A Report on Participatory Workshops for the Design of Adaptive Collaborative Learning

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Abstract. This "work-in-progress" paper discusses the process of conducting participatory workshops during the design of an adaptive, collaborative learning system. We outline our methods for exploring group interaction, collaboration, and learning in an iterative series workshops. We conclude with a discussion of how the results of these workshops have influenced our ongoing work in designing an adaptive system for family groups in the museum.

Keywords: adaptive systems, collaboration, learning, participatory design

1 Introduction

Our current research project aims to create a museum guide supported by an adaptive group user model that supports different learning and interaction styles for a tangible-user interface system. Family groups will collaborate using various multi-modal tangible devices to collect information about artifacts in a museum and later combine the collected artifacts in order to construct a mutual understanding of their experience in the museum. As part of the design process for this system, we studied the patterns of collaboration and interaction in pairs of people engaged in a playful learning task. These workshops explored collaborative activities built around "treasure-hunt" and "puzzle" themes. The exploratory workshop results are being used to guide the design of both a group interaction framework and an adaptive model for group collaboration. This "work-in-progress" paper discusses the process of conducting the iterative workshops and the impact of the findings on our design thinking.

Participatory workshops are frequently used to explore design ideas in ways that are simultaneously analytic and generative. Further, workshops allow for focus on particular design situations within a larger design problem. When exploring complex interactions like an adaptive group learning system, workshops allow designers to explore specific facets of interaction rather than tackling the whole scenario at once [3]. Workshops are developed iteratively, each one constructed as a response to the previous results and a refinement of the original investigation. Ehn has contributed much research to this area and suggests that game playing within participatory workshops helps create opportunities for designers to learn from participants. In this light, the game becomes a tool for research [1].

2 Participatory Workshops

In this report of our project, we describe three sets of workshops, each of which asked pairs of participants to assume fictional roles and accomplish tasks and activities related to the roles. The workshops were conducted in rooms that had been "augmented" with paper tags that provided additional information on physical objects in the space. These paper augmentations were meant to mimic the information that would be available in the museum setting via the guide system. They functioned like a paper prototype allowing for quick changes and iterations throughout the workshops. The participant tasks typically required moving around the space, collecting specific tags and returning them to a central location. Throughout the course of all three workshops, we varied the amount of collaboration that was required or encouraged by the activity and task structure, in order to see what patterns of interaction would emerge from the different design decisions. The learning model used to structure the experience was Bloom's taxonomy: Remember, Understand, Analyze, Apply, Create and Evaluate [2]. Each individual task was designed to be at one of these levels, and part of what we were investigating was whether individuals felt an increase in challenge and learning level when the task level increased, and also how users on different learning levels could collaborate with each other while constructing knowledge as a group.

Workshop 1: The first workshop involved two different rooms: a workshop area with power tools, and a motion capture space with various types of cameras and projectors. This workshop focused on determining if the participants would notice if tasks got more or less challenging. We color-coded information tags and placed them on specific objects in each of the rooms, and instructed participants to only collect the color that they were assigned. The goal for the participants was to develop an understanding of the items in each room through collecting the information cards necessary to complete their assigned task, and then returning these cards to the facilitator. The tasks were designed to increase in difficulty along the first three cognitive levels of Bloom's taxonomy: Remember, Understand, and Apply. These levels differ in both the type of tasks assigned and how the task details are abstracted and described. If the participant returned the correct items according to the task, they were given a task on a higher level of the hierarchy. However if they would return items that were not in the range of appropriate answers, they stayed at the same level.

In our observations of this workshop we found that the participants brought back tags other than the ones intended when the tasks were designed. This occurred despite our efforts to constrain the possible answers via careful task writing and a limited set of available tags. It became clear that assessing right and wrong answers based on a given task would be a challenge for a system, since there were always unexpected but reasonable responses from the participants. Additionally, there was little group interaction observed in this first workshop, which we hypothesized was due to each participant being told to access information only from their assigned color. This limited the participant's ability to communicate and share information, or help each other complete tasks. Since we had constructed the tasks to be completed simultaneously by participants, timing was also an issue. For example, when one person finished early, they either had to take the next task and get out of sync with

their partner, or they stood around waiting, which made their partner more anxious. In the post-task interviews, we found that our learning model did not produce the desired effect, as participants reported perceiving no increase in the challenge level of the tasks. We used this feedback to improve upon and help focus our investigations in a second workshop.

Fig. 1. Text tags and puzzle pieces used for workshops 2 and 3

Workshop 2: In our second workshop, we introduced the idea of a shared activity, which the individual tasks contributed to, in the form of a puzzle (Fig. 1) that acted as a representation for their shared learning goal. Each puzzle piece had an image representing an item in the room, and the pieces were placed next to those items along with some explanatory text, as the tags had been in the first workshop. Any participant could choose any puzzle piece. We abandoned the color-co ded system that we felt inhibited group collaboration. The participants therefore had to negotiate who needed the specific piece more, as there was only one puzzle piece for each item.

The two participants had to work together to learn how to create an interactive installation in the motion capture space that involved six separate components (cameras, projector, etc.). Each of the six component systems was a section of the puzzle containing between two to four pieces that when assembled correctly, created a shared composite image. Additionally, tasks were no longer assigned by the facilitator, but were written out on cards and placed on a table, allowing each participant to select their own task. Each task corresponded to finding and assembling one of the 6 components. The puzzle itself could be constructed in multiple ways, with multiple pieces for one position in the puzzle. However, depending upon which puzzle pieces were combined to create a component, other sections could not be connected in a proper manner. Thus the participants had to negotiate how each individual section would be constructed so that all the sections could be combined.

We observed that participants started with tasks that involved items that were most familiar with them, and that the process of selecting a task was negotiated between the team members. In completing each task, the participants had two main approaches, i) looking for specific objects from a logical perspective, ii) going through the items in a trial-and error manner, checking for physical matches between the puzzle pieces. When an individual's task was completed, they would come back to the table and select another task, which would often place pressure on the other member who was still working on their task. This created a sense of competition between the team members, despite the activity being one of collaboration. In the post-task interviews, the participants noted that they enjoyed the use of the puzzle, and especially the idea that there was various ways it could be constructed, which helped them to reflect upon the activity itself. We purposefully did not include an adaptive learning element in this workshop, as we wanted to focus how to structure a basic collaborative activity. In the next workshop, we re-introduced an adaptive learning element.

Workshop 3: In the third workshop, we used the same puzzle and activity structure, but changed the way in which the participants could combine them and select tasks. The task descriptions were adjusted to create a learning scale, where some activities were simple and others were more complex, based on Bloom's taxonomy. The workshop provided fewer task choices for the participants, attempting instead to provide a level of challenge based on adapting to the participants' learning level. Also, instead of allowing a participant to choose another task once they were finished, we instructed them to help their partner to finish their task. This collaboration strategy was well received and there was little competition observed in the interactions. Having both the participants assembling the puzzles at the table at the same time after completing their tasks created a further opportunity for the two to communicate. In post-task interviews, the participant's reported sense of challenge corresponded to our intentions of manipulating the learning level by restricting their choices to tasks at a certain level.

4 Conclusions

We feel that through developing these workshops, we were able to gain particular insights into group collaboration and how to structure our adaptive model to create an engaging learning experience for our users. This process showed us the need for a shared understanding of a group activity and goal. In our first workshop, little collaboration occurred when the participants were simply carrying out individual tasks. Introducing the puzzle assembly helped make explicit the collaborative aspects of the workshop, despite it only being a representation for the more abstract learning goal. Through conducting these workshops, we identified three distinct types of collaboration: 1) an individual working on a solo task that contributes to a shared goal, 2) an individual working on a solo task with a second person helping them out, and 3) two members working on a shared task for a shared goal. In our third workshop, we observed all three of these collaborative behaviors at different times, and we are now better able to understand when, where, and how to employ adaptive models for collaboration. Finally we have found that it is important to start simple in developing workshop structures for group collaboration. We hope that this preliminary report can serve as an illustrative case study in the design of a complex adaptive, collaborative system.

References

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