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Roles in Online Collaborative Problem Solving

Sandra B. Fan
Dept. of Computer Science & Engineering, University of Washington
sbfan@cs.washington.edu

Abstract

The growth of online social networking has created new opportunities for collaboration in problem solving. How can we ensure that everyone is able to make use of it? In my work, I will explore the use of user role assignments as a way to encourage participation in online collaborative problem solving and design. I propose a design for such a roles system to be built into CoSolve, an online collaborative environment that uses the idea of state-space search as a model for problem solving.

1. Motivation

Describe real world setting

In 2009, University of Cambridge mathematician Tim Gowers asked the world through his blog: "Is massively collaborative mathematics possible?" [1]. He then posted a math research problem to his public blog, and welcomed anyone and everyone to post comments to find a solution. The idea was to attempt to "crowd-source" math problems. Within six weeks, they solved the problem, and project was a success; twenty-three unique participants from around the world had contributed to the conversation now known as "Polymath1", proving that online collaborative problem solving is possible.

Identify problem

However, in his analysis of Polymath1, Gowers identified many issues and ways in which the technology hindered the group's participation. For instance, his examination also suggested some social issues in the group that may have prevented full participation, for instance, some readers of the blog felt intimidated by the status of other, more established mathematicians, in the group. Others felt that their comments might interrupt the flow of conversation, and still others weren't sure how they could participate.

Despite the potential of online collaborative problem solving, it seems that there are still problems with free and equal participation by all. So how can we, as designers, create tools that better enable participation? In my work, I will explore how the roles people play in an online collaborative group can affect their work, and present a design for a roles system in CoSolve, an existing online collaborative problem-solving environment.

Summarize approach to solve the stated problem

2. Background

Explain how this work is related to other existing work

In Polymath1, one issue was that some participants chose to lurk because they felt intimidated by the status of other members. Indeed, Cuthbert [3] notes that collaboration in an educational context causes "group think", where the collaborators in a team converge on an idea without considering alternatives, as students often come to decisions based on the social status of the members involved.

In his study of the Python open-source development community, Ducheneaut [4] found that in order for a participant to gain influence in an open source software development community, novices had to build an identity for themselves; he found established members of the community had to know who you were before you were given access to the source control repository, and a participant is more successful in having his work accepted by the community if he understands the political structure of the community.

One way to possibly combat this effect might be to put participants into each others' shoes. Palincsar et al. [5] found that "reciprocal teaching," where student and teacher taking turns switching roles in a dialogue on text comprehension, was an effective teaching strategy. The teacher first modeled activities related to text comprehension, such as asking questions about the content, or summarizing the content. Then they would switch roles and the student would play the role of "teaching" the material to the teacher. Students learned to model their thinking based on their teacher's actions. We can see that, in learning environments, the provision for flexibility in roles can definitely contribute to learning.

Currently, we have already built an online problem-solving environment called CoSolve. It is inspired by the idea of design as an instance of state-space search in classic artificial intelligence, as proposed by Simon [6]. The problem solving process is modeled as the

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Describe progress to date

building of a tree, in which individual nodes are states that represent solutions or partial solutions. Searching for a goal state along some path within a tree is analogous to searching for the state that represents the solution to a design problem. CoSolve users log onto the website and create or view these trees, apply an *operator* to any state to generate new child states (a new possible solution or idea), and comment on the state by writing an *annotation.* Users will be able to tag annotations with *thumbs-up, thumbs-down, question, information* etc. to indicate different types of comments they may make. For example, they can express users' support or criticism of a solution state.

3. Roles System Design

Explain why more work is needed

From a social perspective, a *role* defines the relationship between members of a group. The general function of roles is to *manage expectations between members of a group*. In software applications, users' roles have almost always been implemented as access control systems, i.e. as a way to specify permissions given to a user or group of users.

In order to scaffold new members' participation in an existing design team, they could be given specific roles to play in the team's process. For instance, a new participant may be reluctant to criticize an established member's ideas. However, if the new participant were specifically assigned the role of criticizing all ideas, perhaps they would feel more comfortable doing so. Additionally, it could be a way for them to learn the design domain as well as the team's working process. This is not only useful for new team members, but also for existing participants to gain perspective on others' ideas.

CoSolve does not have a system of user roles at the moment. The roles policy I am currently implementing automatically assigns one of four roles to each member of the group, and, at a pre-determined time (minutes to months, depending on the timeframe of the problem solving activity), switches the roles between group members. These four roles are called Brainstormer, Critic, Supporter, Team Wrangler.

All of these roles are meant to encourage participation. The Brainstormer role is intended to allow users to freely suggest ideas without self-censoring or criticism. The motivation behind the Supporter and the Critic roles is to help users evaluate the Brainstormers' ideas from either side, as well as encourage users to engage in dialogue with others in the group. The Team Wrangler keeps the group on task.

Technically, these will be built in to the CoSolve system by ensuring that only users of certain roles can access certain tasks. The Brainstormer can only generate new solution paths, but cannot annotate them. The Critic can only annotate with thumbs-down annotations, the Supporter only annotates with thumbs-up annotations. The Team Wrangler cannot directly support or criticize ideas, but instead validates others' annotations as being correctly tagged.

Describe plans for future research

4. Proposed Evaluation

To evaluate my system, I plan to conduct a user study in which teams of participants must use CoSolve to complete two, roughly one-hour design tasks. For one of these tasks, participants will be assigned roles in the roles system, and for the second, they will use CoSolve without role assignments. Ordering of these two conditions is randomized evenly between the participants. At the conclusion of the task, the participants' final solution designs will be evaluated by a panel of judges, to get a measure of the quality of their output. Participants will also be asked to complete a questionnaire comparing their experiences in the conditions; e.g., what level of participation did they felt they engaged in, their satisfaction with their team dynamics, and the design solution.

5. Conclusion

Through explicit role assignments, I hope to find a way to encourage everyone to take advantage of the possibilities of online collaborative problem solving.

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6. References

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