CHI2006 Reality Testing: HCI Challenges in Non-Traditional Environments Workshop Position Paper

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Abstract
Using computers to enhance performance in non-traditional environments presents a number of challenges related to testing. This paper describes my research experience in non-traditional environments, and the Maintainer's Electronic Performance Support System (MEPPS™) as a possible case study for the CHI 2006 Reality Testing: HCI Challenges in Non-Traditional Environment Workshop.

Keywords
Non-Traditional Environments, Evaluation Techniques, Ubiquitous Computing, Usability Testing, Performance

ACM Classification Keywords
H5.2 [User Interfaces]: Evaluation/Methodology

Introduction
During the development of MEPSS™ over the past 5 years, we overcame several challenges in the areas of design inquiry, inspection, and testing methods in non-traditional environments.

MEPSS™ for P-3 is an excellent case study for the workshop, and way to discuss the methods we used and the advantages and disadvantages of each method. MEPSS™ is a multi-platform decision support system developed for assistance in maintenance technician job performance. The system was originally designed to improve the troubleshooting of the Navy's P-3 engine driven compressor, a high readiness degrader and cost driver for this platform. MEPSS™ provides alternatives to traditional maintenance procedures through the use of:

- Online manuals to replace bulky paper-based manuals
- Decision-support systems
- Training modules and procedure diagrams
- Communication systems and knowledge capture
- Historical Maintenance Data

For testing purposes and operational use, the system was hosted on rugged laptops.

Research Experience

During testing we encountered several hurdles. Some of the major challenges include the test environment, safety requirements, and data capture methods.

The test environment consists of the runway, hangar, aircraft, and work center. Several challenges were present in the test environments. On the runway, environmental issues like wind and rain caused interruptions during tests. The hangar also presented another set of issues including alarms and incoming and outgoing planes. The aircraft proved to be the most difficult test location due to the limited amount of space in the cockpit. Of the four test locations, the work center was the best, but it had numerous issues including frequent interruptions from other maintenance personnel and shift changes.

Safety was also a major concern when around the aircraft. For example, it was important to never walk underneath aircraft propellers or use a cell phone inside the hangar.

Recording the results of tests was a significant challenge, since voice recording devices were not allowed during any of the studies. We developed codes that we later translated to help us efficiently record data.

We executed several studies during the time spent iteratively designing and testing the system at onsite visits.

Evaluation of System while Completing Real-World Task
The ultimate test of the system was evaluating how well MEPSS™ helped maintenance technicians as they completed real-world tasks. The most important challenge in performing this type of evaluation was logistics. The work center process for the majority of tasks consists of the maintenance technicians waiting for a plane to come into the hangar with a problem. Once a plane entered the hangar with a problem, the appropriate maintenance technician or team was dispatched. So the time, repair duration, and location of the tests were usually unknown. These tests occurred in the aircraft and frequently employed the think aloud technique.

Formal Usability Inspection

We executed standard usability tests in which maintenance technicians completed scripted tasks representative of daily work in the work center. The majority of the tests were completed in the work center and on the aircraft. Questionnaires and interviews were often part of the usability studies.

Figure 1: Maintenance technician Completing Study

Cognitive Walkthrough

We used cognitive walkthrough to uncover the maintenance technicians' mental models. These walkthroughs were all performed in the work center.

Pluralistic Evaluation

Pluralistic evaluation was effective because two or more maintenance technicians evaluating the system concurrently were more likely to think aloud while executing basic tasks. The pluralistic evaluations were performed in the work center.

Figure 2: Maintenance technicians completing pluralistic evaluation.

Surveys

We also solicited feedback in the form of surveys. For example, we would leave the system in the work center for 2-4 weeks at a time, so they could work with the system in their environment without a test monitor. Maintenance technicians were encouraged to anonymously enter feedback directly into the system. This proved to be a very effective way to get feedback.

Conclusion

The workshop will provide a forum to share lessons learned during execution of the studies above, and use gained experience as input into a framework for conducting studies in non-traditional environments.

Author Background

Keesah Hall works as a Research Scientist at Georgia Tech Research Institute's Logistics and Maintenance Applied Research Center. Currently she designs, develops, and implements performance support technologies that incorporate smart searching capabilities, decision support technologies, communications tools, training, troubleshooting and diagnostic tools, and knowledge/content management tools.

She completed a Bachelor of Science in Computer Science at Spelman College in Atlanta, GA, and a Master of Science in Human-Computer Interaction at Georgia Institute of Technology. Her graduate-level research at Georgia Institute of Technology focused on performance support technologies and content management systems.

Citations

[1] Lafond-Favieres, V., Hall, K., Medlin, B., Wagner, R., Welch, G. *Designing Innovative Electronic Performance Support Systems*. 2003 Society of Electronic Performance Support Systems Conference. 2003.