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SECURING THE MIND: THE EMERGING LANDSCAPE OF COGNITIVE WARFARE

Andreea STOIAN-KARADELI*, Daniel-Gabriel DINU**

* Department of Public Affairs & Security Studies, University of Texas Rio Grande Valley, Edinburg, TX, USA;
**Doctoral School of Business Administration, Bucharest University of Economic Studies, Bucharest, Romania

Abstract: *Cognitive warfare, as a multidimensional and rapidly evolving domain, presents formidable challenges within the contemporary information-driven world. The purpose of this article is to conduct an assessment of the current traits in the terrain of cognitive warfare, centering on its various facets, strategies, and ramifications. By scrutinizing recent research and studies, we undertake an exploration of the dynamic interplay between visual stimuli, emotional reactions, and the dissemination of information in the molding of cognitive warfare tactics. The paper draws upon previous research that focused on the meticulous selection and analysis of video materials employed in cognitive warfare campaigns, discussing their classification as either news or propaganda, their temporal extent, and their pertinence to specific occurrences. Through an examination of video materials from a diverse array of sources, encompassing Russian, Ukrainian, and international news channels, we acquire insights into the purposeful deployment of narratives, visual components, and linguistic cues to exert influence over public opinion and perception. Furthermore, the paper investigates the role of techniques for acquiring biological data in comprehending the impact of cognitive warfare. By utilizing EEG devices, eye-tracking technology, measurements of galvanic skin reaction, mouse tracking, and high- speed cameras, researchers unearth valuable insights into human cognition, attention, and emotional responses during exposure to propaganda materials. This facilitates a deeper comprehension of the mechanisms employed by agents of cognitive warfare to exploit vulnerabilities and shape narratives. Additionally, the relevance of data processing and analysis in cognitive warfare research is also discussed. By employing advanced computational techniques and engaging in collaborative efforts with multidisciplinary teams of experts, researchers can effectively eliminate artifacts, detect patterns, and validate their findings. This rigorous approach serves to ensure the accuracy and reliability of the obtained results, thereby enhancing our understanding of the intricate dynamics at play within cognitive warfare. In conclusion, the paper provides a comprehensive mapping of the emerging landscape of cognitive warfare, discussing invaluable insights into the multifaceted nature of cognitive warfare and, at the same time, contributing to the development of efficacious countermeasures, strategies, and policies aimed at fortifying the mind and safeguarding societies against the manipulative tactics employed within the realm of cognitive warfare.*

Keywords*: Cognitive Warfare; countermeasures; neuroscience; propaganda; Russia; Ukraine*

1. INTRODUCTION

Cognitive warfare has emerged as a multidimensional domain that poses significant challenges in today's information-driven world. The manipulation of human thinking process and behavior through the militarization of neuroscience has become a prominent concern for national and international organizations, within and beyond the defense field. This paper aims to provide a thorough exposition of the evolution and current state of cognitive warfare, exploring its facets, strategies, and ramifications. By scrutinizing recent research and studies, we investigate the interplay between visual stimuli, emotional reactions, and information dissemination in the molding of cognitive warfare tactics.

2. UNDERSTANDING COGNITIVE WARFARE

The expanding spectrum of conflict is no longer limited to physical and cyber domains, as it now encompasses the manipulation of individuals' cognitive processes. Recent developments in cognitive psychology and information communication technology (ICT) empower various actors to intricately target individuals' perception of their environment and volitional capacities. In response to these transformations, cognitive

warfare (CW) has emerged as a novel paradigm in the realm of military strategy.

Acknowledging the lack of a widely recognized definition of cognitive warfare currently, the current work in the field emphasizes the convergence of several prevailing elements such as the deliberate aim to exert influence over particular individuals and collectives concerning political affairs, acknowledging the notion that warfare constitutes a manifestation of politics through alternative means; the overt targeting of human cognition, encompassing the intricate processes by which individuals perceive, interpret, and assimilate information to acquire knowledge and comprehension (Ottewell, 2020); and the utilization of psychological principles and cutting-edge technologies to precisely direct interventions toward specific individuals or groups (Takagi, 2022).

The underlying objective of cognitive warfare is not novel, as proponents have referred to Clausewitz's emphasis on willpower and Sun Tzu's endorsement of achieving victory without direct conflict as early indications of this concept. However, what distinguishes cognitive warfare today is the unprecedented level of precision it can achieve. In the past, the precision of operations was typically limited to the smallest identifiable group that could be analyzed and targeted. Primitive capabilities constrained cognitive warfare-like operations to broad categories such as masses, nations, organizations, and occasionally high-profile leaders. However, the emergence of disruptive information and communication technology (ICT) has revolutionized the field by enabling the identification, analysis, and targeting of thousands, or even millions, of specific individuals based on their behaviors and characteristics. These tactics are expected to continue to mature.

Nevertheless, the effectiveness of cognitive warfare extends well beyond the scope of traditional influence operations. Global actors are cognizant of this evolving landscape and are actively devising methods to harness its opportunities.

On June 21, 2021, the North Atlantic Treaty Organization (NATO), through its Innovation Hub located in France, convened its inaugural meeting on Cognitive Warfare (Claverie & Cluzel, 2021). NATO perceives CW as an amalgamation of two distinct military domains that were previously managed separately: psychological operations and information technologies, including cyber warfare. CW leverages a substantial body of scientific knowledge accumulated over recent decades, which now serves as a foundation for military action. Specifically, it draws upon insights from the disciplines of neuroscience and behavioral sciences, which are then applied on a large scale through computing and network technologies, utilizing an understanding of social, complex, and adaptive systems.

The central principle of CW extends beyond mere strategic advantage without direct combat. Its objective is to exert control over an adversary by influencing their thoughts, preferences, and beliefs through modifications of their cognitive representations of reality. In this context, CW represents a form of warfare that targets the underlying structure of human thinking, responsible for the spontaneous conceptualization of reality at the individual level. The aim of CW is not annihilation but absolute dominion over a population to achieve maximal net gains.

Although shrouded in secrecy, several declassified documents from the past decades have revealed methods and technologies that foreshadow the present ensemble of CW. Notably, an essay published by NATO's Allied Command Transformation office in 2020 proposed CW as the sixth domain of military operations, alongside the existing domains of land, sea, air, cyber, and space (Cole & Guyader, 2020). This opinion piece presents a selection of such evidence, focusing on the human elements of CW, and underscores how the scientific advancements that have contributed to improving human health and communication in recent years can also be employed to disrupt attention span, memory, and reasoning abilities within a population, thereby fundamentally altering their perception of reality.

3. ASSESSMENT OF PREVIOUS RESEARCH ON VIDEO MATERIAL SELECTION AND ANALYSIS IN COGNITIVE WARFARE CAMPAIGNS

3.1 Classification of Materials as News or Propaganda. Research on video material selection and analysis in cognitive warfare campaigns has emphasized the importance of distinguishing between news and propaganda content. In the context of cognitive warfare, where the manipulation of information is a key strategy, the classification of video materials becomes crucial. Previous studies have focused on developing criteria and frameworks to differentiate between news, which aims to provide accurate and unbiased information, and propaganda, which seeks to influence and manipulate public opinion.

For instance, Dugan *et al.* (2017) conducted a content analysis of video materials employed in cognitive warfare campaigns, examining the presence of bias, framing techniques, and manipulative tactics. Their findings revealed distinct characteristics in propagandistic videos, such as the use of emotional appeals, selective presentation of facts, and the creation of narratives to shape audience perception. In contrast, news videos were found to prioritize factual reporting, multiple perspectives, and journalistic integrity.

3.2 Temporal Extent of Video Materials. Another aspect explored in previous research is the temporal extent of video materials used in cognitive warfare campaigns. Understanding the duration of these materials is essential for assessing their impact, evaluating the strategies employed, and identifying patterns in the dissemination of propaganda messages over time.

Dugan *et al.* (2017) conducted a longitudinal analysis of video materials in cognitive warfare campaigns, tracking their temporal extent from their initial release to their discontinuation. They found that propagandistic videos exhibited longer durations compared to news videos, indicating a deliberate effort to captivate and influence viewers through extended exposure. The extended temporal extent of propaganda materials was linked to the intention of reinforcing narratives, instilling emotions, and shaping long-term perceptions among the target audience.

3.3 Pertinence of Video Materials to Specific Occurrences. In cognitive warfare campaigns, the pertinence of video materials to specific occurrences plays a significant role in shaping public opinion and influencing decision-making processes. Previous research has sought to understand the strategic selection of video materials and their alignment with specific events or incidents to advance cognitive warfare objectives. For example, Barna and Dugan (2015a) examined the echoes of the hybrid war and romanian media coverage of the ukrainian crisis and extrapolated the analysis on video materials used during a specific geopolitical conflict (Dugan *et al.,* 2017) and analyzed their pertinence to key occurrences. Their study revealed a deliberate pattern of selecting and disseminating videos that aligned with critical events, aiming to reinforce preferred narratives, manipulate public sentiment, and influence the interpretation of the conflict. By establishing connections between video materials and specific occurrences, cognitive warfare actors strategically shape the public's perception of events, thereby gaining control over the narrative surrounding the conflict.

Previous research on video material selection and analysis in cognitive warfare campaigns has shed light on the classification of materials as news or propaganda, the temporal extent of video materials, and their pertinence to specific occurrences. These studies have underscored the deliberate tactics employed by cognitive warfare actors to manipulate public opinion through the selection, framing, and dissemination of video materials. By understanding these aspects, researchers and practitioners can gain insights into the strategies employed in cognitive warfare and develop effective countermeasures to mitigate the impact of manipulative propaganda.

4. DISCUSSION OF PURPOSEFUL DEPLOYMENT OF NARRATIVES, VISUAL COMPONENTS, AND LINGUISTIC CUES IN COGNITIVE WARFARE

4.1 Insights from Video Materials Analysis. The purposeful deployment of narratives, visual components, and linguistic cues in cognitive warfare campaigns has been a subject of extensive research. Scholars have sought to analyze video materials to gain insights into the strategies employed by cognitive warfare actors and the impact they have on public opinion and perception.

Research studies have examined video materials from diverse sources, including Russian, Ukrainian, and international news channels, to uncover the deliberate tactics used in cognitive warfare campaigns. For instance, Dugan and Dinu (2017) conducted a qualitative analysis of video materials, focusing on the narrative structures employed and the presence of visual and linguistic cues. Their findings revealed patterns in the construction of narratives to shape audience perception and manipulate emotions. The strategic use of visual components, such as imagery, symbols, and graphic design, aimed to enhance the persuasive impact of the videos and create a lasting impression on the viewers.

Additionally, Dugan and Dinu (2017) employed a mixed-methods approach to analyze video materials, combining content analysis with audience reception studies. Their research highlighted the significance of linguistic cues, such as persuasive language, framing techniques, and the manipulation of rhetoric, in influencing the interpretation of cognitive warfare messages. Through this analysis, they uncovered the

intentional deployment of linguistic devices to evoke emotional responses, create a sense of urgency, and foster specific attitudes among the target audience.

4.2 Influence over Public Opinion and Perception. The purposeful deployment of narratives, visual components, and linguistic cues in cognitive warfare campaigns has a profound influence on public opinion and perception. Through the strategic manipulation of these elements, cognitive warfare actors seek to shape the narrative surrounding specific events, issues, or conflicts.

Previous research has demonstrated the impact of cognitive warfare videos on public opinion and perception. Wang et al. (2016) conducted an experiment to assess the effectiveness of video materials in influencing attitudes and beliefs. Their findings indicated a significant correlation between exposure to persuasive narrative of the videos and shifts in product preference that can be extrapolated to correlation between propagandistic videos and shifts in public opinion towards the desired narratives promoted by cognitive warfare actors Dugan *et al.* (2017). The analysis revealed that the deployment of narratives, visual components, and linguistic cues in these videos played a crucial role in shaping the attitudes, emotions, and cognitive processes of the viewers.

Moreover, Dugan *et al.* (2017) conducted an experimental study where participants were exposed to different versions of video materials with varying degrees of narrative framing and visual manipulation. The results demonstrated that the intentional deployment of narratives, visual components, and linguistic cues influenced the interpretation of information and subsequently affected individuals' perception of the depicted events. These findings highlight the persuasive power of cognitive warfare videos in shaping public opinion and perception.

The purposeful deployment of narratives, visual components, and linguistic cues in cognitive warfare campaigns has garnered significant attention in research. Insights from video materials analysis have provided researchers with valuable knowledge about the strategies employed by cognitive warfare actors. Furthermore, these tactics have been found to exert a powerful influence over public opinion and perception. Understanding the impact of narratives, visual components, and linguistic cues is crucial in developing effective countermeasures to mitigate the manipulative tactics used in cognitive warfare.

5. THE ROLE OF TECHNIQUES FOR ACQUIRING BIOLOGICAL DATA IN COMPREHENDING THE IMPACT OF COGNITIVE WARFARE

5.1 Utilization of EEG Devices, Eye-Tracking Technology and Galvanic Skin Reaction. Understanding the impact of cognitive warfare on human cognition, attention, and emotional responses requires the utilization of advanced techniques for acquiring biological data. Researchers have employed various tools and technologies, including EEG devices, eye-tracking technology, galvanic skin reaction measurements, mouse tracking, and high-speed cameras, to delve into the intricate dynamics at play in cognitive warfare campaigns. EEG devices have been widely used to measure brain activity and electrical signals during exposure to propaganda materials. Studies by Johnston *et al.*, (2022) demonstrated the effectiveness of EEG devices in capturing neural responses associated with cognitive processing and emotional arousal. By analyzing the neural correlates of specific stimuli, researchers can gain insights into the impact of cognitive warfare on human cognition.

Eye-tracking technology has been instrumental in understanding visual attention and the influence (Johnston *et al.*, 2022) of cognitive warfare materials on gaze patterns. Dugan *et al.* (2017) conducted eye-tracking studies to investigate how propaganda videos manipulate viewers' attention and direct their focus. By tracking eye movements, researchers identified areas of interest within the videos and examined the patterns of attentional allocation, providing valuable insights into the visual components that attract viewers' attention and facilitate narrative shaping.

Galvanic skin reaction measurements have been used to assess emotional responses during exposure to propaganda materials. Alsharif *et al.* (2022) employed galvanic skin response techniques to measure physiological changes indicative of emotional arousal. The findings of Dugan *et al.* (2017) highlighted the emotional impact of cognitive warfare videos and their ability to elicit strong reactions from the audience. By examining galvanic skin reaction, researchers can identify the emotional triggers employed in cognitive warfare campaigns.

5.2 Insights into Human Cognition, Attention, and Emotional Responses. The application of techniques for acquiring biological

data has yielded significant insights into human cognition, attention, and emotional responses in the context of cognitive warfare. By examining brain activity, eye movements, galvanic skin reaction, and behavioral responses, researchers have gained a deeper understanding of how propaganda materials impact individuals.

Studies have revealed that cognitive warfare materials can elicit cognitive biases, influence decision-making processes, and shape beliefs and attitudes. For example, EEG can be used for measurements to examine the neural correlates of cognitive biases induced by propaganda videos. Their findings demonstrated how specific techniques employed in cognitive warfare exploit cognitive vulnerabilities, leading to biased information processing and the shaping of narratives. Eye-tracking studies have highlighted the strategic deployment of visual components to capture viewers' attention, guide perception, and influence interpretation. Johnston *et al.* (2022) found that *eye-tracking data revealed systematic patterns in visual attention*, indicating the intentional design of cognitive warfare videos to direct viewers' focus towards specific elements. These findings underscore the role of visual cues in shaping narrative comprehension and subsequent cognitive responses. By measuring galvanic skin reaction and physiological arousal, researchers have uncovered the emotional impact of cognitive warfare materials. Dugan *et al.* (2017) demonstrated that propaganda videos evoked strong emotional responses, including fear, anger, and empathy, among viewers. These emotional reactions can shape individuals' perceptions, beliefs, and willingness to accept manipulated narratives.

5.3 Exploitation of Vulnerabilities and Shaping of Narratives. Techniques for acquiring biological data have provided valuable insights into the exploitation of vulnerabilities and the shaping of narratives incognitive warfare. Through the analysis of EEG data, eye-tracking patterns, galvanic skin reaction, and mouse tracking, researchers have identified the mechanisms employed by cognitive warfare actors to exploit cognitive vulnerabilities and guide narrative comprehension.

Heslen (2020) discusses the concept of neurocognitive hacking and its potential applications in cyber conflict at different levels: strategic, operational, and tactical. Neurocognitive hacking involves the activation of specific neural areas in the brain through subliminal or supraliminal stimuli to influence the behavioral outcomes of an adversary. Research indicates that mortality-related stimuli activate certain neural correlates in the brain, such as the right amygdala and left anterior cingulate cortex, leading to negative behavior towards out-group members, including unconscious discriminatory behavior.

The phenomenon of neurocognitive hacking has implications for information operations targeting populations with diverse ethnic, cultural, or religious backgrounds. By leveraging the in-group/out-group dynamic, this approach could be exploited to manipulate target populations using tailored propaganda or the shaping of specific behavioral outcomes. Although the theoretical framework behind neurocognitive hacking is still being developed, the introduction of mortality-related stimuli is proposed to activate an individual's unconscious vigilance system, prompting further evaluation of the stimuli's significance and potential threat. As a result, discriminatory affective reactions towards out-group members may arise as automatic heuristics designed to protect the individual from perceived survival threats.

Consequently, the presentation of mortality-related stimuli via computer networks to targeted audiences holds the potential to facilitate the dissemination of customized propaganda and the manipulation of specific behaviors within a population. The intended outcomes may include sowing division within a target community or weakening support for a particular political regime. Neurocognitive hacking offers a novel approach to cyber conflict, exploiting the neurocognitive processes underlying human behavior. By understanding and manipulating the brain's response to mortality-related stimuli, this technique has the potential to shape attitudes, beliefs, and behaviors within targeted populations. However, further research is needed to fully develop the theoretical framework and explore the practical implications of neurocognitive hacking in the context of cyber warfare (Heslen, 2020).

Studies have revealed that cognitive warfare materials strategically target specific cognitive biases and heuristics to manipulate individuals' decision-making processes. By exploiting biases such as confirmation bias, availability bias, and framing effects, cognitive warfare actors shape narratives that align with their objectives. For instance, Barna and Dugan (2015b) demonstrated how propaganda videos leverage cognitive biases to reinforce pre-existing beliefs, distort perceptions of reality, and manipulate individuals' cognitive processes.

The utilization of techniques for acquiring biological data has shed light on the ways in which cognitive warfare materials shape narratives. The analysis of eye-tracking data has shown how visual components, such as salient imagery, text placement, and graphic design, guide viewers' attention and facilitate the construction of desired narratives. By strategically manipulating visual cues, cognitive warfare actors create a narrative framework that aligns with their goals and influences individuals' interpretation of events.

Furthermore, the examination of emotional responses through galvanic skin reaction measurements has revealed the intentional elicitation of specific emotions to shape narrative comprehension. Cognitive warfare materials often aim to provoke fear, anger, or empathy, evoking emotional responses that strengthen the narrative's impact and enhance persuasion. These emotional manipulations contribute to the successful dissemination of propaganda messages and the shaping of public opinion.

6. CONCLUSIONS

This paper provides a comprehensive mapping of the emerging landscape of cognitive warfare, shedding light on its multifaceted nature while contributing to the development of effective countermeasures, strategies, and policies to fortify the mind and safeguard societies against manipulative tactics. Addressing the complexity of informational conflict requires the identification of symmetrical and asymmetrical means of countering it, the establishment of scientific research tools and institutions, and the development of a legal framework to dismantle this phenomenon. Furthermore, protecting personal digital footprints, securing decision-makers against disinformation, and adopting cultural security strategies become imperative. Lastly, the role of neuroscience in understanding cognitive warfare necessitates interdisciplinary research directions, technological breakthroughs, and ethical frameworks for the use of neurotechnologies, with neuroethics and international laws serving as a legal foundation for counteracting cognitive warfare.

The relevance of data processing and analysis in cognitive warfare research cannot be underestimated. The employment of advanced computational techniques, collaborative efforts, and multidisciplinary approaches contributes to a deeper understanding of cognitive warfare phenomena. By ensuring the accuracy and reliability of findings, researchers can develop more effective countermeasures and strategies to mitigate the influence of cognitive warfare. By employing these rigorous analytical approaches, researchers can enhance our understanding of the intricate dynamics at play within cognitive warfare and inform policies and practices aimed at safeguarding societies against manipulative tactics.

In conclusion, techniques for acquiring biological data, including EEG devices, eye-tracking technology, galvanic skin reaction measurements, mouse tracking, and high-speed cameras, have provided valuable insights into the impact of cognitive warfare on human cognition, attention, and emotional responses. These techniques have revealed the exploitation of cognitive vulnerabilities and the deliberate shaping of narratives by cognitive warfare actors. By understanding these mechanisms, researchers can develop effective countermeasures and strategies to mitigate the influence of cognitive warfare and safeguard individuals against manipulative tactics.

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