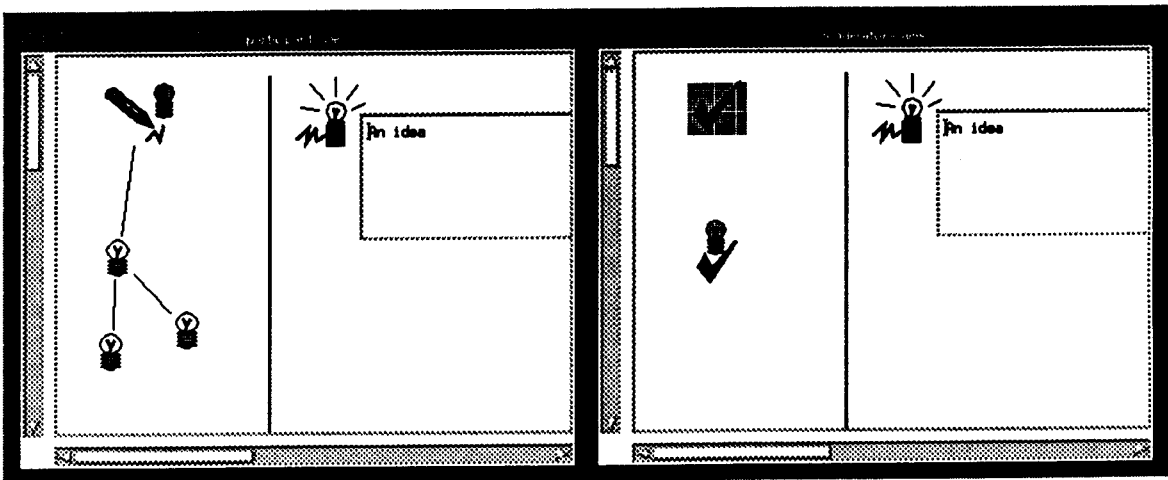


Figure 5: Idea displayed to the group (requires concurrency control).

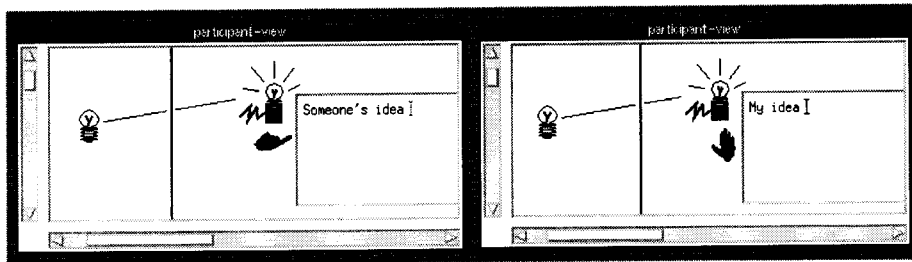


Figure 6: Concurrency control (request on the left and accept on the right).

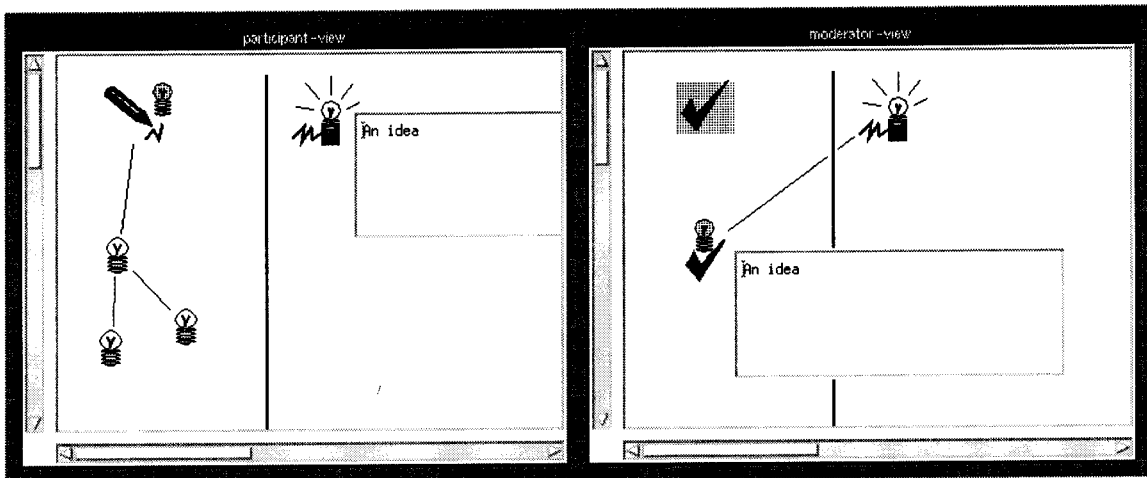


Figure 7: Moderator picks the idea (participant on the left and moderator on the right).

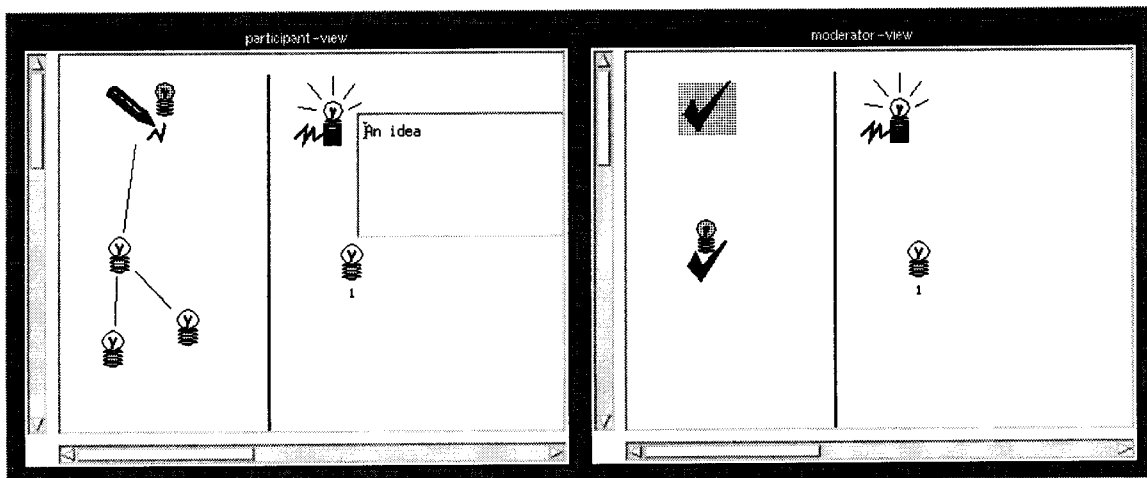


Figure 8: Moderator places the idea in the shared space.

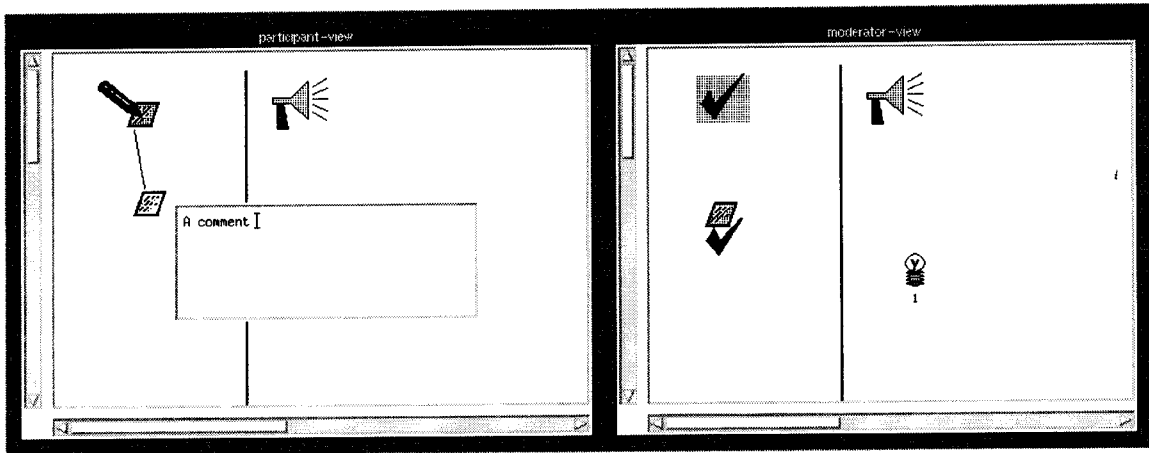


Figure 9: Participant writes a comment (participant on the left and moderator on the right).

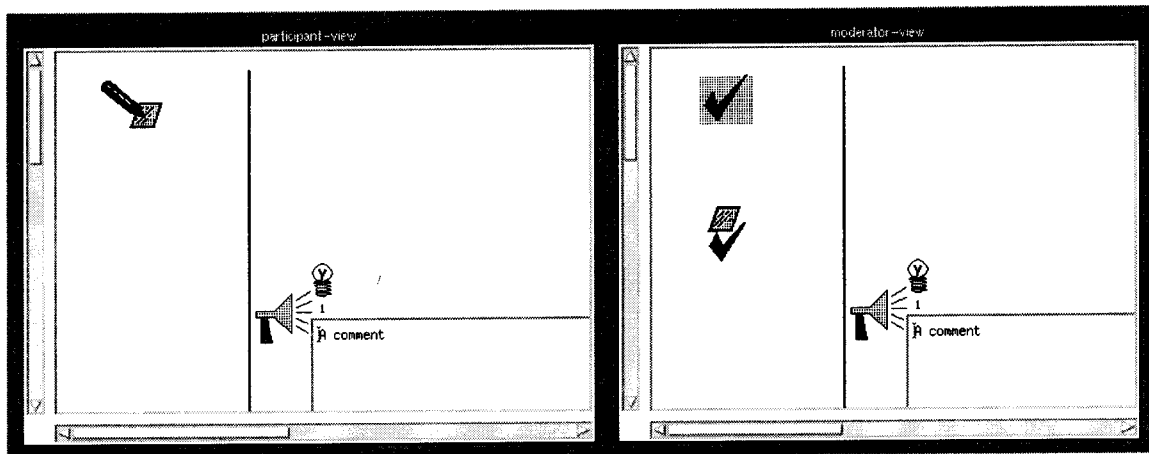


Figure 10: A comment made public (requires concurrency control).

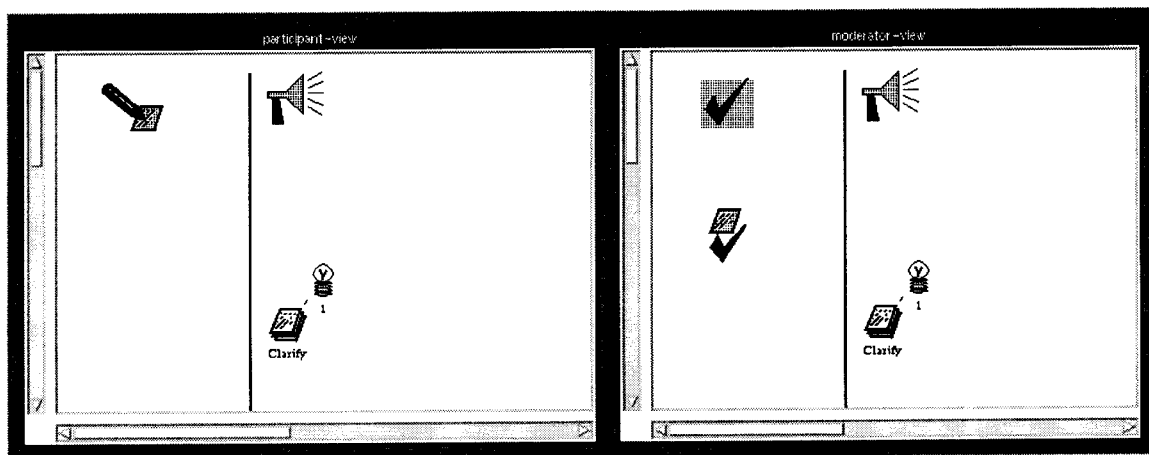


Figure 11: Moderator builds a clarification.

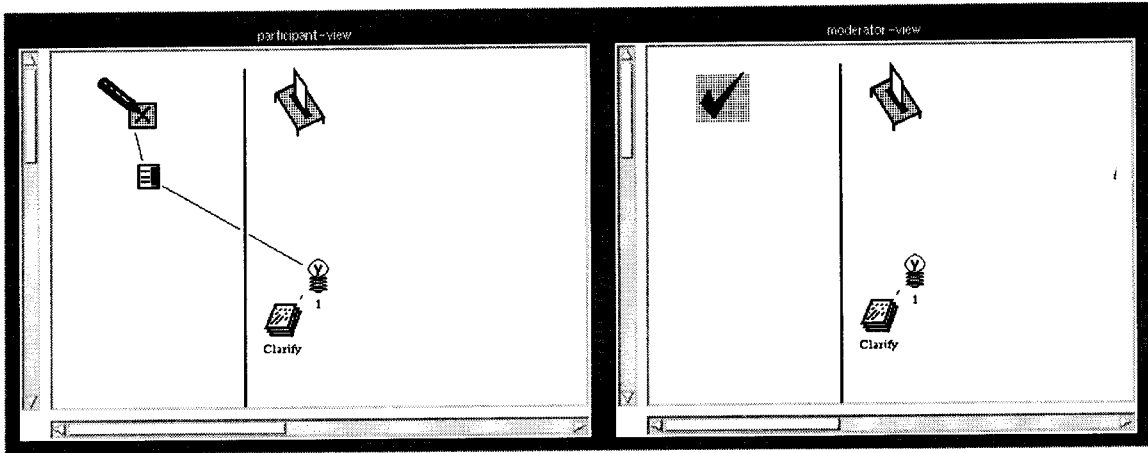


Figure 12: Linking ideas to votes (participant on the left and moderator on the right).

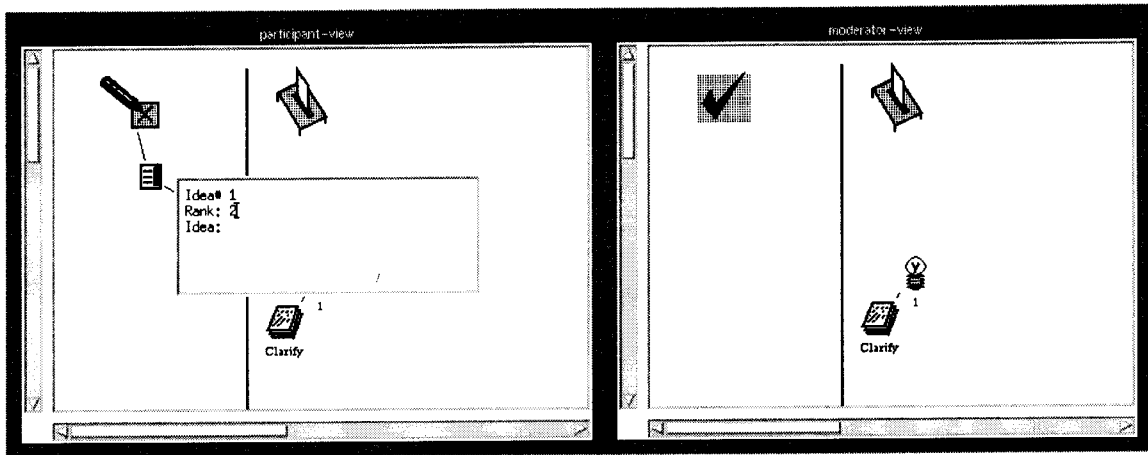


Figure 13: Filling votes.

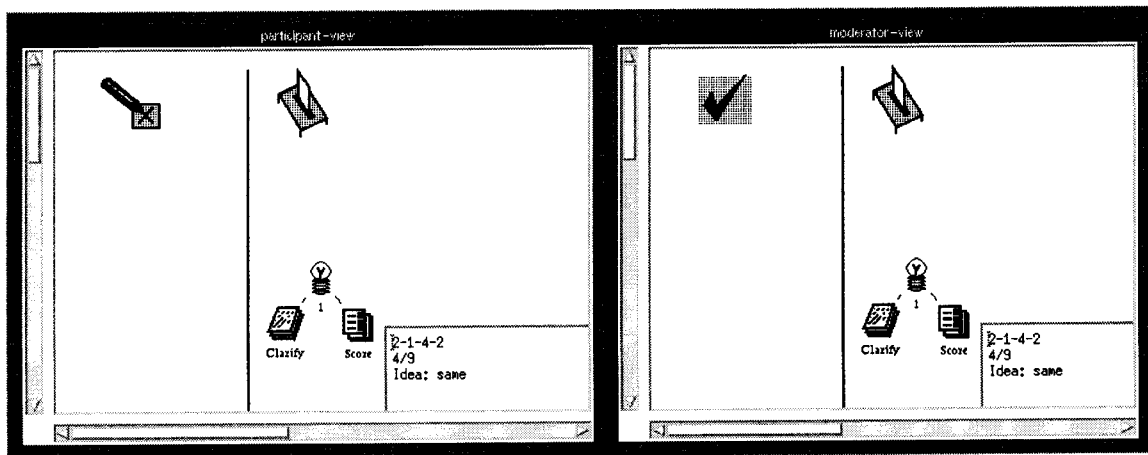


Figure 14: Scores.