Using Multisensory Interactive Storytelling to Broaden Recruitment Efforts

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ABSTRACT

Organizational recruitment efforts represent a sizable, multilayered process, and high attrition rates make that process even more significant. Large institutions, such as the Department of Defense (DOD), require a steady influx of young recruits to meet their operational requirements. While traditional recruitment approaches are still practiced, it is necessary to innovate and create a new generation of recruitment tools with an extensive reach while being cost-effective, engaging, and responsive to the needs of new audiences. Our research effort involved designing and developing a new recruitment tool that uses inexpensive infrastructure and offers an immersive, multimodal, interactive experience that can be delivered on a massive scale; we call it *Soldier Sight*. The emphasis was on the recruitment needs of the U.S. Army, and the same approach can be used for any DOD service or civilian organization. The primary approach was to use interactive storytelling, virtual reality (VR), and immersive technology (head-mounted display) to introduce compelling stories about the Army's military occupational specialties through several interactive tasks, educate prospective recruits about career opportunities and benefits, and effectively expand the recruitment reach. The elements of the system were designed to ensure a cohesive, engaging, informative, and insightful user experience. The resulting tool was tested in a usability study that investigated the ability of VR-supported interactive storytelling to engage prospective military enlistees and increase their interest in the U.S. Army. The study involved thirty-two individuals and collected a comprehensive set of objective and subjective data that reflects user performance and individual responses about their VR experience. The results indicate that the tool represented a valuable recruitment tool with the potential to enrich current efforts and offer an experience lacking in contemporary recruitment tools.

ABOUT THE AUTHORS

Bruce E. Chojnacki is a research scientist focused on information operations, information systems, and cyber defense. He currently serves at the United States Military Academy at West Point, where he is part of the Army Cyber Institute, conducting studies on digital force protection and information warfare. His current research portfolio encompasses vehicle privacy and security, active privacy defense, and computer vision applications designed to enhance military intelligence capabilities. As a U.S. Army officer, Bruce has served in key cyber and information roles, with extensive experience in cyberspace operations and network modeling. His operational deployments include assignments in Kuwait, Iraq, and Poland, where he led information operations and influence efforts, relying on complex simulations of local populations to inform planning and anticipate behavioral outcomes. Bruce Chojnacki holds a Bachelor of Arts in Business Administration from Washington State University, a Master of Science in Management Information Systems from the University of Phoenix, and a Master of Science in Modeling, Virtual Environments, and Simulations from the Naval Postgraduate School.

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INTRODUCTION

The U.S. Army has faced significant challenges recruiting the next generation of soldiers for its all-volunteer force. According to the Department of Defense (DOD), none of the military branches met their enlistment goals for fiscal year 2023 (Garamone, 2023). This marks two consecutive years, from 2021 to 2023, during which the Army did not meet its recruiting targets. The situation has contributed to a drop in active-duty end strength from 485,000 soldiers in late 2021 to 452,000 by October 2023. This end strength represents the smallest Army since 1940, before the United States' (U.S.) entry into World War II (Winkie, 2023). These shortfalls demonstrate an urgent need to explore new recruiting approaches that can better resonate with today's young adult population (Demarest, 2023).

The U.S. Army has employed various traditional recruiting methods throughout history to assemble a fighting force that supports the nation's goals. However, current trends suggest that traditional recruiting methods are becoming less effective. The U.S. Army may not be engaging its primary target demographic of 17- to 24-year-old Americans, a generation that has grown up immersed in online connectivity and digital media. These young adults expect interactive technologies and personalized experiences available in the digital spaces they inhabit. Meeting these expectations necessitates a shift toward recruitment tools that align with the way they consume information and make decisions.

This paper explores the potential of virtual reality (VR) technology, virtual environments (VEs), and interactive storytelling to engage and influence new, younger audiences. It summarizes the development of *Soldier Sight*, a VR experience prototype that could be used to augment the recruitment efforts. Finally, it presents findings from a usability study conducted using *Soldier Sight*. The experience highlights the effectiveness of the storytelling approach while fostering active engagement and interaction among participants (Khundam, 2020, pp. 34–49).

BACKGROUND

This section reviews past U.S. Army recruitment approaches, the use of 360-degree videos, and VR for recruitment efforts in the industry. It examines the benefits of immersive interactive storytelling that utilizes VR technology, the combination of approaches and technologies used for the system described in this paper.

U.S. Army Recruitment Approaches

Over the past two decades, the U.S. Army has explored the use of immersive technologies through online platforms as part of its recruitment strategy. In 2002, the Army launched America's Army, a multiplayer first-person shooter developed as a recruitment tool and a public relations initiative (Zyda, 2022b). The game allowed players to experience various Army roles and experiences in a PC gaming environment. It was distributed free of charge and funded to provide regular updates over the years. The project cost approximately $32.8 million during its first ten years (Sinclair, 2009). By 2004, the game had over three million registered users and was ranked among the top five online games of 2002 (Zyda, 2022a). America's Army was well-known and respected within the online gaming community, but its direct impact on recruitment figures remains difficult to quantify due to a lack of well-designed follow-up data collection that could have provided necessary insight.

A second significant use of immersive technology occurred in 2009 when the Army entered the Second Life virtual world (Brannen, 2008). Collaborating with the Institute for Creative Technologies (ICT), the Army acquired virtual islands termed "MiLands" or Military Lands. These spaces allowed potential recruits to interact with multimedia content that educated them about the Army. Additionally, the so-called "cyber recruiters" equipped with human avatars were available to answer questions and engage directly with potential recruits. The U.S. Army also assessed

Second Life as a modeling, simulation, and training platform. Unfortunately, around 2010, interest and funding in Second Life as a simulation environment dwindled in favor of an alternative called OpenSimulator. That development, combined with low public engagement in "MiLands," eventually led the Army to abandon Second Life as a recruitment tool (Pey, 2021).

Industry Use of 360 Videos and VR for Recruitment Efforts

Private companies have also incorporated 360 videos and VR into their recruitment efforts to enhance the engagement of potential candidates. This approach can help potential recruits determine whether they see themselves as part of the organization, supporting the tasks, and learning the skills depicted in the videos and virtual scenes. One key benefit is the ability to introduce prospective recruits to an organization with which they may have little or no prior experience. That approach can create a desire to learn more about the company and establish a connection with the organization's mission and identity.

The e-commerce platform Jet, headquartered in Hoboken, New Jersey, contracted with Helios Interactive to create 360-degree video vignettes that captured its workspace and culture, providing candidates with the opportunity to observe a typical workweek at the company (Crook, 2015). The initial effort that supported the needs of their headquarters offices was planned to be expanded to include additional segments of the company. Similar effort was reported in the article titled "German Rail and Transport Group Turns to Virtual Reality in War for Talent" (Goodwin, 2015). Faced with a more competitive job market in Germany, Deutsche Bahn began seeking new opportunities to recruit blue-collar workers. The author highlights the company's push into other technologies, including the use of 360-degree videos that depict various jobs available, as well as a VR application that simulates driving a train and inspecting the exterior. These are two examples of how 360 videos and VR technology have been employed in the industry to stimulate interest among recruits. The articles, however, did not comment on the number and quality of candidates they were able to recruit using those novel approaches.

The Power of Immersive, Interactive Storytelling, and VR Technology

Immersive storytelling and VR technology offer distinct advantages for recruitment by enhancing the authenticity and appeal of an organization's message. Through story narratives, users' interaction and active engagement with the elements of virtual scenes enable organizations to communicate their values, culture, and mission, as well as introduce tasks and opportunities in a way unmatched by other media.

VR technology: VR technology offers several unique aspects that set it apart from other media: rich visuals with free user exploration of the environment, interaction with the virtual scene, three-dimensional (3D) sound, and haptic sensory feedback (both input and output) that heighten the complexity of the overall user experience. Users can use their hands to grab, manipulate, throw, and drop virtual objects. They can also receive haptic feedback via the gloves and controllers held in their hands each time the system detects contact with virtual objects. This feedback activates a user's sense of touch, creating the impression that the virtual world has physical substance. The spatial audio (3D audio) provides users with a sound experience that mimics the way sound is experienced in the real world. When a user moves the head, the audio signal delivered to either ear is generated to correspond to that exact head position and orientation. Those spatial cues enable them to determine the position and direction of sound, thereby further enhancing their sense of presence—a psychological feeling of being in a virtual environment that differs from their physical/real environment (Slater & Wilbur, 1997; Corrêa De Almeida et al., 2023). The depth and believability of the virtual environment and phenomena depicted in it help blur the line between the physical and virtual worlds (Slater, 2009).

Storytelling: The sensory-rich simulations are powerful tools for creating immersive, interactive narrative experiences. Storytelling has proven to be an effective method for sharing a message and influencing an audience throughout human history, with oral storytelling traditions being a prime example. Generations in each society would retell the stories and pass down their history and cultural knowledge through captivating storytelling techniques. Storytelling is also frequently employed as a pedagogical device and a powerful teaching tool (Landrum et al., 2019; Miller & Pennycuff, 2008; Gaeta et al., 2015). The storytelling approach is also recommended for scientists to establish a deeper connection with their audiences (Suzuki et al., 2018) and for brand development by organizations (Baker and Boyle, 2009). The domain of cultural heritage has seen numerous applications of the interactive storytelling approach, including 360-degree videos, virtual, and augmented environments (Magnenat-Thalmann & Papagiannakis, 2005; Katifori et al., 2018; Selmanovic et al., 2020; Boboc et al., 2022). For example, presence, engagement, and immersion in an archaeological VR application featuring 360-degree storytelling were explored by (Škola et al., 2020). The research effort investigated both objective and subjective metrics to assess user engagement and immersion levels. It concluded that most users experienced heightened levels of immersion and engagement due to the application's storytelling elements.

There are several key considerations to keep in mind when creating a storytelling experience in a virtual environment (VE). The first consideration is the **direction** in which the user views the environment. Since the user can look in any direction, it may not align with the area where the story narrative is unfolding and where the system designers would like the user to focus. The developer may want the user to look at a specific area of the environment when an action, animation, or dialog occurs; however, the user might not even realize that an event is happening there. A variety of strategies can be deployed to divert the user’s attention to that area. Different sensory modalities can be used for that purpose—auditory, visual, and haptic cues are the most frequent examples of such system signals (Brown et al., 2017).

An additional element to consider in an interactive storytelling experience is the support of **branching narratives** if the system designer wants the player’s choices to affect the outcome of the experience. These choices open or close future branches and can lead to different endings or conclusions to the story. The technique requires time and ingenuity to tell the story seamlessly; to accommodate a variety of users’ preferences and abilities, the researchers suggest using story graphs (Riedl & Young, 2006). Developers must incorporate cues and prompts that subtly guide users toward the intended storyline. This type of guidance usually exists as strategically placed tasks, objectives, or directional signposts, ensuring users remain engaged and oriented toward the narrative arc. Furthermore, as seen in an open-world game, the environment must accommodate a user’s exploration and interaction, potentially out of the expected sequence. This can be accomplished using dynamic story elements that adapt to the user’s choices or by implementing subtle barriers that tactfully steer the story experience back on course. The goal is to create an experience that flows naturally and does not disrupt the narrative of the story.

Branching narratives typically provide users with a greater sense of agency, enhancing their engagement with the story. In the paper, “Beyond Free Will”, the researchers examined approaches to agency in Bandersnatch, an interactive streaming movie on Netflix that utilizes branching narratives. The paper highlights that an essential element of interactive stories is audience agency. This refers to the audience's ability to make meaningful decisions that affect the course of the story. The researchers found that giving an audience agency in a story is possible without giving control (Rezk & Haahr, 2022). This means the audience can create meaningful results in the dynamic story, while narrative and character elements remain beyond their control. The paper concludes that the ability to make decisions and see feedback from those decisions increases the audience’s perceived agency.

An additional element to address in a storytelling environment is users’ **interaction**. A variety of interactive modalities typical of VR technology brings a significant evolution in storytelling situations. In the typical storytelling media, the audience is a passive recipient of visual or auditory information presented to them. In such situations, they can see, hear, and understand the story, but cannot play any part in its progression. VR technology empowers the audience to become active participants and engage with the content. They can interact with the elements of the VE (which includes interaction with other users and virtual humans, if such functionality is supported in the VE) and even create new virtual objects. A study by Zhang, Bowman, and Jones (Zhang et al., 2019) examined the use of different levels of interactivity in an educational VR storytelling user experience focused on the topic of immunology, concluding that interactivity had a significant value for students’ learning, attention, and focus.

An extreme case of highly engaging interactive storytelling is represented in video games, which enable users to be placed within the story's environment through a fast-paced narrative, allowing for interaction with the environment and other players. Games enable players to explore the virtual world and influence the progression of the story. They can also employ branching storylines that lead to distinctly different endings based on choices made by the player (van Vuuren & Jacobs, 2019). Storytelling is frequently utilized in educational games, having a positive effect on students’ motivation and attention (Padilla-Zea, 2014; Ferguson et al., 2019). Another compelling example of VE with a storytelling approach was the system that supported leadership development (Gordon et al., 2004).

SOLDIER SIGHT SYSTEM DESIGN AND IMPLEMENTATION

The primary concept behind the *Soldier Sight* is to create a stand-alone, single-user, interactive storytelling experience that utilizes an immersive 3D environment to educate and inform users about careers in the U.S. Army. The system must deliver a cohesive, engaging, informative, and insightful storytelling experience. To achieve these objectives, it must captivate the users' attention on multiple levels. Users should feel present in the VE and capable of understanding both visual and audio input. They should be able to navigate the environment, manipulate objects, and perform meaningful actions as they would in the real world. Furthermore, there must be a narrative that engages the users, providing them with a clear purpose and objectives for their actions, ultimately leading to a satisfying conclusion.

System Architecture

The development of *Soldier Sight* began on the Meta Quest 2; however, during the process, the researcher obtained a Meta Quest Pro, leading to a transition in development to that VR headset. That system does not require external infrastructure to support user tracking in space, as it employs an inside-out optical tracking approach. The hardware includes two handheld controllers and a headset with QLED displays for each eye, with a resolution of 1800 x 1920 pixels per eye. The device utilizes pancake-style lenses that enhance the optics by reducing glare and improving color contrast compared to the older Fresnel lenses. Furthermore, the Meta Quest Pro headset incorporates eye and face tracking capabilities, as well as enhanced hand tracking, by utilizing additional cameras within the headset and hand controllers.

The Meta Quest Pro can operate as a standalone device or connect to a personal computer (PC) through the Oculus Air Link. In this configuration, the headset utilizes the PC's processing power to run applications and serves as a visual display, while also enabling head-tracking and eye-tracking capabilities. An alternative configuration for connecting the headset to the PC utilizes a USB-C cable. This setup utilizes the PC's processing power and provides electrical power to the headset, a key difference from the configuration with a wireless connection. That capability enables users to stay connected and use the headset for extended periods. We found that the USB-C connection was optimal for developing and operating the *Soldier Sight* system due to its lower latency and greater reliability when running software from a high-end PC. This configuration also facilitated data logging of the *Soldier Sight* system data.

The Unity Real-Time Development Platform was used as a development platform for the *Soldier Sight*. This cross-platform application is compatible with Windows, macOS, and Linux operating systems, offering both free and paid licensing options. Unity applications can run on various computing platforms, including mobile phones, desktop computers, gaming consoles, and virtual reality headsets.

Creating an Immersive Experience

The visual design of the *Soldier Sight* began with the development of the lobby, which was named the Army Story Room. The goal was to create a semi-futuristic environment that introduces the experience that will follow. The area tells the story of the U.S. Army's past and depicts its current and future goals with emerging technologies. Providing images and videos that highlight the Army's history and current environment was important. The host, SFC Bradley, was modeled after a Non-Commissioned Officer in the Army. Each military scenario is designed to simulate the type of environment in which the U.S. Army has deployed in the past. The scenarios incorporate modern elements and objects, and the vehicles, equipment, and weapons reflect the current military inventory that service members use in their jobs. The scenes also incorporated environmental effects, such as fire and smoke, to convey the visual impact of a live environment, increase engagement, and enhance a sense of presence. The experience also included a virtual host, SFC Bradley, who was designed to represent a Non-Commissioned Officer and guide users through the experience. Throughout the design process, the goal was to create believable, engaging, and mission-relevant settings that leave a lasting impression on its users.

Story Flow

The VE consists of three experience rooms within a Unity scene (Figure 1): the Army Story Room, which serves as the starting position for all users (a lobby), the Military Occupational Specialty (MOS) Selection Room, and the After Action Review (AAR) Room. Short hallways connect these three rooms, with no exterior doors. The user begins the VR experience in the Army Story Room, a futuristic set that resembles the interior of the starship Enterprise from the Star Trek television series (Abrams, 2009). The user then moves to the MOS Selection Room via a connecting hallway. Once there, the user can access three MOS Experience Locations through teleportation pads, one for each MOS. After visiting all the MOS Experience locations, the user returns to the MOS Room and navigates down the hallway toward the final room, the After-Action Review (AAR) Room.

Experience Rooms

The first room is the *Army Story Room*, where users begin their experience by being introduced to SFC Bradley, the host of *Soldier Sight* (Figure 2). He provides an initial introduction to the VR experience that will follow. This room serves as a tutorial on the system's mechanics, where users learn how to navigate, interact with, and manipulate objects in the VE. They also learn about the U.S. Army through video, images, and audio narration. The second room is the *MOS Selection Room* (Figure 3). The three MOSs chosen for the *Soldier Sight* represent a diverse mix of jobs available to new military recruits. These MOSs require various knowledge, skills, and aptitudes, and they were selected from three distinct branches of the U.S. Army: Military Intelligence (Figure 4), Field Artillery (Figure 5), and Ordnance (Figure 6). The third room of the virtual environment consists of the *AAR Room* (Figure 7), where the user meets SFC Bradley for an after-action review. The AAR assesses the user's performance in the *Soldier Sight* system. The user conducts a final interaction with SFC Bradley and is presented with a dynamic board showing their overall score. The AAR Room provides additional information on each MOS, including the requirements and opportunities available, as well as details about pay, benefits, and retirement.

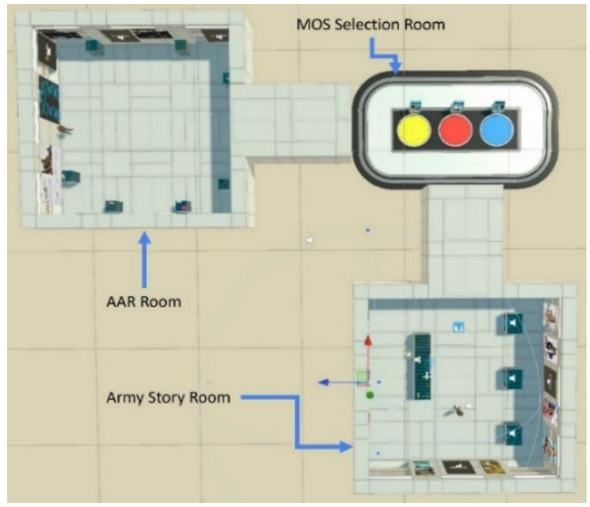


Figure 1. Overhead view of the experience rooms

Figure 2 - Army Story Room

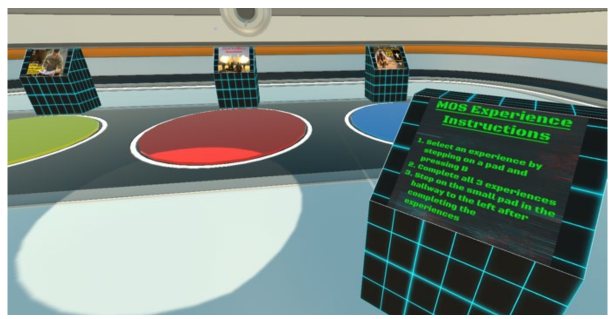


Figure 3 - MOS Selection Room

Figure 4 - Human intelligence collection scenario

Figure 5 - Field Artillery scenario

Human Intelligence Collector Experience Location: The first experience location is designed to simulate a mission typically assigned to a *Human Intelligence Collector (MOS 35M)* (Human Intelligence scenario depicted in Figure 4). A HUMINT Collector observes and collects intelligence about an adversary's intentions, strengths, and vulnerabilities. The scenario begins with the user interacting with SFC Bradley, who provides the details about the mission and assigns the task. The user is asked to search a house suspected of being linked to terrorist activities to locate instances of valuable information and artifacts.

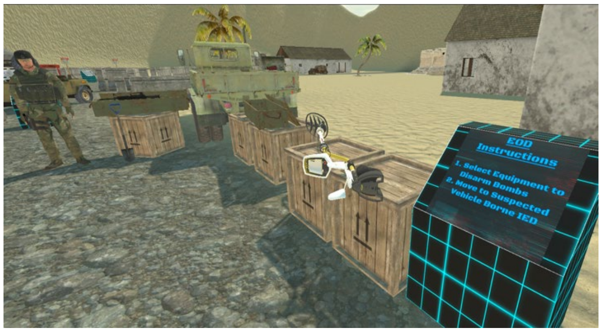


Figure 6 – Ordnance scenario

Figure 7 – AAR Room

Cannon Crewmember Experience Location: The second scenario depicts a mission characteristic of a *Cannon Crewmember (MOS 13B)* in a wartime context (Field Artillery scenario depicted in Figure 5). A Cannon Crewmember manages artillery ammunition, operates large weapon systems, and calculates indirect target locations. The user is tasked with operating a howitzer under the guidance of SFC Bradley. The mission involves observing an enemy convoy from a distance. The scenario is designed to provide users with insight into the fundamental tasks and responsibilities of being a Cannon Crewmember. It challenges users to identify enemy positions accurately, make strategic decisions regarding ammunition, and execute artillery fire. This immersive experience conveys a sense of the rapid-response environment typical of this combat-focused MOS.

Explosive Ordnance Disposal Experience Location: The third scenario represents a mission for an *Explosive Ordnance Disposal (EOD) Specialist (89D)* (Ordnance scenario depicted in Figure 6). The EOD soldiers are experts in employing and disposing of explosives. They are trained to utilize advanced robotics, tools, and techniques to accomplish their mission. The user is tasked with locating bomb disposal equipment. They must select the appropriate equipment and inspect a vehicle rigged with Improvised Explosive Devices (IEDs). The user then disarms the IEDs and transports them to a safe disposal area. Once the IEDs are placed in a disposal box, they are detonated safely. This experience provides users with a simplified representation of the challenges and risks inherent to this MOS.

USABILITY STUDY: DESIGN AND DATA ANALYSIS

This usability study investigated how an interactive storytelling environment can enhance engagement and interest in the U.S. Army among potential military enlistees. The goal was to provide insight into the effectiveness of *Soldier Sight* as a recruiting tool and its potential to broaden its reach and appeal to potential enlistees. All user sessions were executed in the Naval Postgraduate School (NPS) experimental laboratory on the campus (Figure 8).

Participant Demographics

Approval from the NPS Institutional Review Board (IRB) was obtained prior to recruiting volunteers for the study. All subjects were recruited from the ranks of NPS students and faculty; both military and civilian personnel were eligible to volunteer for the study. The student population at NPS reflects the demographics of the military community, where women constitute 17.5% of the active-duty force. A total of thirty-two participants volunteered and completed the study (twenty-nine male and three female). The military grades of military participants ranged from O3 to O5, all officers. Among thirty-two participants, eighteen reported playing video games, while fourteen did not. Of the eighteen who played video games, five spent less than two hours per week, seven spent two to four hours per week, two spent four to eight hours per week, and four spent more than eight hours per week gaming. Twenty-eight participants had prior experience with VR and/or augmented reality (AR), while only four had no such experience. Eight participants expressed their interest in the study due to their previous experience with VR and AR. Among the twenty-eight

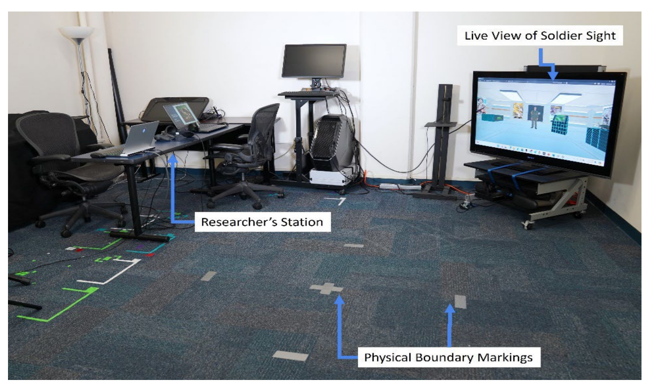


Figure 8 – Experimental laboratory

participants with VR experience, twelve had used VR for personal purposes, and nineteen had used VR for job-related requirements (participants were able to indicate both reasons if applicable to their case).

Objective Metrics

All participants completed their VR sessions. The average time to complete the *Soldier Sight* VR experience was 14.85 minutes, with a standard deviation of 4.89. The minimum time for a VR session was 4.01 minutes, while the maximum was 29.91 minutes. The participant with the most extended playtime of 29.91 minutes watched all six in-system videos and interacted with SFC Bradley six times, which contributed to the participant's extended overall playtime.

The average time to complete the Tutorial section was 4.06 minutes (st. dev. = 1.93, min = 0.82 minutes, max = 8.56 minutes), resulting in a wide range of 7.74 minutes between these times. This may suggest that experienced VR users can quickly grasp the system's mechanics, whereas others may require more time. It also indicates that some users are interested in exploring the tutorial space, while others may prefer to move quickly within the virtual environment.

The participant's score was tracked during the *Soldier Sight* experience. The system collected five individual scores that measured the participants' progress during the VR session and provided feedback on their performance, and the final score was a composite of the individual scores in the matching game, intel, non-intel, EOD, and artillery segments. The maximum Final Score was 26.00 (maximum possible score was 27.00), with an average Final Score of 13.94, and a standard deviation of 5.72. This average indicated that participants completed 52% (13.94) of the tasks in *Soldier Sight*. One-third of the participants achieved the maximum score in one of the scored areas, and no participant attained the maximum score of 27.00.

The average number of interactions with SFC Bradley was 4.72 (st. dev. = 1.78, min = 1, max = 9). The system featured five locations where participants could engage with SFC Bradley, allowing them to interact with him multiple times at each site. The average interaction of 4.72 suggests that most participants engaged with SFC Bradley at each location once. Every participant interacted with SFC Bradley at least once during their session. The average number of informational videos watched was 1.56 (st. dev. = 2.00, min = 0, max = 9). The system accommodated six video locations and allowed viewing videos multiple times at each site. The average number of videos watched was notably low; we can only speculate that participants were either uninterested in the videos, wanted to complete their session in a shorter time (and decided to skip the videos), or were unaware of their availability. Complete information on all study results can be found in Chojnacki (2024).

Subjective Metrics

The study collected several representative sets of subjective data, including the Simulator Sickness Questionnaire (SSQ), System Usability Scale (SUS) Questionnaire, a customized post-task questionnaire, and a demographics questionnaire that we typically present at the very end to avoid introducing unintentional biases.

Simulator Sickness Questionnaire (SSQ): A pre-task SSQ was administered to participants once they signed their IRB informed consent form – it was before they donned the Meta Quest Pro Head-Mounted Display (HMD). A post-task SSQ was given to participants upon completion of the *Soldier Sight* experience, after they removed the HMD. The SSQs were scored based on Kennedy's SSQ scoring criteria (Kennedy et al., 1993). The SSQ consisted of sixteen questions that assessed symptoms reported by each participant. Each question (symptom) offered four options: *None*, *Slight*, *Moderate*, or *Severe*; these options corresponded to a score on a scale of 0 to 3, respectively. The sixteen symptoms were categorized into three clusters: oculomotor, disorientation, and nausea, to which different weights were applied.

This study utilized the work of Bimberg et al. (2020) to categorize the SSQ scores collected in the study. Bimberg associated the following scores: *Negligible* (< 5), *Minimal* (5 – 10), *Significant* (10 – 15), and *Concerning* (15 – 20) symptoms. The pre-task SSQ was used to determine a baseline SSQ score for the participants. In it, twenty-two participants responded *None* to the sixteen questions. Nine participants reported slight symptoms; the symptoms included fatigue, headache, eye strain, difficulty focusing, difficulty concentrating, dizziness when eyes were closed, and stomach awareness. One participant reported moderate fatigue symptoms. The average baseline score for the participants was 0.81, with the oculomotor cluster having the highest average baseline score (0.56). The results indicated that, on average, participants experienced negligible simulator sickness symptoms before their VR experience.

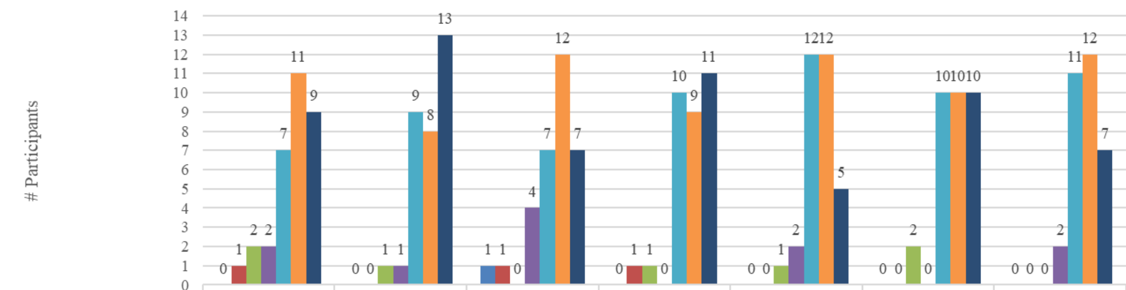
The post-task SSQ revealed that participants experienced increased symptom levels after completing the VR experience. The responses indicated elevated symptoms in at least one of the sixteen areas of the SSQ. Twenty-two participants reported no symptoms prior to participating in the VR study. After completing the VR study, twenty-two participants reported at least one *Slight* symptom. Seven participants reported *Moderate* symptoms, particularly general discomfort, stomach awareness, nausea, and sweating. Only one participant reported a *Severe* symptom, which was 'sweating'. The score for nausea increased to 2.63 (the most significant cluster increase), the score for oculomotor increased to 2.06, and the score for disorientation increased to 1.53. The total SSQ score rose to 6.22, an increase of 5.41. Based on the scoring criteria suggested by Bimberg et al. (2020), participants had minimal symptoms on average.

The pre- and post-task SSQ results indicate that most participants can complete the experience with *Minimal* symptoms of simulator sickness. However, a small minority of participants (one) experienced *Significant* symptoms that could reduce users' willingness or ability to use the system.

Post-Task Questionnaire: All thirty-two participants completed the study. The questionnaire contained twenty-nine questions, including multiple-choice questions, 7-point Likert scale questions, and open-ended responses. The participants answered questions according to their experience with the *Soldier Sight* system in the following areas: cohesiveness, engagement, informativeness, insightfulness, interest, value, and ease of use.

- **Cohesiveness** (introduced as "The extent to which the elements of the user experience work together to communicate a story"): The average cohesiveness score was 5.96 out of 7, indicating that the system's elements effectively communicated the intended story. Participants' feedback revealed that the audio and visual narratives and instructions were important elements that maintained the story's cohesiveness.
- **Engagement** (introduced as "The extent to which elements of the user experience enable captivating user interactions so that an individual feels like an active participant in the story"): The average engagement score was 5.71 out of 7 (Figure 9). This score indicated that the interactive Military Occupational Specialty (MOS) scenarios created captivating interactions that made the user feel like an active participant. Participant feedback indicated that high-quality audio and visual elements were crucial to creating engagement. Participants were positive about using SFC Bradley as the guide to the experience.
- **Informativeness** (introduced as "The extent to which elements of the user experience can provide relevant and compelling content"): The average informativeness score was 5.73 out of 7. Participants indicated that the experience provided relevant and compelling content. Feedback indicated that participants learned or expanded their knowledge of the topic through imagery, video, and hands-on tasks.
- **Insightfulness** (introduced as "The extent to which elements of the user experience can provide deeper understanding and perspective"): The average insightfulness score was 5.57 out of 7. Participant feedback indicated that most users gained additional information about the Army, suggesting that the system enhanced users' knowledge beyond general awareness.
- **Interest and Value:** Twenty-three participants indicated that the experience increased their interest in the U.S. Army, while the remaining nine participants were neutral or uninterested. Twenty-nine, or over 90%, were active-duty military personnel. Since they were not the intended audience for *Soldier Sight*, the feedback may not be relevant. Nearly all participants (twenty-nine) indicated that *Soldier Sight* would be valuable as a recruiting tool (response to question asked in post-task questionnaire).
- **Recommend to Potential Recruits:** Twenty-six participants indicated that they would recommend the system to someone interested in joining the military; four remained neutral, and two expressed that they would not recommend it.
- **Ease of Use:** The average ease of use score was 5.50 out of 7. Participant feedback indicated that two-thirds of the users found the system to be *Somewhat Easy* to use. One-third of the participants reported having difficulties learning or understanding the navigation and control mechanics. Eight participants were confused about the button functions and felt uncomfortable using the joystick for navigation. These participants also struggled when interacting with the on-screen menu; to select an option, the system projects a beam that the user must point at menu options and then press a physical button on the controller to select it. The usability

barriers identified by participants included issues with jarring motion and inconsistent feedback. Participants suggested improving movement mechanics and user prompts to alleviate simulator sickness and confusion.



	6. How engaged were you with the Soldier Sight story?	7. How engaged were you with the MOS scenario missions?	8. Did the presence of the host, SFC Bradley, make the Soldier Sight story engaging?	9. Did the interactions with the objects in the virtual environment help you feel engaged in the Soldier Sight story?	10. How engaging were the audio narratives by SFC Bradley in the context of the Soldier Sight story?	11. How engaging were the visual cues within the virtual environment in the context of the Soldier Sight story?	12. How engaging were the audio cues within the virtual environment in the context of the Soldier Sight story?
Not at all engaged	0	0	1	0	0	0	0
Not very engaged	1	0	1	1	0	0	0
Somewhat not engaged	2	1	0	1	1	2	0
Neutral	2	1	4	0	2	0	2
Somewhat engaged	7	9	7	10	12	10	11
Engaged	11	8	12	9	12	10	12
Very engaged	9	13	7	11	5	10	7

Figure 9 - Post-task questionnaire: Engagement responses (Questions #6 – #12)

Based on subjective feedback, most participants found *Soldier Sight* to be cohesive, engaging, and informative, and provided an engaging and immersive introduction to military occupational specialties. The system effectively communicates key aspects of military occupations in a manner not typically found outside of joining the Army. There is room for improvement in usability, but the tool demonstrated strong potential as a recruiting aid.

System Usability Scale (SUS) Questionnaire: All participants completed the SUS questionnaire (Brooke, 1996) after the task in a virtual session. The use of this questionnaire is standard in research studies. The questionnaire consists of 10 questions, each offering a Likert scale with five options ranging from 1 to 5 (1 = Strongly Disagree to 5 = Strongly Agree). The average score for the SUS was 77.34, corresponding to an adjectival rating of *Good* (st. dev. = 15.63, min = 37.5, max = 100.0). Despite the average score being rated as *Good*, the participants' scores varied widely. Eight participants provided feedback that resulted in a D (*Awful*) rating; two found the usability extremely low, leading to an F (*Poor*) rating. The most common issues mentioned by five participants that led to *Awful* and *Poor* feedback were dizziness, disorientation, vertigo, and nausea. It was observed that these symptoms were most pronounced when participants performed strafing or rotational movements. Another issue reported by six participants was difficulty remembering the functions of various buttons.

Five participants also stated that there were unclear visual cues or instructions, which confused them about the upcoming tasks. Five participants also mentioned that the tasks lacked realism and were too simplified, which did not accurately reflect the actual complexity of the simulated MOS tasks in scenarios. Participants found that the environmental setup was sometimes too simplistic or not representative of a genuine military operational scenario. Although the system's elements received a critique, the average score of 77.34 (*Good*) is promising for its future usability. Most participants used the system in the intended manner, and its usability did not impede the ability to engage with *Soldier Sight* and experience the story.

Study Limitations

Three limitations were identified in this study. The first was that the study focused on a limited number of Military Occupational Specialties (MOS), representing a small subset of the vast range of roles within the U.S. Army. Secondly, the research was conducted within a controlled setting (Figure 8), and the findings may not fully represent the conditions in which military recruiters operate. Lastly, the participants did not represent the target audience. Recruiting civilian participants aged 17 to 24 proved impractical for this study. Instead, the participants in this study were volunteers from the faculty and students at the NPS.

DISCUSSION AND RECOMMENDATIONS

The usability study identified four key elements of virtual reality and interactive storytelling in *Soldier Sight* that contributed to an engaging, informative, and insightful experience. The first element was an immersive environment featuring visual and audio cues, detailed scenarios, and enhanced engagement. The second element was the participants' ability to interact with elements within the VE naturally and intuitively. Another critical element was clear, well-structured instructions that enabled users to accomplish each mission. The last key element was visual and auditory feedback that helped participants understand and complete tasks.

The study revealed that the *Soldier Sight* VR system effectively provided potential recruits with a cohesive, engaging, and informative experience. The findings met initial expectations, demonstrating the potential for VR and interactive storytelling to serve as an additional tool in military recruitment by offering immersive and interactive insights into military roles. However, improvements are needed to control motion sickness and enhance user interaction with the environment, thereby improving the overall user experience.

This study contributes to broader academic efforts to improve VR, interactive storytelling, and recruitment by demonstrating the feasibility and effectiveness of a multi-sensory interactive VR storytelling experience. It highlights the importance of immersive environments, interactivity, and structured tasks in enhancing engagement and informativeness in VR experiences. These insights can be applied to various fields beyond military recruitment. The same techniques can also be utilized in recruitment for civilian institutions and organizations. Additionally, they can be used in applications designed to increase engagement with specific target audiences.

Future Work

Future research should explore specific areas to extend the current study's findings. The first area to improve is using a diverse participant pool that meets the target of military recruitment (17 to 24-year-old civilians). The participant pools should include individuals from demographics and backgrounds that represent the U.S. population. Gathering feedback from the target audience will yield the most valuable insights into its acceptability, relevance, and ability to generate interest.

Future work should explore more diverse military experiences, scenarios, and occupations. This could include scenarios focused on maintenance, communications, and aviation. Additionally, it would be beneficial to incorporate special missions that the Army conducts, such as airborne or air assault operations. VR offers the opportunity to experience military roles and missions with no risk and minimal cost, which would otherwise be unavailable to potential recruits.

CONCLUSIONS

This paper highlights the potential of VR technology and interactive storytelling to support innovative recruitment techniques that cater to the desires, needs, interests, and skills of potential recruits. The *Soldier Sight* VR system successfully demonstrated the feasibility and effectiveness of a multi-sensory interactive VR storytelling experience in military recruitment. VR can become a powerful tool for engaging prospective candidates and offering valuable insights into military careers. The continued development and refinement of VR technologies will play a crucial role in shaping the future of recruitment across various fields and industries.

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