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PATTERNS OF VIRTUAL REALITY USE AND ASSOCIATED SYMPTOMS: A COMPARATIVE STUDY OF CIVILIAN AND MILITARY USERS

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ABSTRACT: *Virtual Reality (VR) technologies have become integral to modern military training, offering substantial advancements in operational preparedness, decision-making, and mission effectiveness. NATO forces, including the United States, the United Kingdom, and increasingly Hungary, have embraced VR solutions to improve joint interoperability and enhance realism in training scenarios, resulting in notable gains in threat identification accuracy and overall personnel readiness. However, the successful deployment of VR in military contexts necessitates an in-depth understanding of physiological and neurological considerations, such as cybersickness, cognitive overload, visual fatigue, and ergonomic strain, each of which can significantly impact soldiers' cognitive performance and physical comfort. Empirical research conducted among military and civilian VR users reveals that military-trained individuals exhibit distinct psychological resilience, improved stress management, and heightened neurological adaptability compared to civilians. These measurable differences reinforce VR's value as a strategic training asset, particularly when supported by ergonomically optimized equipment and adaptive, neurophysiologically informed training protocols. Consequently, continued investment in human-centered VR development is essential to fully leverage the operational advantages offered by immersive training, enhancing both the efficacy and safety of military personnel in complex, real-world environments.*

KEYWORDS: *military training, immersive simulation, cognitive load, simulation technologies*

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INTRODUCTION

The rapid advancement of Virtual Reality (VR) technologies in recent decades has profoundly transformed training methodologies across multiple sectors, particularly within defence and military operations.[1] Improvements in computational power, graphical rendering, and the availability of affordable yet sophisticated VR hardware have enabled military organizations to develop immersive, high-fidelity simulation environments. These advancements have attracted considerable attention from defence institutions worldwide, notably within NATO member states, due to VR's demonstrated potential to enhance operational realism, safety, and training efficiency.

1 Leite – Vieira 2025.

Within the military domain, VR facilitates realistic simulations of complex and hazardous operational scenarios that would otherwise be impractical, resource-intensive, or unsafe to replicate in real-world conditions. However, alongside clear operational advantages, the integration of VR into military training introduces several physiological and neurological challenges. Issues such as cybersickness, cognitive overload, visual fatigue, ergonomic discomfort, and VR-induced stress pose significant barriers that must be thoroughly understood and effectively managed to ensure successful implementation. Recognizing both the opportunities and challenges associated with VR, NATO countries, including prominent adopters such as the United States and the United Kingdom, have actively integrated VR into their military training curricula, contributing valuable empirical insights and operational best practices. As a committed NATO member state, Hungary has similarly begun exploring VR's potential within its strategic modernization initiative, the Zrínyi 2026 Defence and Military Development Program,[2] explicitly highlighting immersive training technologies as instrumental tools for enhancing interoperability, readiness, and training effectiveness.

Given the strategic importance of VR technology for contemporary military preparedness, this paper systematically explores its applications, limitations, and physiological impacts within military contexts, emphasizing empirical comparisons between military and civilian users. It examines in detail how VR's physiological and neurological dimensions affect user experience and training outcomes, providing a scientific foundation for the continued adoption and refinement of immersive simulation technologies within defence frameworks. Ultimately, the publication aims to identify key factors critical to optimizing VR's utility and effectiveness, thereby directly contributing to enhanced military training standards, personnel resilience, and operational capability.

APPLICATION OF VR IN THE MILITARY AND THE DEFENCE SECTOR

Modern armed forces and defence organizations have begun integrating VR into a range of training and operational activities. This section surveys current implementations by NATO and several member states, notably the United States and the United Kingdom, as well as preliminary steps taken by the Hungarian Defence Forces.

As an alliance, NATO has recognized the value of virtual simulation for enhancing interoperability and readiness among its members. As early as 2003, a NATO technical report identified human–machine interface advances and cost-effectiveness as key reasons to pursue VR in military applications.[3] Since then, NATO countries have widely adopted VR across various military domains, often sharing technologies and lessons learned. In one recent NATO exercise (Toxic Trip 2023, a Chemical, Biological, Radiological and Nuclear defence drill), participants used an immersive VR platform to simulate hazardous environments and coordinate responses across allied units, demonstrating how virtual environments can allow distributed training where participants in different locations all "meet" in the same scenario.[4] NATO's Allied Command Transformation and the NATO Modelling and Simulation Centre of Excellence have been actively encouraging member states to develop interoperable VR training systems so that soldiers from different countries can train

2 Kocsi – Kiss 2021.
3 Lele 2013.
4 Virtualware 2023.

together in shared virtual scenarios. These efforts align with NATO's broader strategic emphasis on digital innovation to enhance joint readiness.

The U.S. military has been a pioneer in adopting VR and related simulation technologies. One landmark program was the Dismounted Soldier Training System (DSTS), fielded in the early 2010s as the first immersive VR training system for infantry.[5] DSTS provided squads with networked VR stations where soldiers could move through virtual battlefields, employing their weapons with position trackers and experiencing 360° visual and auditory feedback. It allowed small units to practice urban operations, convoy security, room clearing, and other tactical scenarios without the need for extensive training grounds. An Army evaluation noted that DSTS could effectively support basic and advanced individual training, including mission rehearsal for urban combat, reconnaissance patrols, and convoy ambush drills, by enabling the repetition of scenarios that would be resource-intensive to set up physically.[6] Building on such experiences, the U.S. Army launched the Synthetic Training Environment (STE) initiative in the late 2010s. STE is an ambitious program aiming to unify live, virtual, and constructive (LVC) training under a common architecture by 2025. It envisions soldiers wearing VR/AR headsets to train in digitized replicas of real terrain, integrated with AI-driven entities, so that eventually, a brigade could conduct a coordinated exercise with some soldiers in simulators and others in the field, all seeing the same operational picture.[7] Early components of STE include the Integrated Virtual Trainers for dismounted troops, tank crews, and aviators, and a cloud-based platform to deliver training anywhere on demand. The U.S. has also used VR for specialized training, such as pilot and vehicle crew simulators (long standard in flight schools and armor units) and marksmanship trainers.[8] Moreover, American research has extended into using VR for resilience training, e.g., the Army Research Laboratory has tested VR combined with biofeedback to train soldiers in managing combat stress and fatigue.[9]

The UK's Ministry of Defence has similarly invested in VR to modernize training, particularly for the British Army and Royal Air Force. Under the Defence Innovation Fund (a £800 million program to spur new technologies), the UK has pursued the Virtual Reality in Land Training (VRLT) initiative.[10] This initiative seeks to evaluate how VR systems can augment or replace certain Army training activities to improve efficiency and reduce reliance on expensive real-world exercises. One notable collaboration is with Bohemia Interactive Simulations (BiSim), the developer of the Virtual Battlespace (VBS) series widely used in military simulators. The UK MoD contracted BiSim to develop a special VR module for its existing simulators, testing features such as high-resolution head-mounted displays integration, mixed reality for weapon handling, and enhanced after-action review tools. The integration of mixed reality enables soldiers to train with physical objects, such as replica rifles and mock control panels, while fully immersed in virtual scenarios. This approach has proven effective in developing muscle memory and familiarization with real-world equipment, as demonstrated by Ukrainian troops using US-supplied systems for

5 Bymer 2012.
6 Reitz – Richards 2013.
7 Rozman 2020.
8 Goldberg et al. 2023.
9 Goodwin – Hoffman 2020.
10 UK Government 2019.

combat preparation.[11] In addition to ground forces, the Royal Air Force has used VR for aircrew training and even recruitment outreach (e.g., VR flight demos at public events), and the Royal Navy is exploring VR for immersive mission planning and even submarine maintenance training.[12] As of 2025, the UK reached a milestone by certifying a mixed-reality Joint Terminal Air Controller (JTAC) training system (the CASE JTAC simulator using Varjo XR headsets) for official use, meaning NATO JTAC personnel can now maintain their qualifications through this VR-based system instead of some live exercises.[13] This is a clear testament to how far VR training has come, as a virtual/mixed reality system meets the rigorous standards for training elite personnel in calling in airstrikes, traditionally one of the most hands-on, live-training-intensive skills.

The use of VR in Hungary's military is still in the nascent stages, but recent initiatives and research efforts indicate a growing commitment. The Hungarian Defence Forces have historically relied on conventional training methods, but as the forces modernize, they recognize that simulation technologies must play a larger role in training and education. A clear sign of this shift is the establishment of the Innovation and Technology Directorate within the Ministry of Defence and the involvement of institutions like the National University of Public Service (NUPS) in studying military applications of VR.[14] Hungarian defence researchers have published analyses on how VR could enhance training effectiveness and what negative side effects to watch for. For example, Kovács conducted a series of studies on VR-based military training, examining factors that influence training efficacy and user acceptance among Hungarian soldiers.[15] The first part of his work outlined numerous potential applications of VR for the Hungarian defence sector – from virtual shooting ranges and tactical engagement simulators to VR-based maintenance training for complex equipment. The Hungarian Defence Forces have reportedly tested VR in a few specific contexts. One publicly demonstrated example is a VR system for parachute jump training, a 360-degree video simulator that allows paratrooper trainees to experience the visual sensation of a jump and practice emergency procedures (such as canopy malfunctions) in a virtual environment before any real airdrop. Another area of interest is engaging the younger generation of soldiers and cadets through digital means. In 2019, the HDF organized a "Digital Soldier 2.0" event in Budapest to showcase cutting-edge technologies; attendees could try out a VR tactical trainer that put them in a virtual combat scenario with a full-motion rig (allowing them to turn 360° and even feel motion cues).[16] This was not yet standard issue equipment, but it signaled intent by familiarizing cadets with VR. The HDF hope to build a culture of innovation where future forces will be comfortable with training in both real and virtual environments. Importantly, Hungary is also looking at how VR can support joint training with NATO allies. Through NATO's e-learning and training opportunities, Hungarian personnel have participated in VR-enhanced multinational exercises (for instance, Hungarian JTACs have used simulation systems similar to those of their British counterparts to practice coordination with Allied pilots).[17] While concrete programs (like a

[11] Epstein 2025.
[12] Royal Navy News 2023.
[13] Varjo 2025.
[14] Németh – Virágh 2021.
[15] Kovács 2024.
[16] Hegedűs – Sziválk 2019.
[17] Marlok – Takács 2024.

dedicated Hungarian VR training center) are still under development, the current trajectory suggests that the Hungarian Defence Forces would steadily increase their adoption of VR in the coming years, guided by both their pilot projects and the proven successes of larger allies.

PHYSIOLOGICAL AND NEUROLOGICAL FACTORS IN VIRTUAL REALITY

While VR holds significant potential for military training, its success depends on understanding and mitigating various physiological and neurological factors that influence user experience and performance. Military personnel require training environments not only to be realistic and immersive but also physiologically tolerable and neurologically manageable, ensuring optimal effectiveness and safety for training scenarios.

One primary physiological challenge associated with VR is cybersickness, often described as a form of simulator sickness.[18] Cybersickness manifests through a range of physiological symptoms such as nausea, dizziness, eye strain, and general disorientation.[19] Neurologically, it originates from sensory conflicts, discrepancies between visual cues perceived through VR and the vestibular signals received by the body. Such sensory mismatches provoke stress on neurological systems, particularly the vestibular and visual pathways, disrupting balance, orientation, and spatial awareness. Research shows that cybersickness is common, even in experienced users, impacting up to 60% of VR users to varying degrees.[20] These symptoms are particularly critical in military training, where physiological distress can severely impair cognitive and motor performance. For instance, if trainees experience dizziness or nausea, their cognitive capacity to process crucial training information diminishes, leading to compromised training outcomes or potential safety hazards. Military-specific research highlights cybersickness as a fundamental barrier that must be managed effectively. Methods of mitigation involve carefully structured exposure protocols, adaptive session durations, and possibly pharmacological interventions, such as motion sickness medication or natural supplements, to gradually build physiological tolerance among trainees.[21]

Alongside cybersickness, cognitive overload represents a critical neurological challenge in VR environments. The immersive nature of VR often involves intense sensory inputs, visual, auditory, and haptic cues that can exceed an individual's cognitive processing capacity. Cognitive load theory[22] asserts that excessive simultaneous demands on working memory can significantly degrade the efficiency of learning and task performance. Neurologically, the prefrontal cortex, responsible for executive functions and working memory, becomes particularly taxed when users encounter complex or multitasking scenarios, potentially leading to decreased task accuracy and decision-making impairments.[23]

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18 Vlahovic et al. 2024.
19 Mousavi et al. 2013.
20 Caserman et al. 2021.
21 Dennison et al. 2016.
22 Sweller et al. 2011.
23 Miller – Cohen 2001.

In military VR training, scenarios are often inherently complex, simulating multifaceted operational environments that involve simultaneous demands such as navigation, communication, and threat assessment. If the neurological load exceeds manageable thresholds, trainees may struggle to process vital information, resulting in impaired performance and diminished training outcomes. Empirical research underscores the necessity of scenario and interface design that aligns cognitive demands with neurological capabilities, emphasizing intuitive interaction modalities to minimize unnecessary mental effort.[24] Innovative strategies include integrating authentic military equipment as controllers within VR environments, leveraging established neurological motor patterns and muscle memory to reduce cognitive load. Moreover, neurophysiological feedback mechanisms, such as heart rate variability and electroencephalography (EEG), offer valuable insights into trainees' real-time neurological states. The Australian Defence Force's "Performance Edge" initiative, for example, successfully utilized heart rate monitoring as biofeedback to adaptively tailor training difficulty, illustrating the potential for personalized, neurologically informed VR training environments.[25]

Physiological strain arising from prolonged VR use presents further challenges. Current VR hardware frequently causes physical discomfort through factors such as headset weight, uneven weight distribution, heat accumulation, and restricted fields of view.[26] Prolonged sessions may result in musculoskeletal strain, particularly neck and shoulder discomfort. Neurologically, continuous discomfort or pain sensations can distract trainees, diverting attention and cognitive resources away from critical training tasks. Thus, ergonomic considerations become essential in equipment design and session structuring, ensuring trainee comfort and optimal neurological engagement throughout VR experiences.

Eye strain represents another notable physiological concern with direct neurological implications. Extended exposure to VR environments increased demand on ocular muscles and visual neural pathways, potentially leading to blurred vision, dry eyes, or difficulty focusing.[27] These symptoms reflect neurological fatigue within visual perception pathways, which, if severe or prolonged, can degrade both short-term task performance and long-term visual health. Ensuring regular breaks and adjusting technical specifications, such as improved display refresh rates, resolution, and visual field ergonomics, can mitigate ocular fatigue and sustain neurological comfort during VR sessions.

Psychological and neurophysiological dimensions must also be considered, as certain VR scenarios may inadvertently induce stress, anxiety, or mild aggression. From a neurological standpoint, stress-related responses involve heightened activation of the autonomic nervous system, altering cardiovascular parameters and neural arousal states, which could either enhance or hinder performance depending on the context. Interestingly, research indicates that combat-experienced personnel exhibited significantly higher levels of perceived stress and were more prone to maladaptive coping mechanisms, including aggression.[28] These findings suggest that while military training provides foundational psychological preparation, prolonged or intense exposure to combat stressors can still result in elevated psychological strain rather than reduced sensitivity.

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24 Remigereau et al. 2024.
25 Kluge et al. 2021.
26 Ito et al. 2021.
27 Hirzle et al. 2022.
28 Lokyan et al. 2025.

Finally, issues related to cognitive disorientation and difficulty distinguishing between virtual and real-world contexts were reported infrequently among users in general.[29] This finding suggests that VR environments, despite their immersive realism, generally preserve robust neurological boundaries between virtual experiences and reality. However, even minimal disorientation risks warrant cautious consideration in critical military training scenarios to avoid potential neurological confusion in crucial operational moments.

In summary, the successful integration of VR into military training critically depends on a comprehensive understanding and careful management of physiological and neurological factors. Addressing cybersickness, cognitive overload, physical ergonomics, visual strain, and psychological responses through informed hardware design, tailored training protocols, and real-time neurophysiological feedback is paramount. As military organizations, including the Hungarian Defence Forces, continue to advance VR technologies and methodologies, prioritizing these human-centered considerations will be essential for optimizing the efficacy, safety, and acceptance of VR-based military training solutions.

RESEARCH METHODOLOGY

The primary aim of this research was to investigate patterns of Virtual Reality (VR) usage among different user groups and to assess potential physiological and neurological effects related to VR experiences. Specifically, the study addressed three core research questions: first, the frequency and purposes for which individuals utilize VR devices; second, the prevalence and nature of VR-related symptoms such as nausea, dizziness, or eye strain; and third, demographic or personal factors that might influence VR usage habits and the perception of associated side-effects. To address these questions, an online questionnaire-based survey was conducted in early 2025, employing convenience sampling. Recruitment took place primarily through various online platforms, including Discord communities, Telegram channels, Facebook interest groups, and university-wide email distributions. Initially, the survey yielded 290 responses, however, 85 respondents indicated no prior VR device usage. These responses were consequently excluded, resulting in 205 valid responses for subsequent analysis.

The questionnaire consisted of 14 targeted questions designed to investigate various dimensions of VR usage. Participants provided detailed information regarding their daily technology and gaming habits, VR device ownership, and frequency of VR use, rated on a 6-point scale (0 indicating "never" and 5 indicating "always"). Furthermore, respondents specified the predominant VR hardware type they employed, distinguishing between PC-connected and standalone headsets. Usage purposes were also recorded, covering entertainment, educational activities, creative tasks, social interaction, and fitness and health-related domains. Participants additionally reported the frequency and severity of experiencing side effects, such as cybersickness (nausea, dizziness), visual discomfort (eye strain, blurred vision), headaches, and psychological or physical symptoms, both during and after VR sessions. Finally, demographic characteristics, including age, gender, educational level, and professional background, were collected to enable subgroup comparisons.

The convenience sampling approach employed in this study naturally restricts the generalizability and representativeness of the findings to broader populations. Moreover, re-

[29] European Agency for Safety and Health at Work 2024.

liance on self-reported data inherently poses potential limitations related to recall inaccuracies and social desirability biases. Nevertheless, the study provides valuable initial insights into the comparative physiological and neurological impacts associated with VR usage. These findings offer a foundational basis for further controlled experimental studies exploring the complex interplay among user characteristics, VR engagement patterns, and the physiological and neurological implications of immersive virtual experiences.

RESULTS

Findings are presented in two sections: General Results (entire sample) and Military-Specific Results (participants with military affiliation). Prior to thematic analysis, respondent demographics are summarized to contextualize interpretation. The gender distribution of respondents revealed a clear male dominance, with 66% identifying as male and 34% as female.

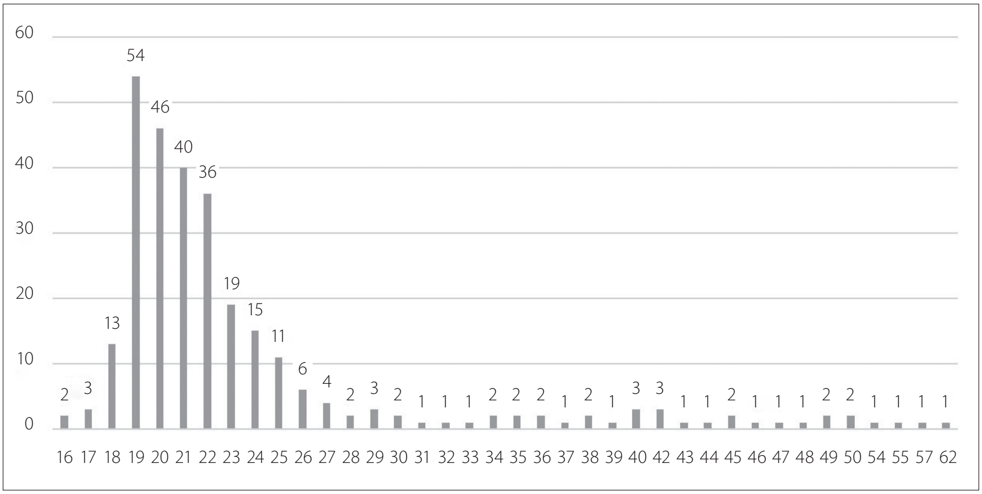

Figure 1 *Age distribution (Edited by the author based on research data)*

Figure 1 illustrates the age distribution. The mean age was 23.7 years (SD = 7.7), with a concentration in the 18–25 range and a peak at age 19. Since the questionnaire was distributed primarily through online tech and gaming communities, this age concentration was expected. However, it is important to note that the sample is not representative of the general population, which was considered when interpreting the results.

GENERAL RESULTS

Only 21% of respondents owned a VR device; however, 71% reported prior VR experience. Despite this exposure, usage frequency was low (mean = 2.00; SD = 1.10 on a 6-point scale). Device types included PC-tethered systems (37%), standalone units (25%), and unknown configurations (38%). Daily technology usage averaged 5.74 hours for work and 2.56 hours for gaming, indicating VR's presence beyond entertainment. Nonetheless, confidence in VR's professional integration remained low (mode = 2; mean = 2.84; SD = 1.41). Across application domains, entertainment showed the highest usage (mean = 2.92; SD = 1.73), while education, work, healthcare, creative use, social interaction, and sports scored substantially lower (means ≈ 1.4–1.6). Notably, domains such as healthcare and social VR, frequent in academic discourse, were rarely utilized in practice.

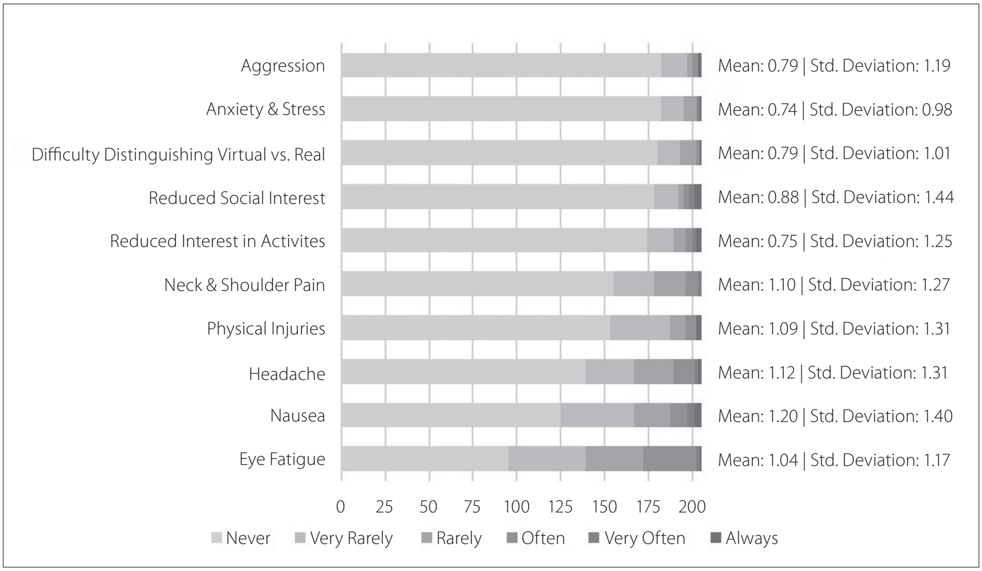

Figure 2 *Frequency of symptoms experienced during VR use*
(Edited by the author based on research data)

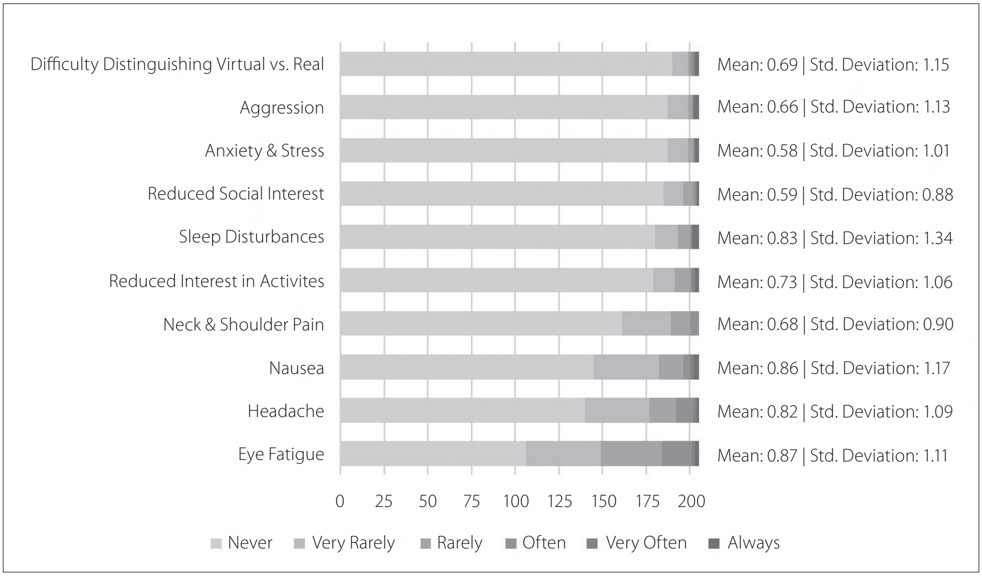

Figure 3 *Frequency of symptoms experienced after VR use*
(Edited by the author based on research data)

Figure 2 depicts in-use symptom prevalence. Nausea, headaches, and eye fatigue were most common (means ≈ 1.0), though typically infrequent. Physical discomfort (e.g., collisions, neck strain) was occasionally reported, consistent with VR's active nature. Psychological symptoms (e.g., disorientation, anxiety) were rare.

Figure 3 shows post-use effects, with eye fatigue, nausea, and headaches remaining the most reported symptoms (means < 0.9). Mild sleep disturbances (mean = 0.83) were more prevalent than expected, potentially linked to cognitive overstimulation. Post-session psychological impacts remained minimal.

Overall, results indicate that while VR is primarily used for entertainment and is generally well-tolerated, mild physical discomfort and residual fatigue are common. These findings align with prior studies on cybersickness and immersive ergonomics.

MILITARY-SPECIFIC RESULTS

The military-affiliated subgroup (n = 73) comprised respondents with military service or military-related education. Comparative analysis was conducted using independent samples t-tests to examine differences in VR usage, application domains, and symptomatology between military and civilian participants. Both groups were predominantly aged 19–22, reflecting typical early-career and educational stages. Military respondents exhibited a broader variance in daily digital work activity, with usage peaks at 4 hours (20.5%) and 6 hours (17.8%), and isolated reports of prolonged use (14–24 hours), likely reflecting duty-related digital operations. In contrast, civilians showed a more centralized distribution around standard full-time work durations (2–8 hours). A notable 6.8% of the military group reported zero daily digital use, suggesting either analog roles or periods of digital abstinence due to operational protocols.

Gaming activity differed significantly: 24.7% of the military group reported no daily gameplay versus significantly lower rates among civilians. This discrepancy may reflect stricter discipline, limited leisure time, or institutional culture discouraging gaming. Conversely, isolated outliers in the military group reported extended gaming sessions, possibly indicating stress-coping behaviors or off-duty recreation. VR device ownership was low in both groups but more limited among military participants (16.4% vs. 22.1%). Nonetheless, prior VR exposure was comparable (~70%), indicating widespread familiarity independent of ownership. Military respondents showed slightly higher optimism towards VR's future utility in professional contexts, potentially reflecting exposure to simulation training environments. However, mean confidence levels remained moderate across both groups, indicating cautious outlooks. VR engagement remained infrequent overall. Both groups primarily used VR for entertainment purposes (gaming, immersive media), while professional, educational, and health-related applications were minimal. Military respondents showed marginally lower usage of PC-tethered VR systems, likely due to access limitations or operational impracticality.

Statistically significant differences emerged in psychological responses. Military-trained participants reported substantially lower anxiety and stress during VR use ($t = 4.316$, $p < .001$), less difficulty distinguishing virtual from real environments ($t = 3.431$, $p = .001$), and fewer sleep disturbances ($t = 3.840$, $p < .001$). Mean scores in these categories approached zero, indicating minimal symptomatology, while civilian responses displayed greater variability and higher averages. These results suggest enhanced psychological resilience in the military subgroup, likely attributable to stress inoculation training, exposure to simulated combat scenarios, and structured cognitive conditioning inherent to military instruction. Physiological symptoms, eye strain, headaches, and physical discomfort showed no significant differences between groups. High intra-group variance limited statistical power in these domains, suggesting that physical responses to immersive technology are more universally distributed, regardless of background. The military group was overwhelmingly male ($t=11.844$, $p<.001$) and significantly less likely to possess IT-related qualifications ($t=6.919$, $p<.001$), reflecting divergent professional pipelines. The binary group variable (military vs. non-military) yielded a highly significant differentiation ($t=-26.129$, $p<.001$), confirming structural separation and validating comparative subgroup analysis.

Overall, military-trained individuals demonstrate higher psychological tolerance and stability during VR exposure, likely linked to their unique training and operational environment. However, physical effects appear consistent across user groups. These findings underscore the moderating role of military experience in immersive technology contexts and suggest operational advantages in training resilience through VR platforms.

CONCLUSION

Virtual Reality (VR) represents a strategic asset in modern military training, enhancing decision-making, threat recognition, and mission readiness. NATO forces, particularly the US and the UK, have demonstrated effective implementation through programs such as the US Army's Synthetic Training Environment (STE) and the UK's Virtual Reality in Land Training (VRLT), showcasing VR's capacity for realistic, cost-efficient, and interoperable training. While still in early adoption phases, the Hungarian Defence Forces also signal intent to integrate immersive systems to strengthen operational effectiveness within NATO frameworks.

VR efficacy is closely tied to physiological and neurological factors, including cybersickness, cognitive overload, ergonomic strain, and stress reactivity. Without proper design, prolonged exposure may impair performance. However, adaptive training protocols incorporating ergonomic design and neurophysiological feedback (e.g., biofeedback-driven scenario adjustments) have proven effective in mitigating these issues, improving cognitive load management, and operational resilience.

Empirical data confirm that compared to civilian users, military-trained users exhibit higher psychological stability, reduced anxiety, and enhanced neurocognitive differentiation between virtual and real environments. While physical symptoms such as eye strain and headaches remain common, the psychological advantages among military personnel highlight the impact of structured, stress-adaptive VR exposure on combat readiness.

Overall, VR offers significant strategic value by optimizing training efficiency, reinforcing cognitive resilience, and minimizing logistical demands. Future development should prioritize human-centered design, integrating physiological, neurological, and ergonomic considerations to fully realize VR's potential in complex defence scenarios and sustain military readiness.

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