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14. ABSTRACT

This paper examines how Artificial Intelligence (AI) is being used to diagnose and treat service members with post-traumatic stress disorder (PTSD). It begins by exploring the history of how the armed forces treated PTSD from the American Civil War to the present. The paper reviews the latest technologies being used to diagnose and treat service members suffering from PTSD and observes future technologies as well. The use of AI can help mental health practitioners diagnose potential PTSD patients, but as this paper argues it should only be used as a tool. The focus here is on the ethical use of AI as a means of promoting positive mental health and recovery from PTSD in relation to human interaction. The paper concludes with the importance of human interaction in the care of PTSD patients while providing ideas of how to better care for service members during the redeployment phase.

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Artificial Intelligence, post-traumatic stress disorder, ethics, virtual reality

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The Ethics of Emerging Technologies in the Diagnosis and Treatment of
PTSD Among Service Members

by

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Date Submitted: 27 October 2020

A paper submitted to the Faculty of the United States Naval War College Newport, RI in partial satisfaction of the requirements for the Ethics and Emerging Military Technology Graduate Certificate Program.

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<u>Abstract</u>

Artificial Intelligence (AI) is being used to diagnose and treat service members with post-traumatic stress disorder (PTSD), but there are legitimate moral and ethical concerns as well as questioning its effectiveness when compared to other treatment modalities. The research explores the history of how military forces have treated PTSD from the American Civil War to the present. It reviews the latest technologies being developed to diagnose and treat service members suffering from PTSD including virtual reality, biomarker detection, deep brain stimulation, and the use of social robots. The research compares and contrasts the ethical use of such AI systems through the lens of utilitarian, deontological, and virtue ethics. Although AI has been proven to help mental health practitioners diagnose PTSD among service members, this research argues that AI technology should be used only as an initiatory or intermediate mean with an end state to promote positive human-to-human interaction. The paper concludes by examining the importance of creating healthy social connections as an essential treatment for PTSD patients while offering ideas to better care for service members during a military redeployment phase.

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Introduction

Standing before an assembly at Trinity College on 15 June 1941, General George C. Marshall profoundly stated, "The soldier's heart, the soldier's spirit, the soldier's soul, are everything. Unless the soldier's soul sustains him, he cannot be relied on and will fail himself and his commander and his country in the end."[1] As long as humans have faced conflictual situations leading to trauma, a potential for psychological issues has existed. One specific psychological diagnosis of a traumatic experience is called post-traumatic stress disorder or PTSD. PTSD develops as "a result of directly experiencing, witnessing, or being repeatedly exposed to aversive details of, a potentially traumatic event such as death, combat, sexual assault or serious injury."[2]

The Department of Veterans Affairs defines PTSD as "the development of characteristic and persistent symptoms along with difficulty functioning after exposure to a life-threatening experience or to an event that either involves a threat to life or serious injury."[3] Because psychoanalysis is a relatively new field in behavioral science, the majority of research and therapies dealing with PTSD have developed within the past one hundred and fifty years. Within this time period the vast majority of PTSD issues studied have dealt with trauma during military combat.[4]

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[1] George C. Marshall, "484 Speech at Trinity College, 15 June 1941," in *The Papers of George Catlett Marshall, vol. 2, "We Cannot Delay," July 1, 1939-December 6, 1941*, ed. Larry I. Bland, Sharon Ritenour Stevens, and Clarence E. Wunderlin, Jr. (Baltimore and London: The Johns Hopkins University Press, 1986), pp. 534-538, https://www.marshallfoundation.org/library/digital-archive/speech-at-trinity-college/
[2] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders,* 5th ed. (Washington, DC: American Psychiatric Association, 2003)
[3] Miriam Reisman. "PTSD Treatment for Veterans: What's Working, What's New, and What's Next." *P & T:* vol. 41,no 10 (2016): 624.
[4] Candice M. Monson, Mathew J. Friedman, and Heidi A. J. La Bash, "*A Psychological History of PTSD.*" *In Handbook of PTSD, First Edition: Science and Practice*, edited by Matthew J. Friedman, Terence M. Keane, & Patricia A. Resick, New York: Guilford Press, 2010, 38

This paper explores the various technologies and therapeutic methodologies used by mental health providers in treating PTSD among combat veterans from the period of the American Civil War to present. It argues that although emerging technologies have their place within PTSD sufferers, face-to-face human interaction and a healthy social structure is more beneficial in overcoming PTSD than virtual reality (VR) and artificial intelligence (AI) technologies.

The research included in this paper does not condone, promote, or recommend any particular treatment modality for a person suffering with psychological disorders or a person who has been clinically diagnosed with PTSD. An individual suffering with any psychological issues including depression, anger, suicidal ideations, or experiencing physiological symptoms including pain, loss of appetite, excessive weight gain, fatigue, or other medical conditions should see their primary care physician immediately. This paper does not delve into the psychological and functional effects of PTSD, nor does the researcher intend to commit information outside of his professional field. The focus here is on the ethical use of AI as a means of promoting positive mental health and recovery from PTSD in relation to human interaction.

In the aftermath of 9/11, it is unclear as to the number of combat veterans suffering from PTSD. One major study of 60,000 service members who served in Iraq and Afghanistan from 2003-2016, estimated the number at 13.5 percent for deployed and non-deployed service members alike. Other studies have shown the number to be as high as 20 to 30 percent.[5] A

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[5] Miriam Reisman, "PTSD Treatment for Veterans: What's Working, What's New, and What's Next," *Pharmacy and Therapeutics* 41, no. 10 (October 2016), 623.

corresponding study revealed "as many as 500,000 U.S. troops who have served in these wars over the past 13 years have been diagnosed with PTSD."[6]

Costs to treat veterans diagnosed with PTSD is another tool used for measuring a sample population. Individuals suffering from PTSD incur high costs not only to the individual but the taxpayer and healthcare institutions. A two-year study performed on U.S. veterans estimated social costs as high as $923 million dollars, while a study conducted on a sample population of U.S. civilian and uniformed females alike diagnosed with PTSD exceeded an annual cost of over $1 billion.[7] A 2005 Veterans Affairs report showed veterans receiving disability compensation grew less than 15 percent from 1999 to 2004, while PTSD cases grew by 80 percent during the same time period.[8]

Several risk factors have been observed in the veteran population that have the potential to increase a veteran's chance of PTSD. Experts cite age of the person when the trauma occurred, gender, racial minority status, economic status, rank, education level, prior psychological history, and family relationships among the primary factors.[9] One interesting study accumulated data from 38 individual studies to determine specific risk factors for PTSD among veterans. The research found that service members had a greater chance of being diagnosed with PTSD during military service if "pre-trauma" markers were present. For instance, a "family history of mental illness, gender[10], personality traits, early traumatization, negative parenting experiences, and

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[6] Miriam Reisman, 623.

[7] Oswald D. Kothgassner et al., (2019) "Virtual Reality Exposure Therapy for Posttraumatic Stress Disorder (PTSD): a Meta-Analysis, European Journal of Psychotraumatology, 10, no. :1, (2019): 2, DOI: 10.1080/20008198.2019.1654782 2

[8] Steven G. Koven, "Veteran Treatments: PTSD Interventions," *Healthcare* 6, no. 3 (September, 2018) 1, doi:http://dx.doi.org.usnwc.idm.oclc.org/10.3390/healthcare6030094.

[9] Miriam Reisman, "PTSD Treatment for Veterans: What's Working, What's New, and What's Next," *Pharmacy and Therapeutics* 41, no. 10 (October 2016): 624.

[10] In a meta-analysis conducted on service members involved in combat operations, females were more likely to experience PTSD than males. Xue Chen et al., "A Meta-Analysis of Risk Factors for Combat-Related PTSD among Military Personnel and Veterans, " PLoS One 10, no. 3 (March, 2015), 13

lower education" might all be contributing factors for PTSD outside of the actual traumatic, combat experience itself.[11]

Advancements in technology, medicine, behavioral health, and the slow progression of stigma removal for those reaching out for help have allowed many modern service members to seek and find relief from PTSD through both psychological and pharmacological treatments. However, this has not always been the case. Since wars among humanity began, warriors have always had to test their individual psychological boundaries. Specific traumatic events might devastate some but have no ill effect on others, and vice-versa.

Throughout history mankind has had to use the best mental tools and technologies available to help cope with the trauma of war. One of the earliest records of psychological war trauma was written by the Greek historian, Herodotus, while writing about the Battle of Marathon in 490 B.C. It seems that a warrior was killed extremely close to another warrior. The surviving warrior immediately became blind without having been wounded.[12] The next chapter will examine some of the psychiatric methodologies and medical technologies of specific time periods used by mental health professionals to treat service member's war and post-war psychological dilemmas. This information will give a better understanding of the effectiveness of traditional methodologies and AI in our modern military environment.

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[11] Xue Chen et al., "A Meta-Analysis of Risk Factors for Combat-Related PTSD among Military Personnel and Veterans, " *PLoS One* 10, no. 3 (March, 2015) 2.
[12] Miriam Reisman, "PTSD Treatment for Veterans: What's Working, What's New, and What's Next," *Pharmacy and Therapeutics* 41, no. 10 (October 2016): 624.

Historical Survey of Combat-related PTSD from 1861 to Present

PTSD and the American Civil War

The American Civil War took place between 1861-1865 and geographically was concentrated in the Eastern half of the United States. When it ended, some 620,000 Americans had died. Later studies push the casualty rate as high as 850,000.[13] The carnage of war was horrendous, as described by many soldiers who survived. Commonplace statements included, "Dead bodies everywhere. You must imagine the scene - I cannot begin to describe it. I shudder at the slaughter."[14] With ten times as many soldiers dying during the American Civil War compared to the Vietnam War, one would think PTSD would be rampant. Perhaps it was.

The lack of consistent media reports, insufficient medical technology, and the air of pride and honor in being a soldier all contributed to the "war is grand" perception. The romanticism of the American Civil War was not a perception, but rather a deception. Alcoholism was rampant. Unemployment sky-rocketed. Suicide was endemic. One could find at least one Civil War veteran housed in virtually every asylum in the country.[15]

The term PTSD was not known during the Civil War. Symptoms at that time, of what is now called PTSD, referred to a soldier having nostalgia, insanity, sunstroke, or melancholy. Other terms used included mania, dementia, and monomania.[16] In 1870, Dr. Arthur Meyers used the term "soldier's heart" when he described a disorder that included fatigue, dyspnea, tremors, and other physiological symptoms displayed in combat soldiers. The multiplicity of names and treatments reveal the questioned search for psychological disorders among service members.

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[13] "Civil War Facts," American Battlefield Trust, accessed July 14, 2020, https://www.battlefields.org/learn/articles/civil-war-facts#What%20happened%20to%20prisoners?

[14] Eric T. Dean, Jr, "We Will All Be Lost and Destroyed: Post-Traumatic Stress Disorder and the Civil War," *Civil War History* 37, no. 2 (1991): 141.

[15] Dillon Carroll, "The Civil War and P.T.S.D.," *New York Times,* May 21, 2014, 2.

[16] Eric T. Dean, Jr. "We Will All Be Lost and Destroyed: Post-Traumatic Stress Disorder and the Civil War," Civil War History 37, no. 2 (1991): 140.

Civil War psychiatric technology to treat such symptoms seemed elementary compared to today. Without knowing the cause, and possessing very little training on the human mind, surgeons and doctors simply did the best they knew how. Risk factors for nostalgia might include the young age of farm boys who became soldiers, and the three-year length of enlistment without being able to see family and loved ones. Medical officials blamed it on "inactivity in the camp."[17] Basically, when the soldier has nothing to do and lives in extremely unsanitary conditions, the physical body and mind began to deteriorate. Ultimately, soldiers displaying PTSD or "nostalgia" symptoms were first thought of just needing rest, food, and time away from the battlefield. Many were sent to hospitals and then rejoined their units at a later time.

Due to the period culture, it was important for doctors to not diagnose mental illness due to the honor and respect that came with being a soldier. A soldier would most definitely face ridicule and shame as a mental diagnosis would reveal a weak and cowardly character. Called *DaCosta's Syndrome*, named after Civil War surgeon Jacob Mendez DaCosta, "irritable heart" was diagnosed as a "biological response to stress," thereby saving the soldier from shameful perceptions of cowardice, low unit morale, or poor leadership."[18]

During the war, soldiers experiencing debilitating nostalgia were sometimes sent from a nearby hospital to an asylum. It was difficult to be discharged from the Army on the grounds of insanity, but many soldiers tried in order to avoid combat and living in field environment conditions. It is estimated that twice as many deaths during the Civil War were due to disease and sickness rather than actual combat.[19]

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[17] Tony Horwitz, "PTSD: The Civil War's Legacy." 2.

[18] Gerri C. Lasiuk and Khaty M. Hegadoren, "Posttraumatic Stress Disorder Part I: Historical Development of the Concept," *Perspectives in Psychiatric Care* 42, no. 1 (February 2006): 17.

[19] Tony Horwitz. "PTSD: The Civil War's Legacy." 2.

After the Civil War, doctors began to see repetitions in PTSD symptoms. Dr. R. M. Wilson noticed that the majority of soldiers experienced the same conditions: exhaustion, breathlessness on slight exertion, pain, and a rapid pulse.[20] Supporting DaCosta's theory on a biological response to stress, treatments to alleviate the symptoms were considered to be physiological, not psychological. The theory was that the infantry soldier's accoutrements were too constricting, thus causing a rise in blood pressure and "extreme excitability of the heart."

The committee studying the research called this "irritable heart."[21] Rest and recuperation were not viable treatments any longer, because doctors had seen the symptoms of "irritable heart" return when the soldier was rejoined with his unit. Therefore, it was recommended that an infantry soldier be fitted with a brace to help support the weight of his field gear and, thus allow more space around the heart area. The tight accoutrements were eliminated, but the symptoms remained. It was then thought that over exertion coupled with tight accoutrements were the culprits, and the exertion was executed during the unit's "setting up" drill.[22] However, the setting-up drill was discontinued, but the physiological symptoms of PTSD continued.

PTSD and the First World War

Experiencing the forerunner of PTSD symptoms known as "shell shock," veterans of the First World War experienced combat like no soldier before them. It was "the war to end all wars" or "The Great War." New weapons technology including the machine gun, armored tank, airplane, chemical gas, and accurate artillery created unprecedented carnage on ally and enemy alike. Thousands of surviving soldiers on both sides experienced extreme psychological

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[20] R. M. Wilson, "Discussion on the Soldiers Heart," *Proceedings of the Royal Society of Medicine* 9, (May 1916): 37.
[21] Wilson, "Discussion on the Soldiers Heart," 17.
[22] Wilson, 18.

disorders due to the unforgiving combat and battlefield conditions. Trench warfare, where soldiers were forced to live in muddy, disease-ridden trenches for months on end, produced depression and hopelessness.

As the weapon technology changed from that of previous conflicts, psychiatric technology began to change as well. The most comprehensive research found on service members experiencing shell shock during the war is found among the historical records of the Royal Army Medical Corps (RAMC). Therefore, this section focuses mainly on the diagnosis and treatment technologies used to treat British soldiers serving during World War I.

Much like the misdiagnosis of the American Civil War and after, certain doctors believed shell shock was a physiological effect caused by compression and decompression of explosives leading to microscopic brain hemorrhaging. It was also believed the release of carbon monoxide in such an explosion could cause cerebral poisoning.[23] Because soldiers not in proximity to explosions suffered from the same symptoms, physicians then believed correctly that shell shock could be emotionally charged rather than physical. As Wiltshire noted in 1916, "In the vast majority of shell shock, the exciting cause is some special psychic shock. Horrible sights are the most frequent and potent factor in the production of this shock. Losses and the fright of being buried are also important in this respect."[24]

By December of 1914, it was estimated that seven to ten percent of British officers and three to four percent of other ranks had shell shock.[25] It has been estimated that as high as 40% of casualties during the Battle of the Somme were shell shocked.[26] Four treatment areas were to

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[23] Edgar Jones and Simon Wessely, *Shell Shock to PTSD: Military Psychiatry from 1900 to the Gulf War* (New York: Psychology Press, 2005), 23.
[24] Jones and Wessely, *Shell Shock to PTSD:* 24.
[25] Alistair McKenzie, "Anesthetic and Other Treatments of Shell Shock: World War I and Beyond," *Journal of the Royal Army Medical Corps* 158, no. 1 (March 2012): 29, doi:http://dx.doi.org.usnwc.idm.oclc.org/10.1136/jramc-158-01-07.
[26] Alistair McKenzie. "Anesthetic and Other Treatments of Shell Shock," 30.

be erected in France to provide psychiatric treatment for soldiers. Several smaller psychiatric hospitals existed in England specifically functioning as treatment centers for soldiers experiencing mental health symptoms. As in the American Civil War, confidentiality with regards to the misperception of emotional weakness was important. Therefore, soldiers needing to be evacuated were merely coded as "wounded" until they arrived at one of the four psychiatric treatment facilities. These treatment facilities were called "NYDN" centers, meaning "not yet diagnosed nervous."[27] As the treatment facilities became fully functional, more soldiers were sent for treatment. From January 1916 to October 1918, over 4,200 soldiers were seen and treated at the Third Army NYDN center alone. Although 63.5% of shell shock patients were returned to their fighting units, no records were kept of relapses.[28]

The actual therapies conducted at the psychiatric facilities varied widely depending on the director and whatever latest technology worked to discharge the soldier to their unit. Major William Brown, 4th Army NYDN, used a modified Freudian approach that advocated for abreaction – getting the patient to relive his combat experiences through light hypnosis and talk therapy.[29] Brown treated between 2,000 to 3,000 soldiers and reported that 70% had returned to their unit. Another therapy consisted of the administration of anesthetic. In one case a soldier had survived a nearby explosion but immediately afterwards could not speak. Six weeks later he was allowed to go into a nearby town with some fellow companions and became drunk at a local tavern. The medical report said he "found his voice" after becoming intoxicated and began singing the rest of the night.[30] Several reports indicated soldiers who had lost their voice due to combat trauma began to speak after being etherized.

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[27] Edgar Jones and Simon Wessely. 29.
[28] Edgar Jones and Simon Wessely. 29.
[29] Alistair McKenzie. 30.
[30] Alistair McKenzie, "Anesthetic and Other Treatments of Shell Shock," 30.

Perhaps no other treatment facility for shell shock was as famous as the hospital in Craiglockhart in Edinburgh. Craiglockhart was open from October 1916 to March 1919. The hospital had received two different commanders during its tenure. Because the research behind combat psychiatry was still relatively new, a strong bias existed as to what therapies or technologies should be administered at the hospital. Once again, it depended on the personality and personal biases of the commander or lead physician. Early therapies included punishment rather than support. One patient stated, "the Director of Medical Services nourished a deep-rooted prejudice against Craiglockhart, and actually asserted that he never had and never would recognize the existence of such a thing as shell shock."[31] A different director, Colonel Balfour-Graham, believed strict disciplinarian rules would be sufficient psychotic treatment for shell shock. He would question each patient and discover what particular interests they had. Then, he would assign to them the complete opposite for their treatment. For instance, intellectuals in their civilian life were forbidden to use the hospital library and forced on physical fitness sports and exercise. [32]

A newer technology at that time was electric shock treatment, or faradization, where the patient would receive a powerful jolt of electricity to various parts of the body."[33] Dr Lewis Yelland, an advocate for such therapy, believed shell shocked soldiers suffered from a weak will and could be cured if they were, as he called it, "re-educated." One actual account of faradization technology therapy recorded a serviceman being "strapped to a chair for twenty minutes at a time while strong electricity was applied to his neck and throat; lighted cigarettes had been applied to

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[31] Thomas E. F. Webb, "Dottyville'-Craiglockhart War Hospital and Shell-Shock Treatment in the First World War, " *Royal Society of Medicine* 99, no. 7 (July 2006): 343.

[32] Thomas E. F. Webb, "Dottyville'-Craiglockhart War Hospital and Shell-Shock Treatment in the First World War," 343.

[33] Jones and Wessely. 38.

the tip of his tongue and 'hot plates' had been placed at the back of his mouth."[34] He was forced to repeatedly endure the "therapy" until his shell shock symptoms subsided.

The most beneficial psychiatric technology administered at Craiglockhart with the greatest recorded success rate was perhaps the oldest therapy known to mankind and did not include medicine, punishment, or electrical shock. Created by clinician Arthur James Brock under the direction of the new facility commander, Professor William Brown; it was known as "ergotherapy" or the "cure by functioning."[35]

Brock believed the best therapy for shell shocked soldiers was to help them reconnect to the environment they knew before the war. He helped the patients secure temporary, local occupations such as farming or as teachers in nearby schools. Brock believed shell shock was "a condition which could only be combated by the useful functioning of the individual in improving the immediate environment for himself and those around him."[36]

For every occurrence of psychiatric malpractice among World War I physicians, numerous successes were also recorded. Each psychiatric doctor had to walk a fine line between providing effective treatments for the soldier and maintaining manpower strength by discharging the serviceman back to the front. The newest psychiatric technologies were crude and for the most part untested in medical laboratory conditions. Success rates varied and were often falsified to protect the physician or to open facility space for the influx of new shell shock patients fresh from the battlefield.[37] To forget about the horrors of The Great War, many psychiatric treatment records were never transferred to the civilian sector. These records could have presented valuable

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[34] Jones and Wessely. 39.
[35] Webb. 343.
[36] Webb. 344,
[37] Jones and Wessely. 38.

information for psychiatric research for future conflicts or to stimulate the advancement of technology in treating PTSD.

PTSD and the Second World War

New technologies and therapies for treating PTSD advanced little, if at all, during the interwar period between 1918 and 1938. Many psychiatric treatment plans were either never documented or the records were destroyed or locked away after WWI. Virtually no education was offered to psychiatry students of the lessons learned from The Great War. It was not until the evacuation of British troops at Dunkirk in 1940 did RAMC remember the emotional trauma succumbed by so many twenty years earlier. Ten to fifteen percent of the British casualties evacuated from Dunkirk were diagnosed as combat stress related.[38] The United States armed forces fared little better at its initiation in the North Africa campaign. U.S. psychiatrists boasted of returning between 50-70 percent of combat stress-related casualties back to duty, but Drs Drayer and Glass admitted "it is difficult to determine the validity of such return-to-duty result."[39] Therefore, actual numbers do not exist. Over 500,000 American troops were casualties of "psychiatric collapse," and 40 percent of all medical discharges in World War II were for psychiatric reasons.[40] Schultz points out that at war's end over 1,393,000 of U.S. Armed Forces personnel were treated for combat fatigue or what we now call PTSD.

U.S. military psychiatry during World War II relied heavily on screening techniques to separate the emotionally healthy soldiers from the psychologically unstable recruits. Doctors

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[38] Edgar Jones and Simon Wessely, "*Shell Shock to PTSD: Military Psychiatry from 1900 to the Gulf War,*" 70.

[39] Jones and Wessely, 87.

[40] Duane Schultz, "The Breaking Point: Combat Stress in WWII," Warfare History Network, accessed July 18, 2020, https://warfarehistorynetwork.com/2016/09/30/the-breaking-point-combat-stress-in-wwii/

believed characteristics such as "constitution, genetic makeup, and temperament, or the effect of childhood experiences," could distinguish those individuals who would be suitable for military service.[41] Psychoanalyst, Dr. Henry Stack Sullivan, joined the U.S. Selective Service with the goal of helping to create and execute an efficient screening process for new U.S. recruits. Sullivan believed if a person could not adjust in civilian life they could not function in the military. However, Dr. William Menninger believed the primary screening goal for U.S. military officials was not to determine the emotionally healthy but to screen out homosexuals, "which they believed destroyed combat effectiveness and morale."[42]

To maintain combat strength, General Omar Bradley ordered that all U.S. servicemen suffering from combat stress be held for only seven days before being returned to their unit unless the soldier was physiologically hindered from doing so. The P.I.E. methodology (*proximity, immediacy*, and *expectancy*) developed by the French and first used by the British in WWI served as the frontline reference. Proximity meant the soldier should be treated for combat stress as close to the frontline as possible. Immediacy meant psychological diagnoses were to be treated with the same importance as physical wounds. Expectancy meant the combat-stressed soldier should be returned to duty as quickly as possible.[43] In the words of U.S. Army psychiatrist, COL William Porter, "The Army is not to be regarded as a treatment method or a social agency."[44]

To keep combat strength at an optimal level, military psychiatrists diligently sought the most effective technologies and treatments for their soldier-patients. British treatments were

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[41] Hans Pols and Stephanie B. Oak. "WAR & Military Mental Health: The US Psychiatric Response in the 20th Century." *American Journal of Public Health* 97, no. 12 (12, 2007): 2133.
[42] Hans Pols and Stephanie B. Oak, "WAR & Military Mental Health: 2133.
[43] Edgar Jones and Simon Wessely. 26-27.
[44] Menninger, W. W. "Contributions of Dr. William C. Menninger to Military Psychiatry." *Bulletin of the Menninger Clinic* 68, no. 4 (Fall, 2004): 282.

primarily conventional including, but not limited to, "drug-induced narcosis, insulin coma therapy, persuasion or re-education, suggestion with or without hypnosis, reconditioning, graduated physical exercise, occupational therapy, and a number of 'superficial analysis.'"[45] The demands upon U.S. military psychiatrists were equally formidable. For instance, during the Tunisian campaign of 1943, it was estimated that "34% of all battle related disorders were labeled neuropsychiatric."[46]

U.S. Army psychiatrists Roy Grinker and John Spiegel and Army neurologist and neurosurgeon Captain Frederick Hanson, had great success administering both sodium pentothal or sodium amytal to traumatized soldiers. The soldier would sleep up to 48 hours. Upon waking, the patient was given a hot shower, food, clean clothes, a "pep talk," and sent back to the line.[47]

The induced coma created a dream-like state allowing the recovering serviceman to speak clearly, calmly, and revisit traumatic events without experiencing the physiological and emotional trauma attached. The soldier's treatment was enhanced by keeping him close to the sounds of combat for the entire duration. Reports estimate as high as 70 percent of soldiers receiving this type treatment were returned to duty within one week, but the statistics were later downgraded due to lack of verifiability.[48] Nevertheless, Hanson and his team's therapeutic approach was so successful, it became official Army doctrine and was administered for the remainder of the war.

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[45] Edgar Jones and Simon Wessely, 71.
[46] Hans Pols and Stephanie B. Oak, 2135.
[47] Duane Schultz, "The Breaking Point: Combat Stress in WWII," Warfare History Network, accessed July 18, 2020, https://warfarehistorynetwork.com/2016/09/30/the-breaking-point-combat-stress-in-wwii
[48] Hans Pols and Stephanie B. Oak, 2135.

PTSD and the Korean War

Peacetime was short for active duty American service members after World War II with the oncoming Korean War in 1950 also known as "The Forgotten War." Though the conflict only lasted 3 years, it took a toll on the psyche of the American service members who fought there, especially in the early months between June 1950 and November 1951 when the fighting was the most dynamic. Psychiatric casualties among U.S. troops ran as high as 460 per 1,000 but gradually tapered as the conflict became static.[49]

The psychiatric programs used to eradicate combat fatigue among the U.S. soldiers were extensions of WWII therapies, which were carryovers from WWI. The type of warfare soldiers faced in Korea was somewhat different than the combat theaters in WWII. Frigid winters, impassible terrain, enemy infiltration, and the looming fear of torture or execution if captured, played havoc upon the combat soldier's psychological faculties not to mention actual combat itself.[50] Initially, there were no psychiatrists in the Korean theater. Soldiers suffering from combat fatigue or PTSD were evacuated to Japan or the United States sometimes as many as 20 soldiers per week.[51]

Under the supervision of COL Albert J. Glass, a U.S. Army psychiatrist and WWII veteran, treatment for combat fatigue was initiated and organized in theater. Within eight weeks of the war's beginning, psychiatric hospitals were established in Korea and Japan.[52] Success rates included 50 to 70 percent of soldiers suffering from combat fatigue being returned to duty

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[49] Edgar Jones and Simon Wessely. 121.
[50] Cameron Ritchie Elspeth. "Psychiatry in the Korean War: Perils, PIES, and Prisoners of War," *Military Medicine* 167, no. 11 (November 2002): 898.
[51] Cameron Ritchie Elspeth. "Psychiatry in the Korean War: Perils, PIES, and Prisoners of War." 899.
[52] Jones and Wessely, 122.

using the P.I.E. method. During periods of less intense fighting, 65 to 90 percent were returned to duty.[53]

There was virtually no advancement in new technologies for treating combat fatigue during the Korean War. Using the P.I.E. method to keep combat strength at an optimal level, drugs were used to invoke sleep and rest when arriving at the psychiatric hospitals. The soldier would be given food, clean clothes, and a hot shower. However, drug abuse became a major problem among many soldiers seeking psychiatric care; so much so that there was great concern among U.S. leadership as how to best handle the issue. It was even rumored that Chinese troops were importing heroin and opiates to the Americans in order to curtail their fighting strength.[54] Electric shock treatment without convulsions was also used as a therapy with some success.

PTSD and the Vietnam War

Contrary to what many may believe, PTSD treatment among American soldiers during the Vietnam War was a great success. Several factors for this success must be noted. First, military psychiatric teams were deployed with combat troops during the initial build up in Vietnam. Second, P.I.E. was the chosen methodology in treating soldiers and could be initiated efficiently due to the large number of psychiatric teams and helicopter evacuation technology available in-country. Third, fewer soldiers were actually engaged in combat, the tours were shorter than previous wars, and the soldiers had regular contact with home.[55] Consequently, psychiatric success during the Vietnam War was so significant that one Army psychiatrist made

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[53] Jones and Wessely, 123.
[54] Cameron Ritchie Elspeth. 53
[55] Edgar Jones and Simon Wessely. 128

the comment, "Psychiatric casualties need never again become a major issue of attrition in the United States military in a combat zone."[56]

The issue with PTSD and Vietnam veterans comes from their return home, not while they were overseas in combat conditions. Vietnam veterans returning home did not receive the welcome as their predecessors fighting in WWII. Sympathy for the soldiers undermined by news media reports, movies, and political unrest in America by those who disfavored the war, was rare even among many healthcare professionals.[57] It is no wonder that drug abuse and alcoholism greatly increased among Vietnam veterans who were trying to cope with the trauma of war and the coldness of the nation they felt they were defending.

The symptoms of PTSD were recognized among Vietnam veterans in the late 1970s. In 1980, the term "PTSD" was actually adopted as the official diagnosis of trauma victims. Because drug use was so common during the war, it became difficult to treat soldiers with pharmacological methods, as it was seen as merely adding to the drug addiction. There was also the problem of misdiagnoses. "Because so many veterans received a diagnosis prior to 1980, and because PTSD may mimic other diagnoses, PTSD often becomes a secondary diagnosis, that is, not the order of primary treatment focus."[58]

Perhaps the greatest study on PTSD conducted among Vietnam veterans was the National Vietnam Veteran's Readjustment Study (NVVRS). A VA funded study mandated by Congress in 1983, the research showed that "the majority of Vietnam veterans had made a successful return to civilian life and experienced few symptoms of PTSD or other readjustment problems."[59] The

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[56] Edgar Jones and Simon Wessely. 129
[57] Thomas D. Blair and Nancy Hildreth L, "PTSD and the Vietnam Veteran: The Battle for Treatment," *Journal of Psychosocial Nursing & Mental Health Services* 29, no. 10 (October 1991): 15
[58] D. T. Blair and Nancy Hildreth L., "PTSD and the Vietnam Veteran: The Battle for Treatment," 17
[59] Jones and Wessely. 133

study found that 15.2 percent of male veterans and 8.2 percent of female veterans had symptoms of PTSD.

PTSD: Desert Storm, Operation Enduring Freedom, and Operation Iraqi Freedom

In this section, technologies and therapies for treating service members with PTSD during Desert Storm, Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are synchronized since the type of warfare, terrain, climate conditions, and weapon technologies are virtually the same with regards to psychological actions and reactions by U.S. service members. Much of the data gathered about PTSD during all three conflicts was due to post-deployment surveys. Many of these surveys were self-reported, meaning truthfulness of the participants was paramount to the validity of the results.

An outstanding research project conducted by the U.S. Navy analyzed data from 3,180 service member mental health visits during combat operations in Iraq from 2006-2007 to determine a) sociodemographics of military members seeking in-theater mental health treatment, b) the distribution of psychiatric conditions, and c) the interventions recommended in theater by mental health providers.[60] Data was collected from the Theater Mental Health Encounter Data (TMHED). Most of the service members surveyed were Marines, Army, Navy, and Air Force, respectively in that order of service members evaluated.

Of those seen by a mental health provider, 31 percent were diagnosed with anxiety disorders, including 11 percent with PTSD. Forty-one percent of those diagnosed with anxiety disorders received medication. Thirty-five percent received a plan including psychotherapy and/or counseling. Thirty-four percent received behavioral modification recommendations

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[60] Kimberly J. Schmitz et al., "Psychiatric Diagnoses and Treatment of U.S. Military Personnel While Deployed to Iraq," *Military Medicine* 177, no 4, (April 2012): 381

including more sleep, better hygiene, classes on substance abuse, and assignments to "help

practice coping skills." [61] Antidepressants were the drugs most widely prescribed for military

patients in theater. The findings also revealed that over usage of hypnotic medications in-theater

to induce sleep should not be overlooked. This could easily jeopardize job performance.[62]

The preceding section gave a brief and general analysis of the in-theater diagnosis,

treatments and technological advancements used to help service members cope with PTSD from

the American Civil War to OIF/OEF. Though advancement in medical technology has allowed

for new pharmacological interventions, such as hypnotic and antidepressant medications,

innovations in PTSD diagnosis and treatment has been relatively nonprogressive.

There has also been a shift in historical leadership priorities from maintaining optimal

combat strength by getting the soldier back to the frontline as quickly as possible, to supporting

the individual service member in maintaining optimal mental health as witnessed in the past

decade. The most beneficial practice of coping with PTSD was for the service member to stay

engaged with their comrades in a temporary safe environment. Human connection was

paramount to their behavioral health.

The shift in focus from mass quantity to individualized quality was the result of new,

"smart-weapon" technology. Emerging weapons technology allows for fewer boots-on-the-

ground, thereby diminishing the need to maintain a large military presence as in past conflicts.

This potentially allows more attention and resources to focus on the individual service member's

health and welfare. Emerging technologies have also opened the door for a myriad of

[61] Kimberly J. Schmitz et al., "Psychiatric Diagnoses and Treatment of U.S. Military Personnel While Deployed to Iraq," 382
[62] Kimberly J. Schmitz et al., 382

opportunities in diagnosing and treating service members with mental health issues including PTSD.

Emerging Technologies for PTSD

As has been documented, the advancement in military psychiatry certainly has not kept pace with the advancement of other defense industries including military weaponry, transportation, medical procedures and diagnostic machines, and cyberwarfare platforms. One major issue with psychological evaluation and treatment, especially regarding to PTSD, consists of many health care professionals not trained to recognize the specific pathologies. Care access is also poor in many places.[63] However, new technologies are in development to help screen, diagnose, and treat service members suffering from anxiety and PTSD.

The next section explores the latest in military psychiatric technology and how its ability to psychologically support service members dealing with mental health issues and possible diagnosis of PTSD. These emerging technologies include virtual reality (VR), artificial intelligence machines (AI), deep brain research (DBR), and functional magnetic resonance (fMRI). Some technologies, like mindfulness meditation or group-talk therapy, do not possess a digital format, but still offer successful treatment plans through conventional means.

Virtual Reality

The precursor of today's virtual reality (VR) technology was devised in the 1990s. For defense and military training, virtual reality was used extensively in training aircraft pilots via

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[63] Alexis Bourla et al., "E-PTSD: An Overview on how New Technologies can Improve Prediction and Assessment of Posttraumatic Stress Disorder (PTSD)," *European Journal of Psychotraumatology* 9, (2018), 2

computerized simulators. After 9/11, healthcare providers sought a variety of ways to implement

virtual reality as a mental health therapy for U.S. combat troops diagnosed with PTSD when

returning from Afghanistan and Iraq. Therapists began to synchronize proven PTSD therapies

with VR platforms to enhance the overall therapeutic care.

Exposure therapy has been an effective treatment for sufferers of PTSD, but it has

downsides. During exposure therapy, the provider helps the patient to recall phobic or fearful

events repeatedly. While somewhat effective, it can also create potential ethical concerns as the

patient must recall the traumatic event and experience the fears that accompany such trauma.

This type of therapy may produce inconsistent visualization of the "imaginal exposure."[64] Thus,

the results will not be stable or predictable. VR technology, which has been effective in treating

phobias, was implemented to treat PTSD and help overcome some of the negative side effects

while enhancing the capabilities of exposure therapy. Together it is called virtual reality

exposure therapy (VRET).[65]

VRET offers many benefits to the patient with PTSD including increased individual

control over stimuli and allowing the user to replicate a myriad of environments.[66] The platform

can induce stressful and anxiety-ridden events comparable to real-life situations. Therefore,

VRET could be a viable method for exposure therapy. However, the efficacy of VRET in PTSD

veterans are uncertain.[67]

Studies conducted by the University of Vienna report that VRET used for veterans

diagnosed with PTSD had only marginal effects when compared to traditional exposure therapies

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[64] Oswald D. Kothgassner et al., "*Virtual Reality Exposure Therapy for Posttraumatic Stress Disorder (PTSD): a Meta-Analysis.* European Journal of Psychotraumatology 10, no.1 (2019): 1.

[65] Oswald D. Kothgassner et al., (2019) p. 2

[66] JoAnn Difede, et al. "D-cycloserine Augmentation of Exposure therapy for Post-traumatic Stress Disorder: a Pilot Randomized Clinical Trial," Neuropsychopharmacology 39, no. 5 (2014): 1052-8, doi:10.1038/npp.2013.3171052–1058.

[67] Kothgassner et al., "Virtual Reality," 2

not utilizing virtual reality capabilities.[68] The studies concluded that VRET is a logical alternative or supplemental choice when used with primary behavioral health therapies such as cognitive processing therapy (CPT) or eye movement desensitization and reprocessing (EMDR).[69]

VRET administered to veterans diagnosed with PTSD reveal positive outcomes. In 2004, the Office of Naval Research funded a project in partnership with the University of Southern California's Institute for Creative Technologies (ICT) to develop a VRET program called *Virtual Iraq*.[70] In the project, a computerized simulation was created closely resembling Xbox® gaming options and graphics. Mission information was given to the researchers by actual combat veterans, thus making the simulation a more realistic experience.

Once the patient has explained the certain combat scenario or multiple scenarios that caused the trauma, the therapist can then recreate a realistic virtual scene on an interactive computer display. The veteran-patient then relives the wartime trauma through the game. Actual battle sounds including rockets, mortars, small-arms fire, Humvee engines, and radio chatter can be injected into the game. The patient's seat can vibrate simulating a rough ride on a desert road.

Olfactory sensations can add to the realism as the therapist has the option to inject actual smells from specialized canisters including smoke, fuel, gunpowder, cordite, body odor, and local food smells.[71] Additionally, Virtual Afghanistan was developed by adding mountainous

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[68] Kothgassner et al., 9

[69] Kothgassner et al., 9

[70] Albert Skip Rizzo et al., "Development and Early Evaluation of the Virtual Iraq/Afghanistan Exposure Therapy System for Combat-related PTSD," *Annals of the New York Academy of Sciences* 1208, (2010): 114-25, doi:10.1111/j.1749-6632.2010.05755.x

[71] Albert Skip Rizzo et al. "Development and Early Evaluation of the Virtual Iraq/Afghanistan Exposure Therapy System, 116-117.

terrain and mission scenarios conducive to that theater of operation. Virtual Iraq and Virtual Afghanistan are now in over 40 Veterans Affairs, military, and university laboratory sites.[72]

The initial outcomes have been positive. Eighty percent of completers utilizing VRET showed both "statistically and clinically meaningful reductions in PTSD, anxiety, and depression symptoms."[73] Results of therapists using VRET as a primary modality updated in 2015 continued to report positive outcomes among veterans with PTSD. Consequently, the researchers observed that VRET could possibly be utilized with some modifications, during a service member's redeployment phase as the initial screening for possible PTSD.

Mindfulness Therapy

Although not a new technology in and of itself, mindfulness-based interventions (MBI) have shown to be an effective therapy for service members, as well as civilians, suffering from PTSD. Differing from CPT and prolonged exposure (PE) therapy, mindfulness-based therapies are "present-centered." This modality helps the patient to accept any thoughts that come into their mind without being judgmental of such thoughts or feelings.[74] Mindfulness refers to "the process of intentionally bringing one's attention, in a nonjudgmental manner, to the internal and external experiences that exist in the present moment."[75] Two of the more popular modalities of mindfulness therapies include mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapies (MBCT).

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[72] Albert Skip Rizzo et al., 119.

[73] Albert Skip Rizzo, et al., 122.

[74] Jenna E. Boyd et al., "Mindfulness-Based Treatments for Posttraumatic Stress Disorder: A Review of the Treatment Literature and Neurobiological Evidence," *Journal of Psychiatry & Neuroscience:* 43, no. 1 (January 2018): 8.

[75] Teresa M. Edenfield and Sy Atezaz Saeed, "An Update on Mindfulness Meditation as a Self-Help Treatment for Anxiety and Depression," *Psychology Research and Behavior Management* 5, (2012): 132.

Oftentimes, people confuse mindfulness with meditation, but they are separate functions used synergistically. The act of meditating began among Asian cultures and has been identified as a core component of Buddhist philosophy. Within the two major types of meditation, transcendental (TM) and mindfulness (MM), mindfulness meditation has been the most recommended for mental health therapy.[76]

The goal in MM is to allow the patient to be mentally focused on the thoughts they are currently having without ignoring them or allowing such thoughts to control their emotions or feelings. Not only have studies shown mindfulness meditation to be successful for PTSD patients as indicated below, but it also has many proven physical benefits such as lowered blood pressure rates, increased cerebral blood flow, reduction in muscle tension, and decreased depression/anxiety.[77]

Mindfulness-based interventions target many of the core features of PTSD including "avoidance, hyperarousal, emotional numbing, negative emotions such as shame and guilt, and dissociation."[78] During meditation, the patient may have thoughts associated with personal trauma, but mindfulness techniques help prevent the thoughts from being associative to the person's identity. Therefore, the thought becomes a dissociative concept allowing the person to remain in control of his or her feelings. By instructing the patient to replace negative thoughts with positive and self-accepting thoughts during the meditation session, the feeling of loving-kindness is introduced. Labeled "metta meditation," it is believed thoughts of love and compassion can be generated by the patient and thus reduce feelings of "guilt, shame, and anger," which are common emotions among PTSD sufferers.[79]

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[76] Teresa M. Edenfield and Sy Atezaz Saeed, "An Update on Mindfulness Meditation," 132.
[77] Edenfield and Saeed, 132.
[78] Jenna E. Boyd et al., "Mindfulness-Based Treatments for Posttraumatic Stress Disorder." 8.
[79] Jenna E. Boyd et al., 8.

The benefits of meditation mindfulness have been documented in the U.S. as far back as the 1960s and 1970s by Dr. Herbert Benson, in what he called, "the relaxation response."[80] Benson believed the sympathetic nervous system, which controls our stress levels and flight-or-fight response, could be balanced by purposely relaxing one's parasympathetic nervous system through meditation. However, meditation is not the only vehicle for relaxation. People have found that prayer, yoga, breathing techniques, tai chi, energy healing, and massage can yield the same benefits.[81] The goal is to relax the mind and body.

A myriad of clinical research has found variations of MM to be highly effective among service members diagnosed with PTSD. Researchers such as Cole, Goldsmith, Gallegos, Kearney, Bormann, Earley, and many more have acquired outstanding results in lessening PTSD symptoms among an exclusive veteran sample population. Mindfulness therapy variations studied included MBCT and alternative MBSR formats such as metta mindfulness, mindfulness-based exposure therapy, and mantra repetition.[82]

Diagnosis of PTSD among service members can be problematic. There can exist certain biases or prejudices, and feelings of guilt, shame, or stigma. Service members are reluctant to openly share their experiences even with the perception of anonymity. Data accumulation and test results can be skewed. On the other extreme, some may over-report for financial gain through medical compensation. However, medical researchers believe advancements in biometric technologies may produce a solution for accurate PTSD diagnosis.

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[80] Marilyn Mitchell, "Dr. Benson's Relaxation Response," *Psychology Today*, March 29, 2013, https://www.psychologytoday.com/us/blog/heart-and-soul-healing/201303/dr-herbert-benson-s-relaxation-response

[81] Marilyn Mitchell, "Dr. Benson's Relaxation Response."

[82] Jenna E. Boyd et al., 19.

Biomarker Technology

Some researchers believe if PTSD is systemic and affects the entire body of the individual rather than just the mind, then it is possible to test specific biological markers for anxiety disorders including PTSD by taking a blood sample.[83] Research conducted by various institutions including Harvard, University of California, New York Langone Medical School, and the U.S. Army Integrative Systems Biology section, found that "disease signals likely span multiple biological domains, including genes, proteins, cells, tissues, and organism-level physiological changes."[84] The tests conducted were superior to previous biomarker testing, in that they were a systems biologic framework or "multi-omic," meaning data was collected from examining the "genomics, transcriptomics, proteomics, methylomics, lipidomics and metabolomics" of the individual.[85]

Initial testing revealed an 81 percent accuracy rate at diagnosing PTSD by using a blood sample and analyzing 28 biomarkers including "DNA methylation, proteins, miRNAs, metabolites, and other molecular and physiological measurements."[86] This emerging technology offers a quick and simple way to overcome many of the complications currently facing the diagnosis of anxiety disorders and PTSD. We will examine next how artificial intelligence is being used to diagnose and treat service members with behavioral health issues. The ethical ramifications of such emerging technology will also be considered regarding human rights and needs.

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[83] Kelsey Dean, et al., "Multi-omic Biomarker Identification and Validation for Diagnosing Warzone-related Post-traumatic Stress Disorder, *Molecular Psychiatry* (2019), 1, https://doi.org/10.1038/s41380-019-0496-z

[84] Dean, et al., "Multi-omic Biomarker Identification and Validation for Diagnosing Warzone-related Post-traumatic Stress Disorder," 1.

[85] Dean, et al*.,* 2.

[86] Dean, et al., 10.

Artificial Intelligence Technology

Artificial intelligence (AI) is "the field of science concerned with the study of intelligent machines."[87] It is important to understand the two major types of AI. Artificial General Intelligence (AGI) is machine intelligence that is capable of "abstracting concepts from limited experience and transferring knowledge between domains."[88] Narrow AI, or sometimes called weak AI, is capable of performing one specific task and its knowledge cannot be transferred between domains. All AI systems in the world today are considered narrow AI technologies. Experts agree that the scientific world is still far away from creating AGI machines which possess rational thoughts, emotions, and abstract ideas.[89]

At the core is a form of AI called machine learning (ML), which is basically the "capability of software or a machine to improve the performance of tasks through exposure to data and experience."[90] As already mentioned, computerized virtual reality platforms are a type of AI, but this section will focus on machines capable of not only teaching but having the ability to "learn" and giving feedback to users as well. Using computer science and machine algorithms, mental health providers hope to effectively diagnose PTSD and establish treatment plans based on thousands of data points specific to the individual client.

Diagnosis for PTSD can be enhanced using AI. AI uses include imaging data, smartphone questionnaires, and biometric data which tracks the person's sleep and skin conductance. Consequently, when magnetic resonance imaging (MRI) is used together with ML

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[87] David D. Luxton, ed., "*Artificial Intelligence in Behavioral and Mental Health Care* (San Diego: Academic Press, 2016) 1.

[88] Mariya Yao, Marlene Jia, and Adelyn Zhou. *Applied Artificial Intelligence: A Handbook for Business Leaders* (New York: TOPBOTS, 2018) 8.

[89] Yao, Jia, and Zhou, *Applied Artificial Intelligence* 9.

[90] David D. Luxton, ed., Artificial Intelligence in Behavioral and Mental Health Care. (San Diego: Academic Press, 2016), 4.

a 92 percent accuracy rate is routinely achieved diagnosing those with PTSD from those without.[91]

The American Psychological Association Presidential Task Force on Military Deployment Services for Youth, Families and Service Members presented their findings in 2007 that listed three challenges to military mental health treatment. This included availability, acceptability, and accessibility to mental health care providers and facilities.[92] One development to help overcome these barriers and make mental health care available, acceptable, and accessible to service members is what the University of Southern California's Institute for Creative Technologies (ICT) calls "SimSensei."

The SimSensei Kiosk is a virtual human interviewer that engages the client face-to-face making them feel comfortable sharing information. SimSensei creates dialogue with the client, in this case a veteran or active duty service member. The dialogue between client and machine is designed to stimulate specific reactions sensed through audio and video that present markers for anxiety symptoms or PTSD.[93]

The SimSensei technology was designed to lessen the stigma related to mental health concerns among veterans. As Hoge et al. (2004) observed among Iraq/Afghanistan war veterans, ". . . those whose responses were positive for a mental disorder, only 23 to 40 percent sought mental health care. Those whose responses were positive for a mental disorder were twice as

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[91] Alexis Bourla et al., "E-PTSD: An Overview on how New Technologies can Improve Prediction and Assessment of Posttraumatic Stress Disorder (PTSD)." *European Journal of Psychotraumatology* 9, (2018). 4.

[92] Albert Rizzo, in *Artificial Intelligence in Behavioral and Mental Health Care*, ed. David D. Luxton (San Diego: Academic Press, 2016), 60.

[93] David DeVault, et al., "SimSensei Kiosk: A Virtual Human Interviewer for Healthcare Decision Support," in Alessio Lomuscio, Paul Scerri, Ana Bazzan, and Michael Huhns (eds.), Proceedings of the 13th International Conference on Autonomous Agents and Multiagent Systems (Paris, AAMAS, 2014), 1061.

likely as those whose responses were negative to report concern about possible stigmatization and other barriers to seeking mental health care."[94]

SimSensei technology is not intended to replace human clinicians, but rather to function as an additional support tool along with questionnaires and other therapeutic modalities. Advantages to the SimSensei system include replicability and consistency in the questions presented and feedback from the virtual interviewer. The system creates an environment of anonymity and client acceptance.

The design goals for SimSensei included a) "users should feel comfortable talking and sharing personal information with the virtual interviewer; b) the system should be sensitive to the user's nonverbal behavior; c) the system should generate appropriate nonverbal behavior itself."[95] The technology monitors the clients head nods, smiles, posture variances, gaze patterns, emotional expressivity, voice quality, and many other variables.[96]
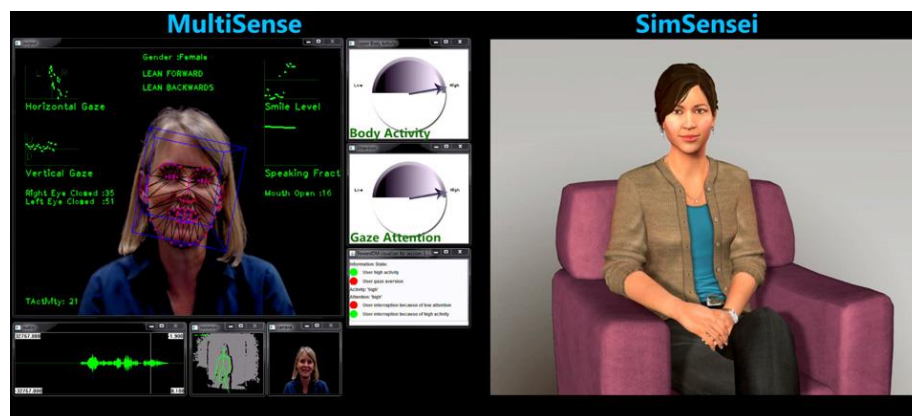
Figure 1. (Left) SimSensei Kiosk records data from multiple facial reference points.
(Right) Virtual Interviewer, "Ellie"[97]

[94] Charles W. Hodge et al., "Combat duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care," *New England Journal of Medicine*, 351, no 1 (2004): 13.

[95] David DeVault, et al., 1062.

[96] David DeVault, et al., 1063.

[97] Albert Rizzo, "SimSensei," USC Institute for Creative Technologies, accessed September 12, 2020, https://ict.usc.edu/prototypes/simsensei/,.

There are potentially many ethical issues with SimSensei technology. Privacy is just one of the issues with this form of biometric technology. SimSensei captures personal data of the individual through facial recognition. This data is stored and can potentially be accessed by unscrupulous people. The stolen information can be used to harass an individual, access their personal bank accounts, or even bring physical harm to the patient. A person's civil liberties are also at risk, as in the case of law enforcement using facial recognition technologies to scan for repeat criminal activity though no crime has been committed.[98] Although SimSensei technology is intended to help service members with behavioral health issues and PTSD, it can be detrimental to the patient's welfare if the sensitive information is hacked or patient-client privilege is compromised.

The AI system of SimSensei has been compared to the Wizard-of-Oz (WoZ) methodology. WoZ studies are "performed in order to simulate the human computer interaction for system evaluation, data collection, and design improvement."[99] The client uses a computer program to answer questions verbally about their mental health issues. The "wizard" is a human operator analyzing the client's questions, and with audio and video monitoring, and provides feedback to the user based on the user's answers, facial gestures, body movements, and voice inflections. The user believes they are interacting only with a computer and that the computer itself is providing all of the feedback based on the user's input.

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[98] Anton Alterman, "A piece of Yourself": Ethical Issues in Biometric Identification." *Ethics and information technology* 5, no. 3 (2003): 142.

[99] Tsiakas Konstantinos et al., "A multimodal adaptive dialogue manager for depressive and anxiety disorder screening: a Wizardof-Oz experiment," in 2015 Proceedings of the 8th ACM International Conference on Pervasive Technologies Related to Assistive Environments, article 82 (Corfu, Greece: PETRA, 2015), 3.
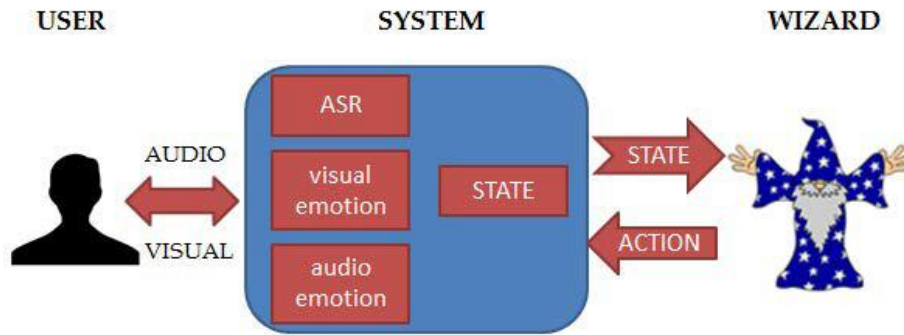
Figure 2. A representation of the "Wizard-of-Oz" methodology[100]

Research indicated the same individuals who tested on both the SimSensei and Woz methodologies found both systems to be somewhat effective. For example, "most people agreed or strongly agreed that they were willing to share information with Ellie (84.2%WoZ; 87.9% AI), were comfortable sharing (80.5% WoZ; 75.8% AI) and did share intimate information (79.3% WoZ; 68.2% AI)."[101] However, researchers found that users felt a closer connection with WoZ than in face-to-face interviews. One explanation for this could be that people feel less intimidated interacting with a computer screen than talking to someone face-to-face, especially when private or sensitive information is being revealed.[102]

There is a word of caution for individuals engaging with WoZ. The basic foundation to determine WoZ success rests upon deception, which if discovered by the patient can lead to a lack of trust between the service member and the therapist. Service members with PTSD are already at a high state of emotional vulnerability, any trust infraction could be extremely hazardous to the patient's well-being.

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[100] Tsiakas Konstantinos et al., "A multimodal Adaptive Dialogue," 3.
[101] DeVault, et al., 1067.
[102] DeVault, et al., 1067.

Further uses of AI for PTSD screening can be found in research conducted by the New York University School of Medicine. Using the same voice technology as Siri®, developed by SRI International, researchers have developed algorithms that analyze a user's speech patterns to look for specific markers identifying depression, anxiety, and pre-screen for PTSD. According to psychiatrist, Dr. Charles Marmar, the speech patterns of veterans with PTSD are ". . . flatter, more atonal speech. We were capturing the numbness that is so typical of PTSD patients."[103] Dr. Marmar explained that speech analysis is merely a screening tool for mental health assessments. "It is similar to women having a mammogram to screen for breast cancer, or men having a PSA test to screen for possible prostate cancer."[104] Voice analysis AI is a screening tool to help clinicians diagnose and treat PTSD. The algorithm has an 89 percent accuracy rating in identifying individuals who had already been clinically diagnosed with PTSD.

Deep Brain Stimulation and Functional Magnetic Resonance Imaging

Two current, high-tech PTSD treatment technologies dealing with the internal brain include Deep Brain Stimulation (DBS) and Functional Magnetic Resonance Imaging (fMRI). DBS is an invasive procedure where an electrical pulse generator surgically implanted in the patient sends electrical signals to electrodes planted deep within their brain.[105] FMRI is a technology where the patient is shown visual stimulations while an MRI is recording responses through brain impulse fluctuations. Both DBS and fMRI are being used to examine what parts of the brain are affected by a traumatic event. One of the primary medical issues in DBS is the

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[103] Dave Philipps, "The Military Wants Better Tests for PTSD. Speech Analysis Could be the Answer," *New York Times* April 22, 2019.

[104] Charles Marmar, phone conversation with the author, July 8, 2020.

[105] Paul Holtzheimer, "Focal Brain Stimulation for Posttraumatic Stress Disorder," *PTSD Research Quarterly* 29, np 2, (2018): 1

correct placement of the electrodes.[106] Medical researchers input vast amounts of patient data

into an AI learning machine to determine the optimal location in the brain for electrode insertion.

Researchers hope to be able to stimulate or alter that part of the brain in order to alleviate

symptoms.[107] Analyzing mass quantities of data using AI machine learning is also used to predict

the most beneficial treatment plan for fMRI technologies.

There are several ethical concerns for both DBS and fMRI procedures. Any brain

procedure, whether invasive or imaging, has a high probability of side effects, especially with

new technologies that are unproven in the medical field. Critics believe there is a real possibility

of a change in the patient's personality.[108] Fairness in patient selection must be considered.

Patient outcome must be a top priority rather what is good for the doctor administering the

treatment. Transparency, protection of research subjects, and quality of research are also to be

ethically considered."[109]

This section examined the development of new technologies to help screen, diagnose, and

treat service members with mental health issues, including PTSD. Research analyzing specific

biomarkers, speech patterns, body gestures, and cognitive behavioral skills are designed to help

mental health professionals make more accurate diagnoses and treatment plans. Research

findings are continually being updated and revised as more information is being discovered on

how the human brain processes and copes with stressful events. However, scientific technology

may not be the "clean cut" answer to mankind's problem in dealing with trauma.

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[106] Camilo Bermudez, et.al. 2018. "Towards Machine Learning Prediction of Deep Brain Stimulation (DBS) Intra-operative Efficacy Maps." *Cornell University*: https://arxiv.org/abs/1811.10415 1
[107] Camilo Bermudez, et.al. 2018. "Towards Machine Learning Prediction of Deep Brain Stimulation (DBS) Intra-operative Efficacy Maps." 1
[108] Maartje Schermer, "Ethical Issues in Deep Brain Stimulation," *Frontiers in Integrative Neuroscience* 5 (2011), 2, https://www.frontiersin.org/article/10.3389/fnint.2011.00017
[109] Schermer, "Ethical Issues," 3

Ethical Theories

In its most basic definition, ethics is "the conscious reflection on our moral beliefs with the aim of improving, extending, or refining those beliefs in some way."[110] The use of artificial intelligence in the diagnosis or treatment of mental health issues among veterans raises unique questions as to the ethical or moral foundation of such technologies.

Many people question whether AI machines can take the place of a human care provider by providing better and more effective behavioral health service. Others wonder how safe such technology really is from an emotional, social, and relational position. Still others wonder who has access to the information they share through an AI machine format. Ethical theories have been debated for centuries, and what one culture or generation deems ethical another disagrees. Mankind must learn and value individual rights before an ethical theory of AI can be formulated. The violation of individual human rights is at the epicenter of such ethical issues.

When considering the ethical treatment of service members with PTSD, one must carefully consider the individual's personality, temperament, social or relational construct, and a host of other important factors. Depending on how one views the value of human life and the quality of that life will determine which ethical system or theory they will adapt and apply as to how they see themselves, others, and the structure of decision-making. This is why hasty decisions during the diagnosis phase, whether by AI or human means, can be dangerous. There are three primary ethical theories; utilitarianism, deontology, and virtue ethics. We will explore each theory and their relation in treating those suffering from PTSD and the service members' individual rights.

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[110] Lawrence M. Hinman *Ethics: A Pluralistic Approach to Moral Theory*, 5th Ed (Boston: Wadsworth, 2013), 5

Utilitarian Ethics

Utilitarian ethics was popularized by Jeremy Bentham (1748-1832) and John Stuart Mill (1806-1873). This ethical theory believes that "the only moral thing is whatever produces the greatest amount of utility, or the greatest overall positive consequences."[111] In the fog of war, soldiers may have a difficult time differentiating between what is the moral thing to do versus what will be the best decision for everyone even if a few must suffer. A study of moral theory and moral failure would be most appropriate for further research. Here, the focus is on the service member's thoughts with PTSD. The traumatic events leading to their diagnosis may have been justified at the moment. However, afterwards the service member begins to think from a dualistic perspective. First, was the trauma I experienced a cause of my own actions? Second, will my treatment plan be individualized specifically for me, or will it be tailored as to what will bring the best outcome for the most people?

Here is where a particular ethical dilemma of using AI for diagnosing and treating PTSD can be manifested. On the one hand, the service member becomes accustomed to using therapeutic technologies through mobile and computer apps, or anthropomorphic platforms to reach the same end state as a mentally healthy service member. The end state or objective is to live according to what society deems as "normal" without suffering from anxiety, panic attacks, and depression caused by PTSD.

This utilitarian approach seems like a great success. The means justifies the end. However, suppose society decides to change what they deem as the normal end state or consequence. What if it becomes economically necessary to discontinue the use of AI technology for PTSD treatment due to high medical costs? In utilitarian ethics, if the majority would receive

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[111] Hinman, *Ethics: A Pluralistic Approach,* 125

more benefit from this, then it could be considered justified. Utilitarian ethics has its place in society, but not with regards to the individual service member needing compassionate care for their illness.

Deontological Ethics

Deontology or duty ethics, was the theory formed by Immanuel Kant (1724-1804). Kant believed a person would act ethically if what they did was done because it was simply the right thing to do.[112] Military personnel should have a moderate to in-depth knowledge of duty. It is part of the oath one takes to defend their nation. The service member suffering from PTSD may come to believe that their suffering was caused by duty. They performed their duty or obligation and it had negative consequences. If duty was supposed to be good for society and a nation, then why are they suffering? However, a deontological approach to the patient's treatment could also carry negative consequences. Another way to look at it is that the soldier suffering from PTSD may believe he or she has to suppress the feelings and thoughts to live up to the duty of a soldier.

Hinman brings out a solid point on how Kantian ethics can be seen toward a suffering patient.[113] If a person's duty is the primary motivator for acting in an ethical way, then emotions or feelings are secondary or non-existent. A person does not have to "feel" anything in order to do their duty. This is the foundation of deontological ethics.

A deontological clinician would be ethically correct to withhold or administer the use of AI as a diagnosis or treatment tool for a PTSD sufferer under two conditions. First, the clinician knows that the use of AI technology will produce a false positive measurement and decides to do the right thing by not administering the technology, whether they possess altruistic feelings or not toward the patient or themselves about the outcome. Second, the clinician displays no

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[112] Hinman, 158.
[113] Hinman, 161

compassion and administers AI technology against the patient's desires. The clinician believes it is the right thing to do, and therefore proceeds believing the act to be ethical. This produces a violation of an individual's right, which is highly unethical.

Virtue Ethics

Virtue ethics, or sometimes called character ethics, may produce a moral foundation that is more conducive in helping the service member suffering with PTSD. Virtue ethics, made popular by Greek philosopher Aristotle, asks the question, "Who should I be?"[114] Virtue ethics is captured with the idea in mind that a person should meet specific goals in life. To meet these goals, certain disciplines or habits need to be instituted in the person's life.

Virtue ethics "considers goodness in local rather than universal terms and emphasizes not universal laws, but local norms."[115] For the PTSD sufferer, personalized care with compassion must be administered with a concern for the service member's respect. AI technology may still be administered, but only to the point where the user understands that it is only a tool to help achieve their goals. Unlike utilitarian or deontological anthropomorphism, virtue ethics respects the individual's privacy, integrity, pain, and shares in their personal outcome or goals. AI only becomes a tool to help the therapist, not a replacement, due to the critical importance of human interaction. Positive reinforcement of virtue ethics can enable the PTSD sufferer to experience emotional stability and overcome the illness.

Aristotle believed with virtues, humans could "flourish," or rather reach their potential. On the other hand, vices demonstrated weak character traits and caused a hindrance in human emotional and social growth.[116] The service member suffering from PTSD can still be a virtuous

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[114] Emanuelle Burton, et. al, "Ethical Considerations in Artificial Intelligence Courses," *The AI Magazine* 38, no. 2 (2017): 7.

[115] Burton, et. al, "Ethical Considerations," 7.

[116] Hinman, 252.

person, if the person possessed character virtues before their diagnosis or they learn and develop

virtuous habits as part of their therapy. However, due to the trauma they faced, they may need

help recouping the virtuous effects of wisdom, patience, love, and forgiveness. It cannot be

emphasized enough that AI technology should only be used as a tool, and then with strict

supervision by a licensed and professionally trained clinician in the use of such technology. The

service member deserves the full effort of mental health care to have the best in individual and

compassionate treatment. With these ethical theories in mind, the next section will examine the

ethical issues and concerns raised when relying on emerging technologies to cure PTSD among

service members.

AI Ethical Considerations

Privacy

One of the most important concerns for individuals when sharing personal data is their

concern for privacy. When service members share personal information through AI machine

therapy, the data is collected for future study and analysis. This gives the human clinician a

better understanding of the client and allows for, hopefully a more comprehensive treatment

plan. However, all data collected is digitally stored. In the case of SimSensei technology, the

user gives facial expressions, voice data, body gesturing, and in many cases, highly-sensitive,

personal information. Not only can digital data be stolen, but facial recognition technology

contains gender, race, and ethnicity biases resulting in false positive data collections.[117]

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[117] Natasha Singer and Cade Metz, "Many Facial-Recognition Systems are Biased, Says U.S. Study," *The New York Times*, December 19, 2019, https://www.nytimes.com/2019/12/19/technology/facial-recognition-bias.html

There is always a risk of a digital database being hacked and information shared through a number of platforms for various reasons. A 2019 report revealed that over 13 million Americans are at risk of having their digitized medical results being hacked online. Over 400,000 of these records included "X-rays and other images that could be downloaded."[118] Hackers have used such information for extortion, shame, or moral injury. In the case of a service member, hacked information could be used in a number of nefarious ways, including career termination or extortion for classified information which presents a security risk.

Though hospitals have a number of security protocols in place to protect digitized records, hackers can still get through digital fire walls. In the last five years, insurance companies discovered that 78.8 million records were compromised from Blue Cross Blue Shield Anthem. It is estimated that hackers can receive up to $500 for every Medicaid and Medicare record they offer for sale on the "Dark Web."[119]

Civilian healthcare agencies are not the only institutions vulnerable to cyber-attacks. In 2015, the Pentagon awarded the technology company, Leidos, $9 billion dollars to develop a state-of-the-art electronic healthcare system. By the year 2022, the VA medical system records will be loaded on the Leidos platform and fully operational.[120] Through the lens of virtue ethics, a person cannot flourish, as Aristotle intended, when they live in fear of their own identity being stolen for immoral gain.

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[118] Marisa Fernandez, *"Axios: The Medical Records of More than 5 Million Americans are at Risk of being Hacked,"* Arlington: Newstex, 2019, https://login.usnwc.idm.oclc.org/login?qurl=https%3A%2F%2Fwww.proquest.com%2Fdocview%2F2428645515%3Faccountid%3D322.

[119] Aliya Sternstein, "This is the Real Threat Posed by Hacked Medical Devices at VA," *Nextgov.Com,* May 25, 2016. https://www.nextgov.com/cybersecurity/2016/05/unlikely-threat-posed-hacked-medical-devices-va/128608

[120] Aliya Sternstein, "This is the Real Threat Posed by Hacked Medical Devices at VA," Nextgov, May 25, 2016, https://www.nextgov.com/cybersecurity/2016/05/unlikely-threat-posed-hacked-medical-devices-va/128608/

Misrepresentation

Another important consideration in the use of artificial intelligence and PTSD diagnosis is the service member's temptation to misrepresent their behavioral health status during a redeployment phase. During redeployment, each service member must complete what the U.S. Army calls the Periodic Health Assessment (PHA). Each branch of service has similar medical protocols. During non-deployment cycles, the PHA is conducted each year.

Consider the scenario of a redeploying service member. He or she is required to go through an out-processing procedure before they can be cleared to go home. This procedure consists of a number of personal health assessments, including but not limited to a behavioral or mental health assessment. Only the service member is responsible for their own answers. The service member quietly sits down behind a computer screen and begins answering the questions before them. "Have you thought about taking your own life." "Are you angry? Do you have trouble sleeping at night? Would you like to speak to a behavioral health specialist?" These are just examples of the many questions a service member might be required to answer.

The service member considers their options. If they are suffering with any behavioral health issues, they could be detained for an extended period of time for further psychiatric evaluation and/or counseling. Answering in the positive to any question might hinder their career as, in their mind, mental weakness is not tolerated in the military. They reason, "If I can just get home, I will be fine." This scenario is not indicative of every service member, of course, or even the majority of redeploying service members, but as a military chaplain, this researcher can personally attest to many who have taken this route as the quickest way home. In their minds, revealing any personal information could present a red flag on their record or delay their homecoming.

There are ethical concerns for this type of diagnosis. Suppose the service member expresses signs of anxiety or depression, which are typical with PTSD symptoms, but his or her feelings are caused by a temporary setback not a traumatic event. A misdiagnosis of having PTSD could be detrimental to the service member's career rather than merely being depressed due to temporary issues. There is also a concern with the vast number of service members required to conduct a PHA within a narrow window of time. Clinicians may become too dependent on the AI technology as a reliable decision maker, thereby increasing the chances of a misdiagnosis. Once a diagnosis of behavioral health issues is placed in a service member's record, it is difficult to reverse the decision. Furthermore, it is virtually impossible to erase the perception of what fellow service members will have if the information is detected. These are ethical vulnerabilities and concerns.

AI can be used to diagnose PTSD with the aid of biomarkers or speech analysis. However, the violation of human rights, as in privacy, and ethical issues behind such technologies far outweigh the advantages of catching a service member lying about their state of mind. This utilitarian approach to military healthcare screening must be reconsidered in light of each service members' rights as an individual rather than government property. In view of Kant's categorical imperative, if everyone chose to falsify their surveys no survey data would hold any value whatsoever. If everyone is placed under AI machine control to reveal the truth, then each service member's civil liberty is eliminated.

Anthropomorphism

Anthropomorphism is "the human tendency to attribute human traits to non-human entities."[121] Humans are social creatures. Isolation from society can cause a myriad of developmental issues. One of the symptoms of service members with PTSD is withdrawal from others; i.e. family, friends, coworkers, etc. The efforts of the therapist are to help the client rediscover the unique advantages a social support system can provide in the healing process. Some researchers fear that the user may become emotionally attached to the AI technology being used, as in the case of a virtual therapist, and find it difficult to blend back into human society.

A 2018 report from Damiano and Dumouchel, shows an opposite outcome. The use of Social Robotics (SR) can promote anthropomorphic reactions in the user, and thus produce a positive outcome to connect with society.[122] The idea behind the report is that anthropomorphizing AI is healthy as long as it allows the user to re-engage with society and that the user knows that it is an AI platform and not real. The end result is the main objective; to provide help for the user so they live a productive life. As in the issue with privacy, this utilitarian approach does not consider the mental state of the service member with PTSD.

Researcher Sherry Turkle, who has extensively studied human-robot interaction through ethnographic research, declares there is much more harm to be done by exposing humans to the temptation of anthropomorphism than a greater good. Turkle believes that social robots are "evocative" and cause vulnerable people, such as children, mentally ill adults, and the elderly to "mobilize high emotional charges and create an illusion of relationship."[123]

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[121] Luisa Damiano and Paul Dumouchel, "Anthropomorphism in Human–Robot Co-evolution," *Frontiers in Psychology*, 9 (2018): 2, https://www.frontiersin.org/article/10.3389/fpsyg.2018.00468
[122] Damiano and Dumouchel. Anthropomorphism in Human–Robot," 3
[123] Damiano and Dumouchel, 4

Certainly, service members suffering with PTSD easily fit in this category. The overwhelming danger is that the service member escapes from social reality through isolation but becomes attached to an AI platform in the form of a social robot as the only person who "understands, trusts, and loves" them. The AI platform provides only a false security, while blocking the highly effective support system through human social interaction. Salles, Evers, and Farisco (2020) report other objections to the use of what they call "anthropomorphism by design." Namely, that mental manipulation through the use of AI could order specific decisions by the user. AI that is not truly social cannot produce something that is humanly social; thus, creating a false identity of reality. Lastly, anthropomorphism in the use of AI could make the user believe they are emotionally stable, when in reality they are being deceived.[124]

This section examined the ethical issues with using emerging technologies to diagnose and treat service members with PTSD. The next section will emphasize the need for healthy, human interactions and positive community support as the most beneficial therapy for service members with PTSD.

The Social Connection

Throughout this paper, an emphasis has been placed on AI being used as a tool to support the human practitioner in forming efficient mental health diagnosis. Although AI machines can accomplish some tasks with higher efficiency and speed than humans, computers are not humans. AI machines are manifestations of human beings and are therefore programmed with human biases that cannot contain all characteristics of human thought. Computers cannot love,

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feel, imagine, reason, or sympathize with human emotions. These characteristics are vital for PTSD treatment and can only be found among human beings within a social construct.

Studies conducted by various academic research facilities on predeployment and postdeployment of U.S. Army combat units to Afghanistan clearly showed that unit cohesion has a monumental effect on behavioral health. Higher unit cohesion revealed not only lower levels of PTSD, but also showed lower levels of suicidal ideations.[125] Many researchers believe there is a mental health protection factor within cohesive units. A 1997 study had similar results among Vietnam veterans which "found that strong perceived unit cohesion was associated with lower rates of psychopathology. . . with low to moderate combat stress exposure."[126] Perhaps the most definitive sampling of evidence in favor of social support in the treatment of PTSD for service members comes from NVVRS, which emphasized a perceived social support system as the most important mediator of the risk for PTSD.[127]

Experientially, humans have proven that forming social connections through families, communities, states, and nations increases physical and psychological safety. One may consider that AI machines could offer the same psychological safety net for service members with PTSD as humans. Humans can build and program AI machines to carry on conversations and take care of menial household tasks, but AI machines may never be able to respond with rational thinking or compassion as humans.

According to researchers Hubert Dreyfus and Stuart Dreyfus, human intuition and "know-how" will never be duplicated by a machine, as neither will human judgment and

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[125] Lauren Anderson et al., "Prospective Associations of Perceived Unit Cohesion with Postdeployment Mental Health Outcomes," *Depression and Anxiety* 36, no. 6 (2019): 2, doi:10.1002/da.22884

[126] Anderson et al., "Prospective Associations of Perceived," 3.

[127] Anthony Charuvastra and Marylene Cloitre, "Social Bonds and Posttraumatic Stress Disorder," *Annual Review of Psychology* 59 (2008): 5. doi:10.1146/annurev.psych.58.110405.085650

imagination.[128] Using AI to interpret emotions becomes impossible since human programming to respond to emotions is extremely biased. Consider a service member with PTSD using an AI machine as part of their therapy plan. The program sensing the service member's emotions contains biases by the programmer. Suppose the AI machine misread the service member's emotions and prescribed an erroneous solution such as increasing medication or doing something which might have harmful psychological effects to the service member. AI machines cannot make the necessary calculations, because every potential output would have to be programmed into the machine. The programmer can only program their own potential outputs based on their experience, knowledge, and biases.

Conclusion

This paper examined the various technologies and therapeutic methodologies used by mental health providers in treating PTSD among combat veterans and its ethical considerations from the period of the American Civil War to present. This paper argued that although emerging technologies have their place in helping service members diagnosed with PTSD, face-to-face human interaction and a healthy social structure is far more beneficial in overcoming PTSD than virtual reality (VR) and artificial intelligence (AI).

The different approaches to diagnose and treat service members throughout the past one-hundred sixty years have changed as technologies changed. However, there are constants. First, veterans with PTSD are human beings in need of human compassion, understanding, and care. Second, any technology should be considered a tool to assist the individual on their journey back to a healthy, human social interaction.

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[128] David M. Kaplan, "Why Computers May Never Think Like People" in *Readings in the Philosophy of Technology*, ed. by Hubert Dreyfus and Stuart Dreyfus (Lanham, Md: Rowman & Littlefield, 2004), 375

We live in a world of fast-changing technologies. Western culture has been permeated with the idea of faster means easier, and easier means better, but this is not always the case for every life situation. Consider the treatment for combat soldiers with PTSD during wartime. The soldier was taken away from the battlefield to rest and recuperate, but not too far away that would lead them away from the sound of battle. Maintaining a connection with comrades and realty was paramount for good mental health.

In the case of testing for PTSD among modern combat veterans, AI certainly can be used to make an initial diagnosis. However, can a machine with a programmed algorithm know exactly what is in the mind of the veteran when the greatest neuroscientists in the world are still in the infancy stage of learning how the brain and neurons function? AI should only be a supplemental tool, since AI cannot produce emotion, imagination, or wisdom as that of a human. A service member suffering from PTSD has been emotionally and mentally changed. Only a human can understand such emotional and mental trauma.

Looking forward, strict guidelines must be set in place to safeguard against human abuses in the use of AI technology. The Ethical Guidelines for Trustworthy AI lists three primary components of the ethical use of AI: "1. it should be *lawful,* complying with all applicable laws and regulations; 2. it should be *ethical,* ensuring adherence to ethical principles and values; and 3. it should be *robust*, both from a technical and social perspective, since, even with good intentions, AI systems can cause unintentional harm."[129] Guidelines such as these must be incorporated into every facet of AI. Human rights should be the primary focus of mental

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[129] Urs Bergmann, et. al., *Ethics Guidelines for Trustworthy AI*: High Level Expert Group on Artificial Intelligence (Brussels: European Commission, 2019), 7, https://ai.bsa.org/wp-content/uploads/2019/09/AIHLEG_EthicsGuidelinesforTrustworthyAI-ENpdf.pdf 7

healthcare, not funding for new AI research or a government grant to create the next new technology.

Better PHA processing procedures for service members need to be developed with a concentration on the mental health of the veteran. New procedures would include adequate time to engage with each service member face-to-face by a licensed clinician. Opportunities should be granted to spend time with family and friends prior to the PHA to reduce the temptation to falsify mental health surveys in hopes of going home quicker. Better efforts to remove the stigma within the military of having behavioral health issues need to be implemented by higher military authority. We must remember that we are humans. Human problems need human solutions. Technology is only a tool for humans to use. AI machines have their place, but machines cannot love, forgive, imagine, or express true empathy to those in need. Americans will do well to implement their own critical thinking in what is needed, what is desired, and what is foolish.

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