Modified Field Studies for CSCW Systems

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Abstract

At the National Institute of Standards and Technology (NIST), we are in the process of instituting and assessing collaboration technologies for manufacturing applications. This position paper for the Computer Supported Cooperative Work (CSCW) Evaluation Methodologies Workshop briefly describes the modified field study method used to evaluate a groupware system supporting both synchronous and asynchronous communications over data for manufacturing research and operations teams. The paper also briefly describes the context in which the work is being performed, the groupware system being evaluated, data collection techniques and tools, an overview of the types of metrics used and some technical issues facing this endeavor.

Overview

This position paper for the Computer Supported Cooperative Work (CSCW) '98 Evaluation Methodologies workshop briefly describes the modified field study method used to evaluate a groupware system supporting both synchronous and asynchronous communications over data for manufacturing research and operations teams. With the ultimate goal of identifying ways to reduce deployment costs of effective groupware systems, we are evaluating the usefulness of two techniques to reduce the time to perform studies of groupware systems in manufacturing operations environments where the costs are high for conducting long term studies. The primary technique we are exploring focuses on deploying a groupware system in a comparable yet lower cost environment[1] than the target environment and using the experiences there to refine the system prior to deployment in the target environment. This work explores the use of groupware tools in manufacturing process analysis and in trouble-shooting scenarios[2] in an automated robotic welding context. The process analysis scenario, in this case a research environment, closely resembles the trouble-shooting scenario, an operations environment (where the costs are relatively high to deploy groupware technologies). The second technique involves employing data visualization tools for the groupware system log data to facilitate identifying particularly interesting aspects and patterns of collaboration. Using the log data visualizations, we expect to increase the effectiveness and efficiency of follow-up interviews with users and thereby increase the effectiveness and efficiency of the user-centered design process itself. The evaluation methodology used is a field study, which is modified in that preliminary work in the research

[1] Where "lower cost environment" is defined with respect to deployment costs.
[2] In this situation, the process analysis activity will be mimicked in the trouble-shooting activity.

environment will be used to "seed"[3] the groupware system prior to deployment in the operations environment.

Background

At the National Institute of Standards and Technology (NIST), we are in the process of instituting and assessing collaborative technologies for manufacturing applications. We are particularly interested in how collaborative tools can be used in manufacturing environments and how manufacturing practices will change as a result of their use. A challenge to implementing and assessing groupware technologies in the manufacturing domain, is that users tend to strenuously avoid involvement in any new information technology implementation that does not immediately improve getting products to market, especially studies of those technologies. Therefore, we are additionally interested in using, developing and testing methods for reducing the time needed and cost involved to do effective user-centered design and field studies of groupware systems in manufacturing operations environments where the costs are high for conducting long term studies. This work is a joint effort between NIST's Manufacturing Engineering Laboratory and Information Technology Laboratory.

Our current work is set in the context of automated gas-metal robotic welding. We have performed the initial requirements gathering and analysis relative to collaboration in a research scenario surrounding testing of automated robotic gas-metal welding equipment, welding processes, and the analysis of subsequent welds by a geographically dispersed team. The collaboration scenario in the research environment has a corresponding collaboration scenario in the operations environment where trouble-shooting problem welds require analysis by geographically dispersed teams of people with a variety of expertise. We are using Teamwave Workplace[4] as the primary collaboration system for this project, and have been working with the vendor to augment a special version of it to facilitate logging of events for our analysis. We have populated a set of rooms which illustrate the basic welding research scenario for educational and demonstration purposes. We are currently in the process of deploying this in our research environment, consisting of NIST researchers and their industrial partners.

Description of the CSCW system

Teamwave Workplace [Roseman] is a rooms-based[5] groupware system with a whiteboard backdrop. Rooms provide boundaries for data groupings and user interactions. Data organization within rooms is configurable by its occupants in how they organize various tools housing their data, such as file viewer, file holder, PostIt note, etc. The tool set provides for synchronous and asynchronous user interactions, but importantly, these interactions are in the context of relevant data. Figure 1 shows a screen shot of a room in Teamwave Workplace supporting the analysis activities of a test weld. The left-most portion of the room shows summary status and navigation information, the center portion shows data regarding a representative "good" weld and the right

[3] To facilitate user training, actual data will be inserted into the groupware system based on projected use.

[4] Teamwave Workplace is a commercial product identified in this document for the purpose of evaluating computer-supported cooperative work technologies. This identification does not imply any recommendation or endorsement by the National Institute of Standards and Technology.

[5] A room metaphor is employed to segment human interactions and data groupings.

portion shows tools containing information for a “bad” weld. At the bottom of the window is an in-progress chat session regarding the analysis of the latest weld data.

Evaluation goals

As previously mentioned, we would like to reduce the time, and therefore expense, of lengthy user-centered design and deployment field studies, while maintaining the integrity of the user-centered design concept for effective deployment of groupware technologies in manufacturing environments. Additionally, we are interested in how manufacturing practices will change as a result of the introduction and effective use of these technologies. To understand the impact of these technologies, three major activities must be performed and documented, they are: 1) understand the targeted manufacturing practices prior to the introduction of groupware technologies, 2) measure the ‘effectiveness’ of those technologies once introduced, and 3) assess how the manufacturing processes change as a result of those technologies. We are also interested in best practices for the introduction and deployment of these technologies.

Figure 1: Teamwave Workplace with welding data

Evaluation methodology

We are using a modified field study methodology to support our evaluation goals. Specifically, we are using what we learn during the requirements gathering and process workflow documentation phases to "seed" the groupware system with relevant artifacts (data and tools) prior to its deployment for the users. To accomplish this, we are populating a set of rooms with artifacts representing our understanding of the process workflow, relevant data, and anticipated collaboration points. Some initial training and/or demonstration of the system with this "seeding" will be performed with the users. We expect this "seeding" to lessen the time it takes new users to understand and effectively use the system in their work environment. It is expected that this "seeding" will be done in the operations environment as well. By using automated logs, we will be able to see how closely our initial work corresponds to how real users use the system, and we will be able to track the changes made to rooms as the system is used.

Data collection techniques/tools

We are collecting data from a variety of sources:

- user interviews,
- direct observations,
- an email list for the welding researchers, and
- Teamwave Workplace's augmented log data.

We are in the process of building a data visualization tool to help assess the log data because of the log data's relatively fine granularity. The visualization shows room occupation, tool use for each user and where synchronous and asynchronous use occurs. We expect this data visualization tool will lessen the evaluation time required to identify and understand pertinent aspects and patterns of usage. We should also be able to identify irregular use patterns from the visualization and can follow up on those in user interviews. Figure 2 depicts some sample visualizations of the log data[6], they are provided to give the reader a feel for the types of visualizations completed to date. The visualization on the left shows tool usage (all types) by users as they occupy different rooms. The visualization on the right shows a different view of tool usage by users as they occupy different rooms. All visualizations are on a time scale relative to other events in the log and have flexible zooming of those time scales.

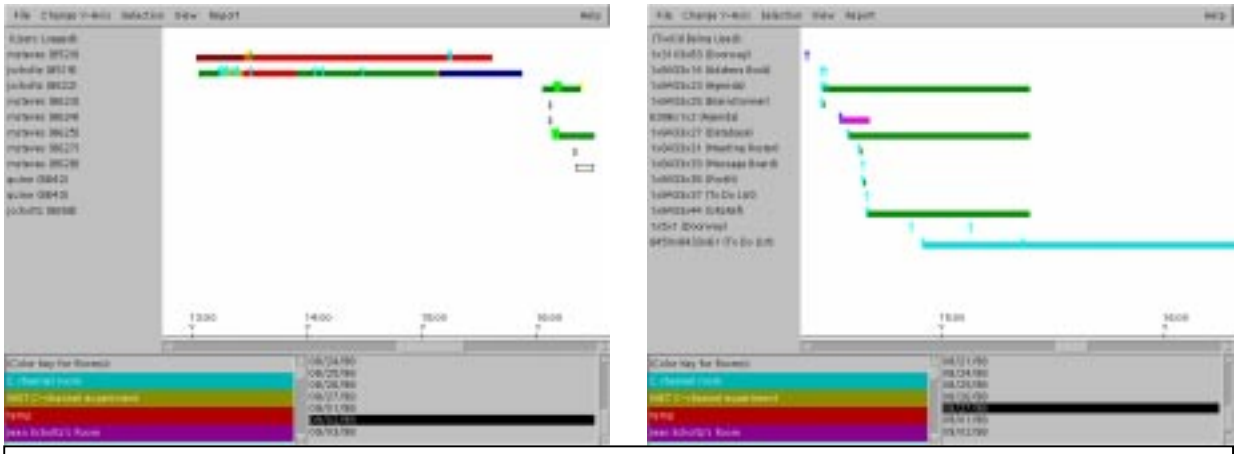

Figure 2: Sample log data visualizations

Metrics

The following categories of metrics being used in the evaluation:

- General, e.g., How is the system being used?
- Communications, e.g., When are synchronous vs. asynchronous communications used?
- Navigation, e.g., How (well) are users getting around the system?
- Room and tool use, e.g., How are various rooms being used and what sort of data is located in each? Is there an efficient organization scheme for data in and between related rooms?
- Collaborations relative to workflow, e.g., Can we characterize the collaborations relative to welding roles and/or to workflow?

[6] Color is an integral part of these visualizations. Intrepretability is significantly diminished in non-color copies.

- Critical measures of success, as defined by the user population.

We expect to use the groupware's log data to help us identify patterns of use and usability issues to specifically target some usability questions during user interviews. One very pertinent issue for us is how to recognize effective characterizations of asynchronous interactions. For this type of groupware system, some experts define asynchronous collaboration as the act of leaving artifacts in a room for another user's later use [Greenberg 98]. We feel it is important from an evaluation aspect to differentiate if asynchronous communication is intended to facilitate the relatively immediate task at hand facing the group, or it is intended to facilitate some future task, e.g., storing artifacts for follow-on data reuse tasks, such as user training on weld anomalies of particular welding work cell configurations.

Conclusion

Using traditional and innovative techniques and methodologies, we plan to evaluate CSCW technologies for selected manufacturing scenarios. NIST is conducting this work to develop deployment guidelines for manufacturing enterprises, to assess how manufacturing practices will change as a result of collaboration technology use and to determine where these anticipated changes in manufacturing practices flag future data interchange standards requirements. This case study employs a modified field study methodology as the evaluation methodology. The methodology is modified in that the groupware system is "seeded" with pertinent artifacts prior to deployment for users. It is expected that this "seeding" will facilitate users' effective use of the groupware system. Further, in addition to more traditional techniques of observation to help evaluate groupware usability (direct observation, user interviews, and email monitoring), we are developing a log data visualization tool to help assess how the groupware system is being used to more quickly hone in on patterns of groupware system use and collaboration. We expect these innovations to improve the effectiveness and efficiency of the user-centered design principle for groupware.

ACKNOWLEDGMENTS

We particularly thank Dr. John Tang, of Sun Microsystems, for his contributions on this project during his tenure as a guest researcher at NIST and after.

This work is funded by the Systems Integration for Manufacturing Application (SIMA) program, Advanced Technology Program (ATP) and the National Advanced Manufacturing Testbed (NAMT) at NIST, with additional funding by the Defense Advanced Research and Projects Agency (DARPA).

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