Optimizing Instructor GUI for Night Vision Training: An Eye Tracking Evaluation of VTIGS Usability

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Introduction

The Virtual Terrain Image Generation System (VTIGS), developed by AMST Systemtechnik GmbH, is used to configure night vision training scenarios for pilots wearing Night Vision Goggles (NVG). It features a dual-screen GUI setup, with one screen for scenario control, the other for terrain visualization. While the interface is designed for aviation-trained personnel, it is increasingly used by individuals without aviation backgrounds. This study investigates how perceived complexity and usability differ between these two user groups, using a mobile eye tracking (VPS 19 of Viewpointsystems, Figure 1) to capture attention distribution and interaction behavior.

Research Questions

1. How do users interact with GUI elements such as visibility settings and scenario adjustments? What visual attention patterns emerge during these interactions?

2. How does non-aviation personnel's performance compare with aviation-related personnel in terms of using icons and navigating the menu structure?

3. Based on the insights from the first two questions, what design en hancements can be recommended to improve clarity and reduce the complexity of the GUI for a broader field of users?



Figure 1: VPS 19 eye tracking device used in the study [1].

Methods

A total of 15 participants from AMST, representing both aviation and non-aviation domains, were recruited for this study. Using the VPS 19 mobile eye tracking glasses from Viewpointsystem GmbH, participants completed three structured tasks within the VTIGS interface. The setup included two displays: a primary screen for control and a secondary screen for terrain output. Eye tracking data was analyzed using iMotions software, with Areas of Interest (AOIs) defined across both screens (Figure 3).
Key eye tracking metrics, such as fixation duration, dwell time, and gaze transitions were extracted. Pre- and post- experience surveys captured demographic data and perceived complexity.

Figure 2: Current VTIGS GUI in dark mode [2].

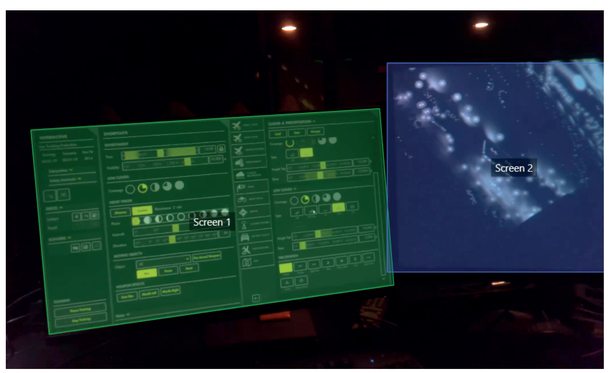


Figure 3: Dual screen setup of VTIGS instructor station with AOI overlay in iMotions.

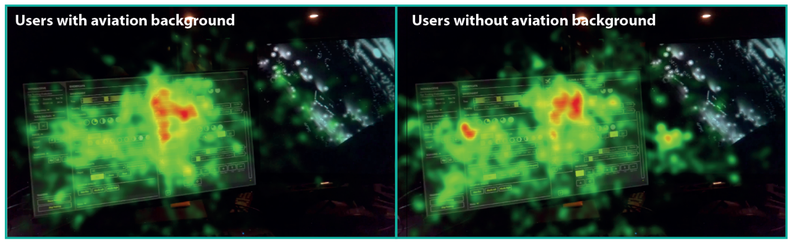


Figure 4: Heatmap comparison of gaze behavior during mid-flight adjustments, aviation-related personnel vs non-aviation-related personnel.

Results

Users with aviation background completed tasks faster and with more focused gaze patterns. In contrast, non-aviation users showed longer fixations, more revisits, and greater visual attention on the output screen, indicating possible increased cognitive load. These patterns were consistent with higher self-reported stress and usability confusion, confirming the need for clearer labels and interface simplification.

Discussion

The study showed that small interface details, like unclear labels or icon designs, can create major usability issues, especially for non-aviation users. Differences in attention and task performance reflected distinct mental models between user groups. Triangulating survey feedback, task data, and gaze metrics helped identify key pain points and inform targeted interface improvements.

Conclusion

This study evaluated the VTIGS instructor GUI using eye tracking, surveys, and task-based testing to uncover usability challenges across aviation and non-aviation users. Key differences in task performance, attention patterns, and perceived complexity revealed how user background shapes interaction. These findings highlight the importance of adapting GUI design to support a broader range of user expertise.

References

[1] Viewpointsystem. (2022). Vps 19 product sheet. Product sheet, Viewpointsystem GmbH.
[2] AMST-Systemtechnik GmbH. (2022, December). Virtual terrain image generation system - user manual (Rev. 3.1 ed.)