



Versana Balance™ with Whizz Comparative Usability Study

Introduction

In a usability study, participants worked with GE HealthCare's Versana Balance system, both with and without the automatic image optimization function – Whizz. Whizz image optimization is available in B-mode, Whizz color, and Pulsed/Continuous wave Doppler. Twenty-four physicians experienced in performing abdominal and carotid artery ultrasounds performed two scans with and two scans without Whizz on a volunteer patient and responded to questions about impressions of the Versana Balance system and Whizz. Following the completion of the sessions, task times, keystrokes per task, and the subjective data were evaluated. This study was carried out by Use-Lab GmbH, an independent human factors consultant agency on behalf of GE HealthCare (GEHC).

Abstract

Objective

The comparative usability study described in this white paper was performed to evaluate potential advantages of the Whizz function, including time savings, fewer keystrokes, less effort, higher satisfaction and easy learning. Furthermore, the study considered advantages of Whizz compared to products participants used at their workplace (competitor and GEHC) and aspects of the overall usability of the Versana Balance systems.

Methodology

24 physicians experienced in performing abdominal and carotid artery scans performed a total of four scans consisting of five tasks each on a volunteer patient. Each participant performed two scans with and two scans without Whizz; the order of the conditions (with or without Whizz) was alternated between participants as was the order of scans. Tasks included B-mode, Whizz color, and Pulsed/Continuous wave Doppler scans. Whizz will continuously optimize the brightness, contrast and uniformity of B-mode images when scanning different tissues. Whizz color optimizes the color flow by adjusting color flow gain and frequency automatically when activated by user. Whizz in Pulsed/Continuous wave Doppler (ASO: Auto Spectral Optimization) auto adjusts the velocity scale/pulsed repetition frequency (live imaging only), baseline shift, and invert. After each scan, participants responded to questions about workload; after working with each

mode, they responded to additional questions about their experience; finally, after completing all scans, they were asked to compare working with Whizz versus without, as well as compared to the system they regularly work with. Following the sessions, Use-Lab GmbH performed video analysis to assess task times and keystrokes per task.

Results

77% of physicians who used a competitor system and experienced the Versana Balance system would prefer working with Versana Balance with Whizz over their current system. 86% of physicians who experienced the Versana Balance system think that targeted morphological features and anatomical structures are clearly visible. 95% of physicians who experienced the Versana Balance system think that the system's design has good ergonomic features. 100% of physicians who experienced the Versana Balance system agree that it would be easy to train new users on the Versana system. 78% of physicians who experienced the Versana Balance system think that Whizz was reliable, based on responses on a 5-point scale.

Statistical comparison showed that participants required significantly fewer keystrokes with Whizz than without Whizz ($p < 0.001$, Wilcoxon signed rank, one-sided) and were significantly faster with Whizz than without Whizz ($p < 0.05$, Wilcoxon signed rank, one-sided). Whizz allowed participants to be up to 38% faster.

Procedure

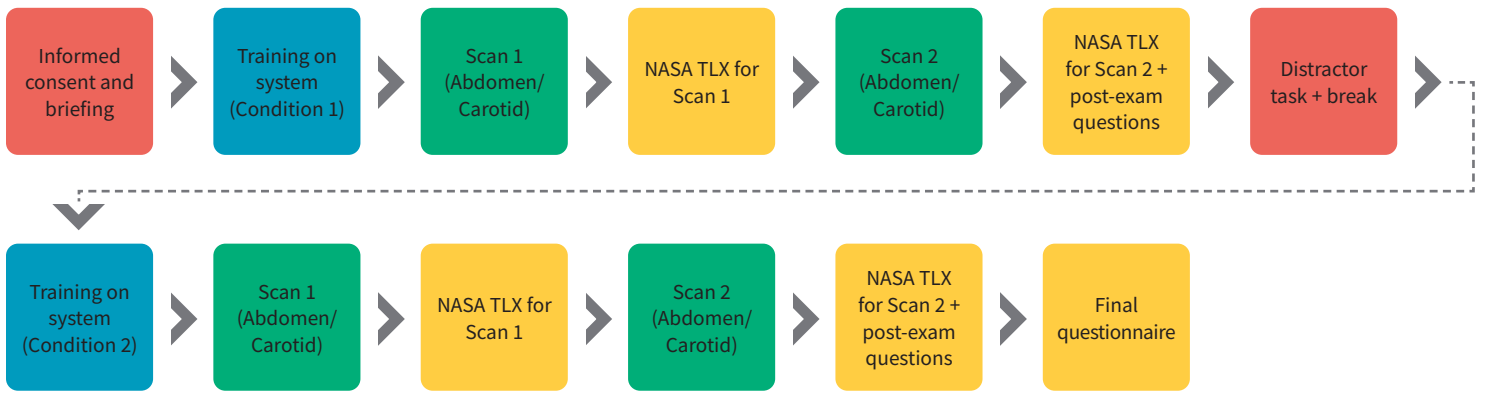


Figure 1: Procedure carried out with each participant.

Background

The study hypothesized that the Whizz function of the Versana Balance system automatically optimizes image quality to save user’s time. This study was conducted to evaluate time-saving potential as well as other possible advantages of using Whizz and the Versana Balance system.

Participants

24 physicians who perform abdominal and carotid ultrasound exams participated in the study. One participant was excluded from the objective and subjective analysis due to changes following their session. Of these 23 physicians, 56% were experienced with competitor systems.

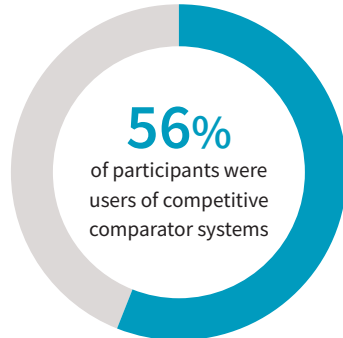


Figure 2: Participants split based on brand experience.

Two further participants were excluded from objective analysis due to changes after their session and their inability to stay on task, respectively.

The 21 participants included in objective analysis performed a median of 4 carotid (range: 0-35) and 22 abdominal (range: 4-150) scans per month.

Methodology

This usability study was single-blinded. GE HealthCare was not given access to personally identifiable information.

This study was carried out and results were analyzed by an independent third party, Use-Lab GmbH, who also recruited participants and a healthy volunteer. The study took place in Use-Lab’s simulation lab in Steinfurt, Germany.

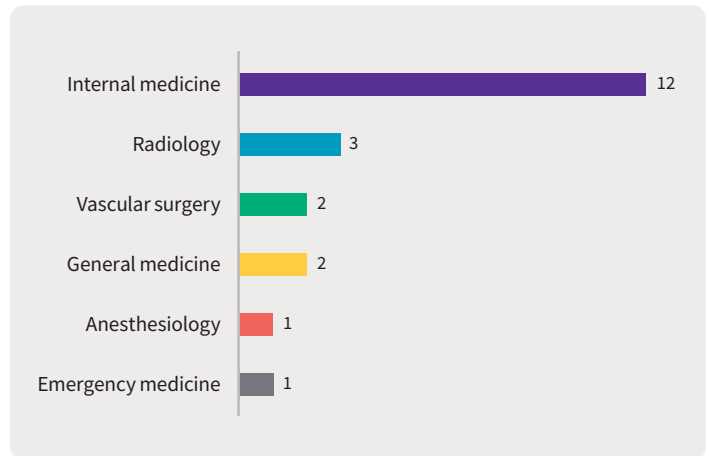


Figure 3: Participants included in objective analysis split based on department.

Workflow

Figure 1 shows the procedure performed with each participant.

Training consisted of an explanatory video in English provided by GE HealthCare that showed participants how to work with the Versana Balance and included or did not include Whizz and a touchscreen, as appropriate.

Exams: Participants performed a total of ten scanning tasks each. Each task consisted of multiple images to be taken. Images could be B-mode, Color Flow, or Color Flow with Pulsed wave Doppler images.

Scan protocol

Right upper quadrant

- Liver longitudinal (6 B-mode images)
- Liver transverse (6 B-mode images)
- Vascular anatomy of the liver (2 B-mode images; 1 Color Flow image; 1 Color Flow with Pulsed wave Doppler image)
- Gallbladder (4 B-mode images)
- Right kidney (2 B-mode images; 1 comparison with echogenicity of liver)

Unilateral right carotid

- Transverse (3 B-mode images)
- Longitudinal (4 B-mode images)
- Longitudinal (4 Color Flow images)
- Longitudinal (6 Color Flow with Pulsed wave Doppler images)
- Vertebral artery (1 B-mode image; 1 Color Flow image; 1 Color Flow with Pulsed wave Doppler image)

All participants performed all tasks twice: once with and once without Whizz; the order of conditions was alternated between participants as was the order of exams. Half of participants worked with a Versana Balance system with a touchscreen; half with a system without a touchscreen.

Tasks were defined as beginning with the first interaction of a participant with the touchscreen monitor or ultrasound keys after the moderator had given a task and ending with the press of the button to take the final image of a task. These definitions were used for time and keystroke counting. If a participant said they were not able to find the anatomy in a given task or that they had confused longitudinal and transverse, the task was excluded from analysis.

Keystrokes were defined for each interactive element of the Versana Balance keyboard and touchscreen. After a test session was completed, a Use-Lab team member counted the keystrokes for each task; 2 Use-Lab team members were considered “qualified” to count keystrokes following an analysis of two participants each resulting in an inter-rater reliability of 0.8. Keystrokes are compared within task within participant.

Similarly, times were assessed per task. Tasks in which a participant spoke more than usual or posed many questions were excluded from the time analysis. Two Use-Lab team members were considered “qualified” to assess times following an analysis of participants each resulting in an inter-rater reliability of 0.9. Times are compared within task within participant.

NASA TLX questionnaires in modified form were provided after each exam, leading to participants filling them out a total of four times.

Post-exam questionnaires consisted of three questions relating to participants’ experiences of the system they had just worked with.

Break time consisted of a distractor task and an actual break – about 15 minutes each. The distractor tasks asked participants to read an unrelated user manual and answer questions about it.

Final questionnaires asked participants to compare the Whizz and non-Whizz conditions with each other as well as the Versana Balance with Whizz against the product they most often used at work. Questions focused on efficiency, time saving, general usability, ease of learning for new users, and image quality. Questions posed on 4- and 5-point scales are evaluated with top-box analyses, by which the two most positive options are grouped together.

Results

Analyses led to a total of 172 evaluable task-pairs for time-on-task and 177 for keystrokes (task performed in both conditions). At least 4 paired tasks per participant were included with a maximum of 10 paired tasks.

Whizz saves time

Comparison showed that participants performed tasks statistically significantly faster with Whizz than without Whizz ($p < 0.05$, Wilcoxon signed rank, one-sided). Whizz allowed users to perform tasks up to 38% faster.¹ 60% of physicians who experienced the Versana Balance system think that the amount of time saved by using Whizz allow the physicians to focus on other tasks.

“Image optimization without loss of time and without detailed knowledge of the device function/operation/key assignment.”

– Gastroenterologist with 15 years of ultrasound experience

Whizz saves keystrokes

Comparison showed that participants required statistically significantly fewer keystrokes with Whizz than without Whizz ($p < 0.001$, Wilcoxon signed rank, one-sided). Looking at physicians with low experience (26 tasks; defined as less than 1 scan of the carotid artery per week on average), physicians needed an average of 18% fewer keystrokes with Whizz than without it.

“Automatic adjustment to situation by pressing only one button; no manual adjustment of many wheels (time saving; better image; no slipping of image).”

– General practitioner with 8 years of ultrasound experience

Whizz is reliable and brings a clinical advantage

Nearly 8 out of 10 (78%) of physicians who experienced the Versana Balance system think that Whizz was reliable, based on responses on a 5-point scale. Additionally, 60% of physicians who experienced the Versana Balance system think that Whizz could increase their diagnostic confidence, based on responses on a 4-point scale.

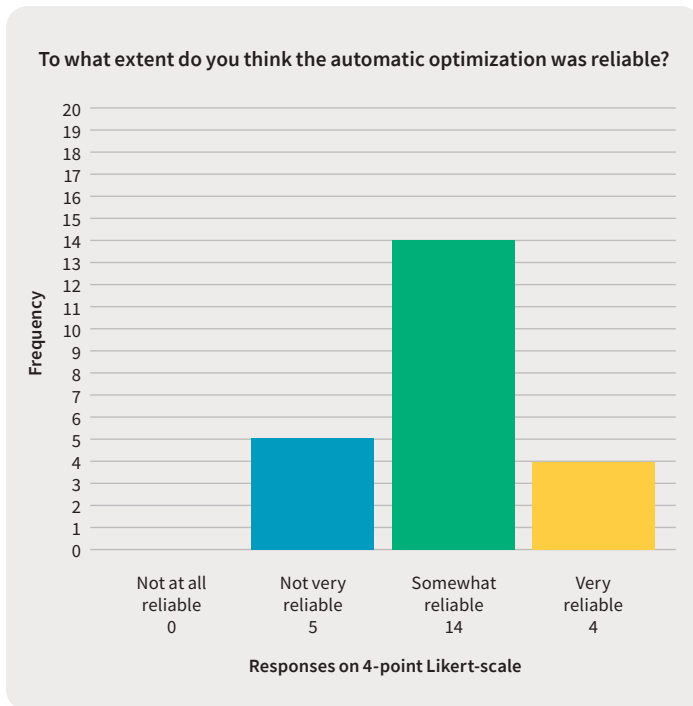


Figure 4: Participants' views on Whizz's reliability.

Versana Balance with Whizz supports new users

100% of physicians who experienced the Versana Balance system think that it would be easy to train new users on the system.

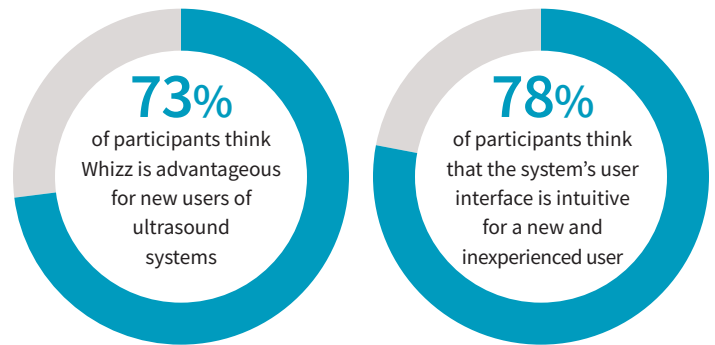


Figure 5: Participants' views on new user training

“Makes image optimization possible even without closer knowledge of the equipment.”

– General practitioner with 7 years of ultrasound experience

“No optimization software used so far. Usability is intuitive and simple.”

– Gastroenterologist with 15 years of ultrasound experience

Versana Balance has good ergonomic features

95% of physicians who participated in the study agree that the Versana Balance system has good ergonomic features. 61% competitor system users thought that Versana had better ergonomic features than the system they worked with most often after using Versana.

The Versana Balance touchscreen is highly responsive

90% of physicians who experienced the Versana Balance system with touchscreen think that the touchscreen is responsive. After working with the Versana Balance touchscreen, 83% of users of competitor systems thought the Versana Balance touchscreen was better than the one they usually work with.

Whizz has excellent image quality

91% of physicians who experienced the Versana Balance system think that the overall image quality is good.

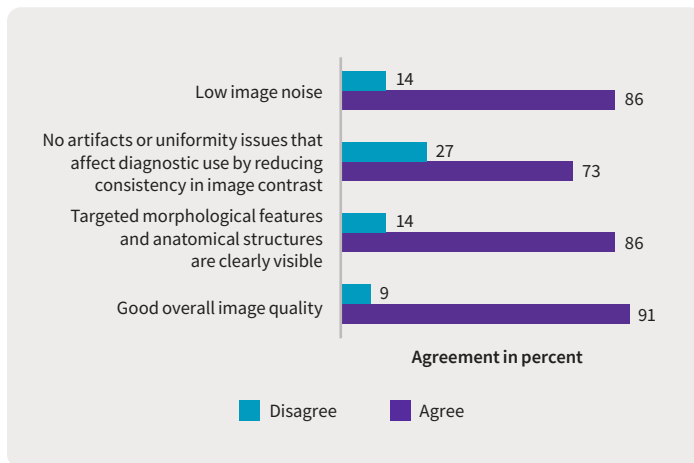


Figure 6: Participants' views on image quality when working with system with Whizz.

“Better image quality than the function I worked with previously.”

– Internist with 3 years of ultrasound experience

“Better color adjustment due to shaper contrasts; thus, individual structures are better highlighted; better recognition of structures; faster recognition of structures here especially of intra-abdominal structures.”

– Internist with 3 years of ultrasound experience

Users prefer Whizz

Which system would you prefer to work with?
(Non-GE HealthCare users only)

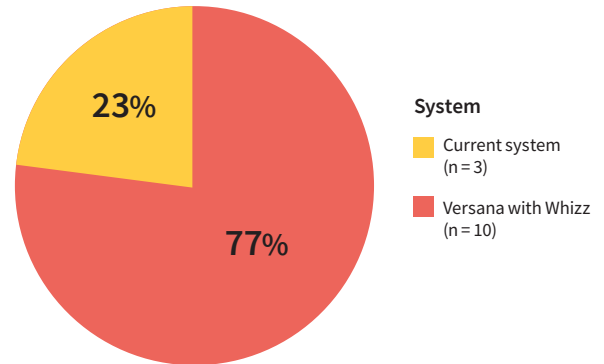


Figure 7: Participants' views in working with Versana with Whizz over their current system.

“The brightness did not have to be turned up again after each image optimization. This is a good advantage.”

– Anesthesiologist with 5 years of ultrasound experience

Conclusion

The results of this comparative usability study show that users appreciate the Whizz function and prefer to work with Versana Balance with Whizz. The Versana Balance Whizz function, which automatically optimizes image quality, allows for a more efficient workflow by helping users save time during procedures, and is helpful for new and less experienced users. The system is easy to operate, and new users can be easily trained on the system. Working with Whizz objectively and subjectively saved time and the Versana Balance system was perceived as having good usability.

Footnotes:

1. Based on 17 physicians who completed a transverse scan of a volunteer patient's carotid artery in B-mode, 25th and 75th quantiles: -56.34% and 56%.

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