

Usability Test of a Siemens Premium Ultrasound System



With over 160 years of innovation, Siemens Healthcare is one of the world's largest suppliers of technology to the healthcare industry and a leader in medical imaging, laboratory diagnostics, and clinical IT.

Introduction

Siemens Medical Solutions USA, Inc. Ultrasound Business Area made a concerted effort to improve the overall usability of their premium ultrasound systems, the new ACUSON S Family™ of ultrasound systems, HELX™ Evolution with Touch Control. The systems utilize advanced technologies and diagnostic tools to expand clinical capabilities. Siemens felt confident that they had achieved their goals and wanted to measure users' performance and determine user satisfaction with one of these systems, the ACUSON S3000™ ultrasound system. In order to accomplish this, Siemens needed to be able to measure the outcomes of their efforts in an objective way.

Macadamian's 10+ years of experience with usability testing and knowledge in the healthcare domain made the firm an excellent candidate for the job. Our user experience researchers are experts at working with clinical teams and technologies. "After talking with many user experience companies, we felt Macadamian had the expertise to deliver on our requirements," says Doug Younger III, Global Director of Marketing, General Imaging/ Radiology Segment, Ultrasound Business Area, Siemens. The pace at which projects are delivered and the quality of work contributed to Macadamian being selected to work on this project.

Ultrasound systems should support a process that provides a high level of usability for all users. At the request of Siemens, user experience researchers at Macadamian evaluated the usability of the Siemens system by conducting a comprehensive usability test.

The usability test was conducted in a third-party usability research lab set up to resemble a clinical environment for sonographers. After a careful screening process, 20 sonographers were recruited to act as test participants. Participants had between 5 - 40 years of experience and regularly conduct abdominal ultrasound exams. None of the participants had prior experience with the Siemens system.

“I have enjoyed working with Macadamian’s user experience and marketing teams. Everyone has been extremely professional and passionate in learning and studying about healthcare and ultrasound. I also saw the team rigorously execute our study protocol with the highest integrity to ensure the study was fair and results were collected objectively.”

— Douglas Younger III, Global Director of Marketing, General Imaging/ Radiology Segment, Ultrasound Business Area, Siemens

Macadamian researchers directed, filmed, and edited a training video that participants watched prior to the usability test. This video ensured each participant received consistent training. After watching the video, each participant was given the same amount of time to become familiar with the system.

Following the training, they completed 11 common tasks in abdominal sonography, which included the following:

- adding and clearing annotations and measurements,
- adjusting measurement calipers and annotations,
- invoking and optimizing a dual image, and
- using color and Doppler modes to optimize and measure waveforms.

Macadamian researchers worked with expert sonographers to formulate these representative tasks. These experts were not the same individuals as the test participants in the study.

During the usability test, the researchers captured metrics for effectiveness, efficiency, and user satisfaction. To assess the effectiveness of the system, task success and error rates were collected and the number of deviations measured efficiency of use. To assess the satisfaction of the system, Macadamian collected ease of use ratings after each task and qualitative feedback.

The metrics are defined as follows:

- 1. Task Success:** A participant achieving the correct outcome for a task with no assistance.
- 2. Error:** An unintended action, mistake or omission a participant makes while attempting to perform a task. The action that results in an error is considered, all actions to correct an error are considered deviations.

"I had no idea how to do [this task] and I figured it out the first try so the visual layout on the touch screen was really intuitive."

— Usability test participant #16

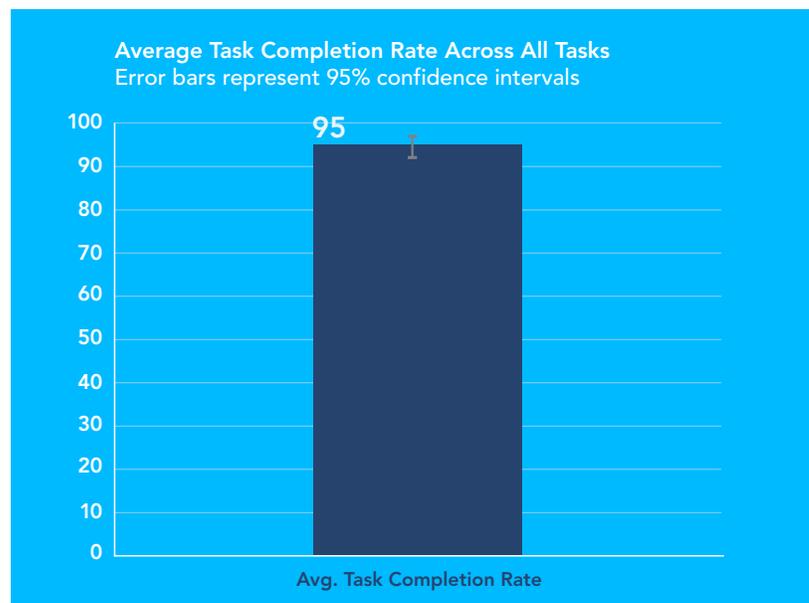
3.Deviation: An action taken by a participant that deviates from the most optimal way of performing a task.

4.Satisfaction Rating: A rating of a participant’s impression of the ease of use of the system after each task.

Additionally, at the end of the usability session, participants were asked to complete the System Usability Scale questionnaire. The questionnaire is standard practice in usability testing where the participants are asked to rate various aspects of the system on its usability and learnability.

The data from the study was analyzed and reported in accordance to ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports, following the same reports as those submitted to American Office of the National Coordinator for Health Information Technology.

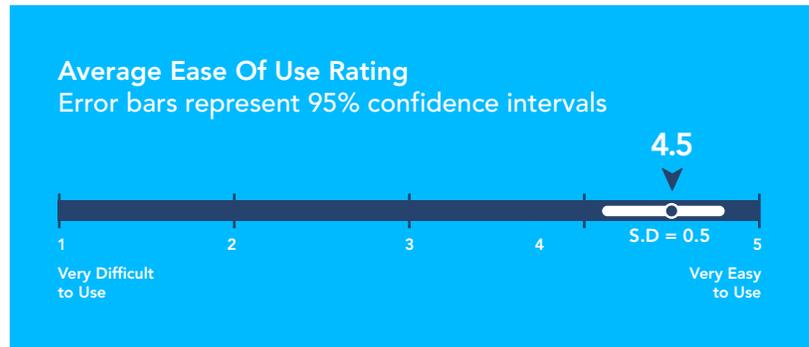
In terms of effectiveness, the results indicated that with the Siemens system very few errors were observed and tasks had high completion rates.



"I never really liked the touch screen but I really like this one. It's intuitive."

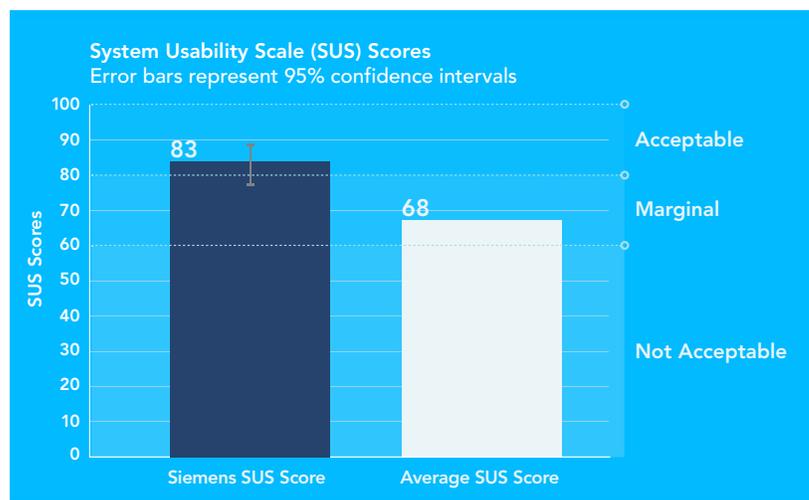
— Usability test participant #12

To gather insights about the participants' attitudes towards the system, qualitative feedback was captured as well as post-task ease-of-use ratings. The Siemens system scored very high for ease-of-use and also received a large amount of positive qualitative feedback.



Regarding efficiency, few deviations were observed. For example, navigating to an incorrect touch panel or interacting unnecessarily with the interface.

At the end of each usability test, the sonographers completed the industry standard System Usability Scale questionnaire to measure perceived system usability and learnability. The Siemens system scored very high with an overall score of 83 out of 100. Scores over 80 are considered well above average while scores below 60 tend towards poor usability. An average score is 68¹.



¹ Sauro, J. (2011). A Practical Guide to the System Usability Scale. Denver, CO: A Measuring Usability LLC Publication (p. 37).]

Siemens found the results of the study favorable and the data collected will empower the Siemens Ultrasound Sales Team when reaching out to potential customers. For the Siemens Ultrasound Human Factors Engineering team, the usability test identified the areas that would help improve the interactive experience with the system and led to the discovery of design recommendations for future releases. Participants also identified additional aspects of the ultrasound system that were out of scope for this study which informed the team of areas to evaluate in the future (e.g. image quality).

Macadamian's success with this research is leading towards similar usability studies for the Siemens Ultrasound Business Area as well as other healthcare divisions within Siemens. The data resulting from this research will also be used to support future research in the Ultrasound Business Area.

Thank you.

m a c a d a m i a n

Macadamian is a full service software design and development firm. From product ideation to market ready – and everything in between, we provide a complete range of usability, design and engineering services. From big consumer brands to enterprise, telecom, and healthcare; our solutions are founded in design that thinks of the customer first while leveraging the cloud, Big Data, and Internet of Things to deliver context-aware and adaptive experiences.. The result? Engaging software solutions that have a direct impact on the bottom line.

Visit macadamian.com

Call 1-877-779-6336