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# Investigating the Impact of VR and Digital Simulators on Reducing Cognitive Disorders in the Field of Cognitive Warfare

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## Abstract

Cognitive disorders, which disrupt processes such as thinking, memory, learning, and information processing, pose significant challenges in the context of cognitive warfare. These disorders can severely impair both the military performance and psychological resilience of soldiers, necessitating effective interventions. Emerging technologies, particularly digital simulations and Virtual Reality (VR), have demonstrated potential as innovative tools for mitigating cognitive impairments. This paper investigates the impact of these technologies on reducing cognitive disorders within the framework of cognitive warfare. By creating immersive and interactive environments, digital simulations facilitate the assessment and rehabilitation of critical cognitive functions, including attention, memory, and problem-solving skills. Additionally, VR has shown promise in alleviating anxiety and stress associated with high-pressure combat scenarios. Despite these advancements, further research is needed to evaluate the long-term efficacy of these technologies and to develop evidence-based therapeutic protocols. The findings suggest that VR and digital simulations hold transformative potential for addressing cognitive impairments in military contexts. As such, they represent a valuable addition to the psychological rehabilitation toolkit, offering new opportunities to enhance soldiers' cognitive resilience and operational effectiveness.

**Keywords:** Cognitive disorders, Virtual reality, Digital simulators, Cognitive warfare.

## 1 | Introduction

Cognitive warfare, a new strategy in both the military and social arenas, aims to alter public perceptions, beliefs, and behaviors by leveraging information and media. This type of warfare, with the aim of undermining

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public trust in institutions and creating confusion in society, can have profound and adverse effects on individuals' mental and cognitive health. Cognitive disorders, which include problems in the processes of thinking, remembering, learning, and processing information, can be caused by psychological pressures, stress, and exposure to incorrect information [1]. In the context of cognitive warfare, the main goal of the enemy is to change the way people think and behave in society. This type of warfare can lead to psychological disorders such as anxiety, depression, and Post-Traumatic Stress Disorder (PTSD). Soldiers exposed to this type of warfare may experience information confusion, which has a direct impact on their decision-making [2]. For this reason, there is a need for tools to manage the adverse effects of cognitive warfare on the mental health of soldiers.

New technologies, especially digital simulations and Virtual Reality (VR), have been proposed as practical tools in reducing the adverse effects of war on soldiers' mental health. VR can help improve cognitive functions by providing interactive and engaging environments that stimulate the brain. For example, by using digital simulations, soldiers can practice in real conditions without any risks to them. This can help them cope better with stressful situations and maintain their cognitive abilities [3]. Research has shown that the use of digital simulations can have a positive impact on cognitive functions. For example, one study found that soldiers who underwent VR-based rehabilitation programs improved their abilities in the areas of attention and memory [4]. These types of therapies could serve as tools to mitigate the adverse effects of cognitive warfare.

Additionally, the use of VR can help reduce anxiety and stress associated with war situations. Simulated environments designed to create calm can increase feelings of security and help individuals better cope with the psychological challenges of war [5]. However, the use of VR technologies also has its challenges. The high cost of the equipment required for VR may limit its availability. Users may also need training to utilize the technology effectively. Side effects such as nausea or discomfort may also affect some people when using VR environments.

Ultimately, this article explores the impact of technology and digital simulations on mitigating cognitive impairments in the realm of cognitive warfare. The main goal of this article is to analyze how new technologies can be used in the mental rehabilitation of soldiers and to examine the challenges and opportunities in this field. Given the importance of the topic, the results of this research can help develop effective strategies for managing cognitive impairments caused by cognitive warfare and enhance the quality of life of soldiers after their return home.

# 2 | Literature and Theoretical Basis of the Research

## 2.1 | Definition of Cognitive Warfare

Cognitive Warfare, as a new strategy in the military and social arena, seeks to change public perceptions, beliefs, and behaviors through the use of information and media. This type of warfare, which is known as a more advanced form of psychological warfare, is based on the management of human perceptions and impressions [1]. The main goal of cognitive warfare is to penetrate the minds of individuals and perform mental manipulations to change attitudes and dominate the information analysis model in individuals. For example, in the Cold War, both sides (the United States and the Soviet Union) used propaganda and disinformation to weaken each other. This type of manipulation can lead to confusion in public opinion and a decrease in the morale of military forces.

The history of cognitive warfare dates back to technological and information developments in the 20th century. With the advancements in information and communication technology, cognitive warfare has become an independent type of warfare in which information management against the enemy plays a key role. For example, in the 2016 US presidential election, the use of bots and fake user accounts to spread misinformation and influence voters demonstrates the power of this type of warfare. With the advent of social

media and the Internet, new methods of cognitive warfare have emerged in which information spreads rapidly and has profound effects on public opinion.

## 2.2 | Cognitive Disorders

Cognitive disorders refer to problems that affect the cognitive processes of thinking, remembering, learning, and information processing. These disorders can be caused by various factors such as brain injuries, stress, anxiety, and psychological conditions [2]. For example, soldiers on the battlefield may be affected by severe stress, which can lead to memory impairments or a decrease in their ability to concentrate.

The history of research in the field of cognitive disorders dates back to the early 20th century. At this time, researchers began to investigate the effects of brain injuries on cognitive functions. As time passed and the science of psychology progressed, more attention was paid to the impact of environmental and social factors on cognitive disorders [3]. Today, cognitive disorders are studied not only as a result of physical injuries but also due to psychological stress caused by critical situations.

Cognitive impairments come in many forms and can have a significant impact on a person's quality of life. These impairments may include memory problems, decreased attention, impaired problem-solving, and poor decision-making. For example, one study found that soldiers exposed to combat may experience significant short-term memory impairment [6]. These impairments not only affect a person's performance but can also affect their social relationships.

## 2.3 | Technology and Digital Simulations

New technologies, particularly digital simulations and VR, have been recognized as practical tools in treating cognitive disorders. Digital simulations allow the creation of interactive environments in which users can interact with different situations. These technologies can be used as a tool for assessing cognitive functions and their rehabilitation [3].

VR is a new technology that provides users with 3D simulated environments, allowing them to experience an authentic atmosphere. For example, soldiers can use VR to simulate battlefield conditions without any risks to themselves. Research has shown that the use of VR can have a positive effect on reducing anxiety and stress, as well as enhancing cognitive abilities such as memory and attention [7].

However, there are also challenges related to the high cost of VR equipment, which may limit its availability. Users may also need training to use the technology. Side effects such as nausea or discomfort may also affect some people when using VR environments.

# 3 | Related Works

**Table 1. Research background.**

| Research Results | References |
|---|---|
| This research examines the role of cyberspace in cognitive warfare operations. The authors emphasize that cyberspace is recognized as an essential platform for conducting cognitive warfare operations. | [8] |
| This study examines the impact of the enemy's cognitive warfare on Generation Z and discusses the challenges and solutions ahead. The authors emphasize that cognitive warfare has targeted the adolescent generation as a tool to achieve the expansionist goals of arrogant powers. They identify four main components (changing thoughts, changing beliefs, changing behavior, and changing structures) and present 12 challenges of cognitive warfare in the country. | [9], [10] |
| This article analyzes the enemy's cognitive warfare objectives and emphasizes that cognitive warfare is a tool for achieving development goals without military conflict. The authors identify 24 environmental factors that affect cognitive warfare and propose resilience strategies, including increasing public awareness and media literacy. | [11] |

**Table 1. Continued.**

| Research Results | References |
|---|---|
| This article examines the various dimensions of cognitive warfare, emphasizing that it involves targeting the cognitive faculties of the general public and elites within the target society by altering norms, values, beliefs, attitudes, and behaviors. The authors highlight various techniques, including propaganda, rumor-mongering, and the utilization of social media, in this type of warfare. | [12] |
| This article examines the role of the media in cognitive warfare. The authors argue that the media act as key tools in managing public opinion and can influence changes in attitudes and behaviors. The article also examines how the media is used to create confusion and undermine public trust. | [13] |
| This article examines the United States' hybrid and cognitive warfare against Iran. The authors state that this type of warfare includes psychological, informational, cyber, propaganda, and media warfare, which aims to undermine the Islamic Republic of Iran. | |
| This article examines the challenges of cognitive warfare in the digital age. The authors state that with the advancement of information technology, new challenges have arisen in the field of information management and countering cognitive warfare. | [14] |
| This article examines the various dimensions of cognitive warfare, emphasizing that a comprehensive understanding of social psychology and communication theories is essential for effectively combating it. | [15] |
| This article explores new strategies for addressing the challenges posed by cognitive warfare. The author emphasizes the importance of public education, strengthening media literacy, and building social support networks. | [16] |

# 4 | Research Methodology

This research was conducted based on a review of reputable scientific articles, books, and documents available in scientific databases such as Google Scholar, JSTOR, and Scopus. The sources collected include research articles, theses, and reports related to the topic of cognitive warfare.

# 5 | Research Findings

This section provides a more comprehensive and detailed review of research findings on the impact of technology and digital simulations on reducing cognitive impairments in the field of cognitive warfare. The findings are based on studies and analyses conducted in the field of cognitive warfare, cognitive impairments, and the application of new technologies, including VR.

## 5.1 | The Impact of Cognitive Warfare on Cognitive Disorders

Cognitive warfare, as a modern strategy, can have profound adverse effects on individuals' mental health and cognitive functions. These effects can manifest in the form of various psychological and cognitive disorders.

### 5.1.1 | Memory impairment

Memory impairment is one of the most common problems faced by people affected by cognitive warfare. These impairments can include difficulties in recalling past information or retaining new information. Soldiers may have difficulty recalling painful memories of war, especially when these memories are accompanied by negative emotions. For example, a study conducted by Solomon et al. [17] found that a significant percentage of soldiers returning from the battlefield showed symptoms of PTSD, which directly affected their memory.

### 5.1.2 | Reduced attention

A reduced ability to focus on specific tasks is another negative effect of cognitive warfare. Research has shown that soldiers who are under psychological stress may not be able to focus effectively on their tasks [4]. This can lead to serious errors in critical decision-making. For example, a soldier may fail to react quickly or make the right decision in a crucial situation, which could have dangerous consequences.

### 5.1.3 | Impaired problem-solving

The ability to analyze and solve complex problems may also be affected. This can lead to a decrease in the individual's effectiveness in critical environments. For example, when soldiers are faced with unexpected situations, they may not be able to make decisions quickly or come up with practical solutions.

### 5.1.4 | Increased anxiety and depression

Cognitive warfare can lead to increased levels of anxiety and depression in individuals. Psychological stress caused by misinformation and propaganda may increase feelings of hopelessness and distrust [1]. These feelings can directly affect cognitive functions and lead to a decrease in the individual's quality of life.

### 5.1.5 | Change in attitudes

Cognitive warfare can also alter individuals' attitudes and beliefs about reality. Manipulating information or spreading fake news may confuse and undermine public trust, which in turn will increase anxiety and social tensions [3].

### 5.1.6 | Communication problems

People affected by cognitive warfare may experience communication problems. These problems can be caused by social anxiety or a lack of self-confidence that prevents them from communicating effectively with others.

## 5.2 | The Role of New Technologies in Cognitive Rehabilitation

New technologies, especially digital simulations and VR, have been recognized as effective tools in the rehabilitation of cognitive disorders. These technologies are increasingly used in the treatment of cognitive disorders caused by brain injuries, stress, and psychological conditions.

### 5.2.1 | Virtual reality

VR is a new technology that provides users with 3D simulated environments, allowing them to have an authentic experience. This technology enables users to experience environments similar to the battlefield, facing real conditions without any risk to themselves. The use of VR can have a positive effect on reducing anxiety and stress, as well as strengthening cognitive abilities such as memory and attention [5]. For example, a study conducted by researchers showed that soldiers who underwent VR therapy were able to increase their skills in the areas of attention and memory. This type of therapy helps people cope with their traumatic experiences and feel more secure.

### 5.2.2 | Cognitive function assessment

VR can also be used to assess cognitive functions. These assessments include measuring attention, memory, information processing speed, and problem-solving ability. The use of simulated environments enables the creation of controlled scenarios, providing more accurate results than traditional assessment methods.

### 5.2.3 | Personalized therapy

New technologies have also made it possible to design personalized treatment plans. Systems can create programs tailored to the specific needs of each patient [18]. This type of customized therapy can increase the effectiveness of treatment.

### 5.2.4 | Use of robotics

Robotics has also played an essential role in cognitive rehabilitation. Robots are able to analyze patients' movements and provide exercises tailored to their needs. This technology is beneficial for patients with brain injuries.

# 6 | Positive Effects of Virtual Reality

The use of VR not only helps reduce cognitive impairments but also has positive effects on the quality of life of individuals:

Reducing anxiety: simulated environments designed to create calmness increase feelings of security and help individuals better cope with the psychological challenges caused by war.

Increased social interaction: this technology allows for greater interaction with others and reduce feelings of loneliness.

Improved cognitive functions: research has shown that frequent use of VR , enhances problem-solving skills, critical thinking, and creativity in users.

Increased motivation: the use of new technologies typically increases patients' motivation to participate in the treatment process, as interactive environments are more engaging.

Improving quality of life: thise technology not only have a positive impact on aspects of treatment but also improve the overall quality of life of patients. For example, people who used VR to practice social skills were able to better cope with social situations and gain more confidence.

# 7 | Challenges and Limitations

Despite the many benefits of new technologies, some challenges need to be considered:

I. High cost: the equipment required for VR may be expensive and access to them may be limited.

II. Training need: users may need training to be able to utilize this technology.

III. Side effects: some people may experience discomfort or nausea when using VR environments.

IV. Limited access: some patients may have limited access to new technologies, especially in remote areas or developing countries.

V. Social acceptance: some individuals may be resistant to using new technologies or may be concerned about possible side effects.

VI. Mismatch: some programs or systems may not be able to meet the specific needs of patients; therefore, they require further customization.

# 8 | Conclusion

This paper shows that cognitive warfare has profound adverse effects on cognitive impairments and can lead to problems such as memory impairment, decreased attention, and anxiety in individuals. These effects are especially evident in soldiers who are exposed to psychological stress caused by war and misinformation. Given these challenges, the use of new technologies, such as VR, has been considered an effective solution in cognitive rehabilitation. This technology can not only help reduce the symptoms of cognitive impairments but also improve the quality of life and increase the motivation of patients.

However, to fully exploit the potential of this technology, further research and development of therapeutic approaches based on it are needed. Additionally, challenges such as high costs, training requirements, and limited access in certain regions need to be addressed to make these tools more widely adopted in the treatment process. Ultimately, integrating new technologies with traditional therapeutic approaches can help create more comprehensive solutions for the management of war-related cognitive disorders.

## 8.1 | Suggestions

The following are suggestions for future research related to the topic of this study.

### 8.1.1 | Exploring the impact of VR on cognitive rehabilitation

Research into how VR technology can be used for cognitive rehabilitation in people traumatized by war or mental disorders could help develop new treatments. This research could include clinical trials that evaluate the effectiveness of these technologies in improving memory, attention, and problem-solving skills.

### 8.1.2 | Analyzing the role of digital simulators in military training

Investigating how digital simulators are used in military training and their impact on reducing cognitive impairment in soldiers can help improve training programs and prepare the armed forces. This research could include studying soldiers' experiences and analyzing training data.

### 8.1.3 | Assessing the impact of new technologies on mental health

Research into the effects of new technologies, such as artificial intelligence and augmented reality, on the mental health and cognitive functions of people exposed to cognitive warfare can provide valuable information for policymakers and mental health professionals.

### 8.1.4 | Comparative analysis of technology-based therapies

Comparing the effectiveness of different technology-based therapies (such as VR, augmented reality, and educational games) on cognitive disorders caused by cognitive warfare can help identify the best practices.

### 8.1.5 | Investigating the impact of social media on cognitive perceptions

Research into how social media affects individuals' cognitive perceptions and how public opinions about cognitive warfare are formed can help to better understand cognitive warfare tools.

### 8.1.6 | Developing predictive models to identify cognitive warfare risks

Creating predictive models based on Big Data to identify cognitive warfare threats and assess their effects on society can help make better decisions in dealing with these threats.

These suggestions can pave the way for deeper and more practical research into the impact of technology and digital simulations on reducing cognitive impairments in the field of cognitive warfare.

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## Data Availability

All data are included in the text.

## Conflict of Interest

The authors declare no conflict of interest.

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