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THERAPEUTIC MEDIA: TREATING PTSD WITH VIRTUAL REALITY EXPOSURE THERAPY

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> "War is perhaps one of the most challenging situations that a human being can experience. The physical, emotional, cognitive and psychological demands of a combat environment place enormous stress on even the best-prepared military personnel."[1]

1. Introduction

Post-traumatic stress disorders (PTSDs) of returning military personnel feature widely in psychological and psychiatric discourses, as well as within the U.S. military. Recent studies demonstrate that U.S. forces returning from missions in Iraq and Afghanistan are increasingly diagnosed with PTSD.[2] Symptoms include difficulties related to sleeping and concentration, hyper-vigilance, among others.[3] On the more abstract clinical level, such as the one found in recent the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), "post-traumatic stress disorder (PTSD) involves the development of characteristic symptoms, such as distressing memories or dreams about the traumatic event, flashbacks, psychological distress produced by internal or external cues that symbolize the traumatic event, physiological reactions,

[1] Albert Rizzo et al., "Virtual Reality Goes to War: A Brief Review of the Future of Military Behavioral Healthcare," *Journal of Clinical Psychology in Medical Settings* 18 (2011), 176.
[2] Lennis G. Echterling, Thomas A. Field, and Anne L. Stewart, "Evolution of PTSD Diagnosis in the DSM," in *Future Directions in Post-Traumatic Stress Disorder: Prevention, Diagnosis, and Treatment*, ed. Marilyn P. Safir, Helene S. Wallach, and Albert Rizzo (New York: Springer, 2015), 203.
[3] Albert Rizzo et al., "Virtual Reality Exposure Therapy for Combat-related Posttraumatic Stress Disorder," *Computer* 47, no. 7 (2014), 32.

avoidance of associated stimuli, and negative alterations in cognitions and mood. These symptoms appear after exposure to one or more traumatic events (e.g., exposure to war as a combatant or civilian, […]).”[4]

While combat-related PTSD, with its related therapeutic techniques, has a long history, treatment regimes are increasingly informed by the application of digital media technologies, which more recently include virtual simulations employing head-mounted displays (HMDs). As critical historical reflections have shown, postwar PTSD treatment by means of psychoanalytic therapy or exposure therapy presumes particular concepts of trauma, therapy, and subjectivity.[5] With the development and application of virtual reality (VR) technologies and HMDs, virtual therapy—or cybertherapy—has gained both scientific and public attention not only in relation to the treatment of combat-related PTSD, but also for other anxiety disorders such as the fear of flying.[6] Typical virtual reality exposure therapy (VRET) applications for military purposes—such as *Bravemind*, developed by the University of Southern California’s Institute for Creative Technologies—make use of virtual scenarios “experienced” by a patient wearing an HMD. Here, HMDs are employed to “trigger” traumatic events in order to re-engage with those anxiety-inducing situations, and, by re-experiencing them, helps patients in processing and reducing the resulting fears and psychosomatic stress symptoms.[7] The proclaimed “effectiveness” of this form of exposure therapy is reported in subject-specific texts that market and record the positive outcomes to reduce

[4] Cristina Botella et al., “Virtual Reality Exposure-based Therapy for the Treatment of Post-traumatic Stress Disorder: A Review of Its Efficacy, the Adequacy of the Treatment Protocol, and Its Acceptability,” *Neuropsychiatric Disease and Treatment* 11 (2015), 2533.

[5] The following sources critically examined PTSD in relation to traditional forms of psychotherapy in the context of First and Second World War combat experience: Charles Kaiman, “PTSD in the World War II Combat Veteran,” *The American Journal of Nursing* 103, no. 11 (2003): 32–42; Ruth Leys, “Image and Trauma,” *Science in Context* 19 (2006): 137–149; Ruth Leys, *Trauma. A Genealogy* (Chicago: University of Chicago Press, 2000); Catherine Malabou, *The New Wounded: From Neurosis to Brain Damage* (New York: Fordham University Press, 2012); Wolfgang Schäffner, “Event, Series, Trauma: The Probabilistic Revolution of the Mind in the Late Nineteenth and Early Twentieth Centuries,” in *Traumatic Pasts. History, Psychiatry, and Trauma in the Modern Age, 1870–1930*, ed. Mark S. Micale and Paul Lerner (Cambridge: Cambridge University Press, 2001), 81–91; Allan Young, *The Harmony of Illusions: Inventing Post-Traumatic Stress Disorder* (Princeton: Princeton University Press, 1995).

[6] For an overview of possible fields of application for virtual therapy see Max M. North and Sarah M. North, “Virtual Reality Therapy,” *Encyclopedia of Psychotherapy* 2 (2002): 889–893.

[7] Subject-specific texts often speak of “clients” instead of “patients.” It is quite common in the context of psychotherapy to use both terms. In this essay I employ the term patient in order to stress the severe impact on quality of life for returning soldiers with symptoms of PTSD.

PTSD symptoms through the use of quantitative clinical studies. For this kind of virtual therapy in combination with HMDs, the literature reports a high success rate: "Results indicated post-treatment improvement on all measures of PTSD and maintenance of these gains at a 6 month follow-up, with a 34% decrease in clinician-rated symptoms of PTSD and a 45% decrease on self-reported symptoms of PTSD."[8]

But as digital media technologies continue to provide the functional and conceptual basis for triggering traumatic memories, and initiating a therapeutic process for reducing associated stress symptoms, such forms of exposure therapy necessitate other readings. Digital technologies, and in particular software applications and VR devices like HMDs, are based on deterministic paradigms such as algorithms, data structures, and sensory technology. These paradigms are programmatically encoded to serve a purpose that is not merely technological but rather directed towards users' needs and context. In the context of virtual therapy, the application of digital technologies is conceptualized to evoke memories and emotional reactions as well as to provide the therapist with tools to guide therapeutic sessions. Read from a media theoretical perspective, such technologies are therefore purposefully attributed with their own therapeutic agency so to have an impact on users' feelings and change both their psychological condition and behaviour. As such, the integration of these technologies in therapeutic regimes motivates a series of fundamental questions: What is the specific function of media technologies in therapeutic rationale and the pragmatic settings of virtual therapy? When should a patient, or more precisely, a soldier, be considered treatable by using these types of techniques? And how are digital media technologies to be conceptualized as therapeutic media promising significant effective and affective impacts on patient emotion and behaviour?

In this essay I use promotional videos and related subject-specific texts to analyze virtual world design for application in HMDs and multi-sensory feedback strategies, as well as the therapeutic impact of multiple interfaces, so to illustrate the indispensable, and indeed inseparable coaction of media technologies and therapeutic concepts in virtual therapy. To that end, I argue that the programming and design processes of virtual therapy applications are neither participatory nor incidental. Rather, they constitute the very possibilities for treating PTSD in this realm at all. But between the deterministic coding of virtual therapy systems and their intended application remains a conceptual tension that needs to be integrated, in particular by the design of haptic and

[8] Albert Rizzo et al., "Virtual Reality Exposure for PTSD Due to Military Combat and Terrorist Attacks," *Journal of Contemporary Psychotherapy* 45 (2015), 257.

graphical user interfaces (GUIs) as well as virtual scenarios. As digital media technologies are conceptualized to function as a fundamental part of therapeutic settings, it is necessary to begin to review subject-specific texts and information materials to describe how, for example, visualizations in VRET are intended to act as therapeutic media to shed light on the ideas underlying VRET, as well as to assess further developments of VR applications in relation to HMDs.

Taking the well-documented VRET application *Bravemind* as an example, I focus on therapeutic technologies developed by a U.S. university in cooperation with the U.S. military. As *Bravemind* is developed as an advancement of the VRET system *Virtual Iraq,* it provides a valuable basis to both relate to the current technological and clinical state of an application, as well as to trace subject-specific discourses regarding both practical and therapeutic flaws of the precursor system *Virtual Iraq*.

I do not address civilian PTSD in those countries where military missions take place. While I take a critical stance, this article focuses on Western military developments instead of on those whose lives are so markedly affected by military intervention. In this sense, the scope of the essay is necessarily limited as it seeks to critically explore media-related technological settings and the operative concepts that underlie the treatment of PTSD in Western military personnel—a technology-in-the-making that presumes sufficient funding for such an operation and a degree of scientific enterprise.

I begin by sketching the sociocultural background for the application of digital technologies in healthcare contexts, with attention to the structural and operational conditions of mobile and (presumably) individualized media technologies, such as HMDs. Dealing with the design of virtual worlds and the integration of sensory feedback that immerse patients in trauma-relevant environments, I demonstrate how design and integration demarcate what it means for a subject to be effectively treatable in VRET, including how VRET relies on the stereotyping of both scenario and characterization. In addition, I employ marketing videos and subject-specific texts as well as ethnographical studies as sources to examine the interaction design of interfaces, such as HMDs and GUIs for clinicians to guide patients through virtual scenarios, in order to illustrate the confrontational force of adaptive real-time visualizations and the tensions between imaging and imagination with regards to recurring traumatic memories. In doing so, this paper contextualizes VR technologies and HMDs beyond applications in popular culture, thinking critically about their visual and operational regimes as therapeutic tools affecting users, patients, and therapists so as to open a debate about the more serious implications of these technologies and their future.

2. Dispositions of Acceptance—Personalized Digital Media Technologies in Health-Related Contexts

The growing interest in VR and HMDs in therapeutic contexts is indicative of the broader trend to integrate (and personalize) digital media technologies in medicine and healthcare. Umbrella terms such as *eHealth*, *Health 3.0*, and *digital health* suggest a vision that seeks, in broad terms, to integrate healthcare-related procedures and processes with digital media technologies.[9] But to understand the sociocultural context in which virtual reality simulations, mobile media technologies, and HMDs are gaining acceptance as components of exposure therapy, it is necessary to examine the use of digital media technologies in health-related contexts. With the spread of mobile technologies such as tablets, smart watches, and other types of body sensors, "smart" and adaptive technologies are used by increasingly larger segments of the population to individually measure and monitor health-related parameters.[10] While some digital tools prove to be clinically useful, a wide range of these technologies promote a narrow quantitative perspective on what constitutes a "healthy life." Nevertheless, between the two extremes—serious clinical use and a more hedonistic lifestyle-inspired use—different types of personalized digital monitoring devices have gained both acceptance and instructive functions.[11]

On a sociocultural level, the development and deployment of virtual therapy relies on discourses and practices that integrate media-based guidance for health-related issues. One such perspective concerns the spatial dimension of digital healthcare technologies. While traditional modes of healthcare centre on hospitals, nursing homes, and related facilities, technological devices such as the mobile blood glucose monitor *iHealth Align*, used in conjunction with a smart phone, expand patients' acceptance of the ubiquity of personal digital healthcare technologies.[12] Until recently, heath-related counselling typically

[9] For further reading, see Serena Barello et al., "eHealth for Patient Engagement: A Systematic Review," *Frontiers in Psychology* 6 (2015), accessed March 30, 2016, doi:10.3389/fpsyg.2015.02013.
[10] See, for example, Deborah Lupton, *The Quantified Self: A Sociology of Self-Tracking Cultures* (Cambridge: Polity Press, 2016) and Dawn Nafus and Jamie Sherman, *Self-Tracking* (Cambridge, Mass.: MIT Press, 2016).
[11] Elias Aboujaoude, Wael Salame, and Lama Naim, "Telemental Health: A Status Update," *World Psychiatry* 14 (2015): 223–230.
[12] Mark Weiser, "The Computer for the 21st Century," *Scientific American* 265 (199l): 94–104. See also James N. Gilmore, "Everywear: The Quantified Self and Wearable Fitness Technologies," *New Media & Society* (June 2015), accessed March 20, 2016,

followed anomalies, emergencies, illnesses, or chronic diseases. But today the boundaries between institutional healthcare and personal routine have become blurred. As more people use digital media applications to monitor and track their health status, these technologies spread far beyond their situatedness in medical institutions.[13]

Acceptance also concerns the mutual adaption of mobile devices with their users. While smart healthcare technologies are advertised as being adapted to user's bodies, needs, and actions, marketing tends to conceal the required disposition of users towards the affordances that these technologies offer. Read critically, marketing and subject-specific texts seem to suggest that if one is not sufficiently "adaptive," cognitively and practically, it will not simply be a matter of being technologically capable of using them, but to cope subjectively with the smart, ubiquitous, and connected utility of these healthcare services. With this, we might recognize how subjects are turned into *users* both through conceptualization during the design phase as well as in the use of technologies. I will discuss this in relation to VRET in more detail later in the essay, but for now it is important to state that every technology demands a certain level of adaptation by the user.[14] The question is: how far does adaptation extend and how does it affect the life of the user? What are consequences of not being able to adapt?

Accepting individualized mobile media technologies (including in psychotherapeutic settings) depends upon adapting human senses to technological sensors. The expectation that the body's technological devices will respond to movements and data transmitted through tracking systems, or to digitized mood changes transmitted though physiological sensors, signals a disposition not only toward "outsourcing" one's own sensorial and bodily awareness to digital devices, but also toward creating, and relying on, a responsive feedback loop.[15] Using these devices, and feeding them personal data that is further processed by digital networks, suggests, I argue, an implicit acceptance of surveillance and control. Indeed, users' habituation to wearable

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doi:10.1177/1461444815588768.

[13] Rebecca Randell, Stephanie Wilson, and Geraldine Fitzpatrick, "Evaluating New Interactions in Health Care: Challenges and Approaches," *International Journal of Human-Computer Interaction* 26 (2019): 407–413.

[14] This is one of the fundamental issues in the sociology of technology. See, for example, Lucy Suchman, *Human-Machine Reconfigurations: Plans and Situated Action*, 2nd ed. (Cambridge: Cambridge University Press, 2007), in particular 206 ff.

[15] Margarete E. Morris et al., "Mobile Therapy: Case Study Evaluations of a Cell Phone Application for Emotional Self-Awareness," *Journal of Medical Internet Research* 12, no. 2 (2010), e10.

devices paves the way to accepting fully immersive HMDs. Advocates of medical virtual reality and virtual therapy are in some cases euphoric over the increasing availability of mobile phones and HMDs such as the *Oculus Rift*,[16] as these technologies herald a "new dawn of virtual reality in health care."[17]

The widespread design and ubiquitous integration of mobile and adaptive digital technologies in numerous healthcare practices contributes to the acceptance of virtual therapy both in public discourse and in the military. The primary mental and somatic disposition of individuals and collectives toward using these kinds of technologies further promotes their acceptance in therapeutic contexts. They are considered helpful or, at the very least, harmless. It is against this background that VRET gains acceptance through the indispensible use of mobile and adaptive media technologies in healthcare practices.

3. The Virtue of Virtuality: Scenarios and Interfaces of Virtual Therapy

The use of digital media technologies in virtual therapy—and VR in conjunction with HMDs, in particular—promises to overcome some of the limitations of traditional exposure therapy. Conceptually speaking, exposure therapy "is a set of treatment programs that are commonly used to reduce pathological fear and related emotions, such as guilt, common in post-traumatic stress disorder (PTSD) and other anxiety disorders (e.g., obsessive-compulsive disorder)."[18] To that end, patients "intentionally confront feared, but otherwise safe, objects, situations, thoughts, sensations, and memories with the goal of reducing fear and other negative reactions to the same or similar stimuli in the future."[19] Exposure can take different forms, and relies on different techniques, depending on the patient's pathology and symptoms.

There are three primary types of exposure procedures: *in vivo*, imaginal, and interoceptive. Each provides a certain space and level of engagement for

[16] *Oculus Rift* is the trade name of a virtual reality HMD developed by Oculus VR beginning in 2013. In 2014, the company joined forces with Facebook Inc. (Stuart Dredge, "Facebook closes its $2bn Oculus Rift acquisition. What next?", *The Guardian*, July 22, 2014, accessed June 11, 2016, https://www.theguardian.com/technology/2014/jul/22/facebook-oculus-rift-acquisition-virtual-reality).
[17] Giuseppe Riva and Brenda K. Widerhold, "The New Dawn of Virtual Reality in Health Care: Medical Simulation and Experiential Interface," *Annual Review of Cybertherapy and Telemedicine* 13 (2015), 3.
[18] Edna B. Foa, "Prolonged Exposure Therapy: Past, Present, And Future," *Depression and Anxiety* 28 (2011), 1043.
[19] Foa, "Exposure Therapy," 1043.

confronting phobic scenarios. While with *in vivo* exposure patients visit the spaces that invoke fear, with imaginal exposure patients are instead asked to imagine feared situations. In particular, for those military personnel for whom returning to the actual space of traumatic experience is not possible, imaginal exposure offers the possibility for them to willingly expose themselves to traumatic memories. Interoceptive exposure is intended to help patients cope with the more somatic symptoms of panic and fear (such as hyperventilation), and, by actively stimulating these symptoms, attempts to regain control over them. Many who advocate for the use of virtual exposure therapy (VET) assert the innovative potential of this treatment by pointing to some of the limitations of *in vivo* exposure, including:

> (a) Many patients are reticent to expose themselves to the real phobias stimuli or situation; (b) in vivo exposure can never be fully controlled by the therapist, and its intensity can be too much for the patient; and (c) this technique often requires that therapists accompany patients into anxiety-provoking situations in the real world at great cost to the patient and with great time expenditure on the part of both therapist and patient.[20]

From a media-critical perspective, how digital media technologies contribute to overcoming the above mentioned limitations is crucial for understanding the promises of VRET in relation to more traditional forms of exposure therapy: exposure to the "real phobias stimuli," controlling the intensity of exposure by the therapist, and reducing costs. In this statement by researchers who advocate VRET the application of virtual scenarios, HMDs, and other media-technological features seems to contribute simultaneously to making the therapeutic setting more flexible in regard to possibilities of exposure (e.g., virtually accessing situations that would not be accessible physically due to destruction or distance) and more controllable in regard to emotional and economic intensity. Such a conceptual tension in the application of VRET points to a basic issue for analyzing VR applications; namely, how the interplay between virtual scenarios and the physical world is configured so to evoke particular effects in user perception and behaviour. Taking the primary therapeutic setting of an exemplary VRET application called *Bravemind* as a starting point, I investigate the basic configuration of users (i.e., patient and therapist), as well as physical and virtual spaces and their respective affordances and agencies, in constituting a therapeutically effective setting.

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[20] Guiseppe Riva et al., "Interreality in Practice: Bridging Virtual and Real Worlds in the Treatment of Posttraumatic Stress Disorders," *Cyberpsychology, Psychology, and Social Networking* 13, no. 1 (2010), 55.

Drawing on one example, I scrutinize the visual design of *Bravemind*'s virtual worlds to show how ideas about traumatic situations are visually encoded. Finally, I question how *Bravemind's* developers and designers have integrated multi-sensory input and interaction devices, and how these are intended to both guarantee immersion for the patient into virtual worlds as well as connect them to past experiences. These different aspects provide an analytical basis for thinking critically about the coaction of media technologies and therapeutic concepts in VRET.

3.1. Worlds of Bravemind*: Virtual Scenarios and Multi-Sensory Input*

Since 2005, the University of Southern California Institute for Creative Technologies (ICT) has been developing VRET applications such as *Virtual Iraq*, and notably, *Bravemind*, termed a "clinical, interactive, virtual reality (VR) based exposure therapy tool."[21] Its name is an acronym standing for "Battlefield Research Accelerating Virtual Environments for Military Individual Neuro Disorders," a joint research project run by ICT and University of Southern California's Brain and Creativity Institute (BCI).

Bravemind's therapeutic setting consists of at least of three interrelated actors (fig. 1). The first is the patient who wears an HMD (such as the *Oculus Rift*) while standing or sitting, often carrying a machine gun mock-up to enhance the sense of being on a mission. Second, the therapist, meanwhile, controls the virtual scenarios through a so-called *Wizard-of-Oz interface*, or a clinician controller (for instance, by adding simulated bomb explosions in real-time), and simultaneously talks to the patient about his or her experience. And third, the design and function of the system itself act as a third "actor," comprising both software and hardware components.

[21] "Bravemind," USC Institute for Creative Technologies, accessed June 9, 2015, http://medvr.ict.usc.edu/projects/bravemind/.

Fig. 1: Screenshot from a promotional video by University of Southern California Institute for Creative Technologies depicting a typical setup of a virtual therapy session. On the left, the therapist controls the virtual scenarios at the clinician's interface. The patient wears an HMD with stereoscopic projections of virtual scenarios in the foreground and a control screen displaying non-stereoscopic visualizations of the same scenario in the background.[22]

As mentioned above, one of VRET's purported therapeutic benefits lies in its virtuality: with traditional exposure therapy, patients may be reluctant to engage with traumatic or stressful situations, whether in the physical world or in their imagination. "While the efficacy of imaginal exposure has been established in multiple studies with diverse trauma populations […], it is reported that some clients are unwilling or unable to effectively visualize the traumatic event [...]. In fact, research on this aspect of PTSD treatment suggests that the inability to emotionally engage (in imagination) is a predictor for negative treatment outcomes […]."[23] Accordingly, one of VRET's major advantages is that it allows patient to "effectively visualize the traumatic event," and thus to engage with it emotionally. Those patients unwilling to imagine traumatic situations are potentially more likely to accept the virtual scenario projected before their eyes as a substitute for their own imagination, or for their own processing (via words). In this respect, HMDs and virtual scenarios gain agency over the patients' own narration and memories of

[22] "Virtual Reality Therapy: Bravemind and Strive," UCS Institute for Creative Technologies, accessed March 3, 2016, https://www.youtube.com/watch?v=LRL0TzrNtVc&list=PLBF277FAE78E8CB39&index=5.
[23] Rizzo et al., "Virtual Reality Exposure for PTSD," 257.

traumatic events by providing a very certain visual narrative of these events. What patients might possibly remember, expressed through language and in relation to their past experience, is now "streamlined" through a software-based application that is made to "effectively visualize" traumatic events without subjective detours (in the form of avoiding treatment). The use of VR in exposure therapy raises some crucial questions: What kinds of VR strategies are more likely to allow a patient to "effectively visualize" and "emotionally engage"? And, moreover, what kinds of affordances do they offer to patients who might otherwise be unable or unwilling to engage in exposure therapies? The therapeutic rationale for effective treatment outcomes relies on granting digital media technologies a central therapeutic agency by taking over the role of patients' own imagination and, as such, their emotional engagement.

3.2. Designing Virtual Worlds

In their introductory book *Understanding Virtual Reality*,[24] William Sherman and Allan Craig offer four key elements for experiencing VR: virtual world, immersion, sensory feedback, and interactivity.[25] As non-particular to specific VR applications, these elements can help structure a critical exploration of VRET and its particular media-based conditions and operations. For Sherman and Craig, "a computer-based virtual world is the description of objects within a simulation. When we view that world via a system that brings those objects and interactions to us in a physically immersive, interactive presentation, we are experiencing it via virtual reality."[26] We might ask: What kind of visual world lies at the foundations of *Bravemind*'s VR experience? According to *Bravemind*'s designers, "Clients can be immersed in simulations of trauma-relevant environments."[27] As an updated version of its precursors, *Virtual Iraq* and *Virtual Afghanistan*,[28] *Bravemind* consists of 14 virtual settings that

[24] William R. Sherman and Alan B. Craig, *Understanding Virtual Reality. Interface, Application, and Design* (San Francisco: Morgan Kaufmann, 2003).
[25] For a critical overview of the history of VR, see Kenn Hillis, *Digital Sensations: Space, Identity, and Embodiment in Virtual Reality* (Minneapolis: University Of Minnesota Press, 1999), see especially pages 1–29.
[26] Sherman and Craig, *Understanding Virtual Reality*, 7.
[27] Rizzo et al., "Virtual Reality Exposure for PTSD," 257.
[28] The developers further reported: "In 2011, the U.S. Army funded the development of an updated and expanded version of Virtual Iraq/Afghanistan system. Now referred to as BRAVEMIND, one of the primary goals for this effort was to increase the diversity of the VR scenario content and improve the customizability of stimulus delivery to better address the needs of clinical users who have had a diverse range of trauma experiences. This effort was supported by drawing on the vast amount of user feedback generated from both clients' and clinicians' feedback from use of the previous 2007 VRE system." Rizzo et al., "Virtual Reality Exposure for PTSD," 258.

resemble what is imagined to be "typical" Middle Eastern cities and landscape, described as: "separate Iraq and Afghanistan cities, a rural Afghan village, an industrial zone, a roadway checkpoint, slum and high-end residential areas, a mountainous forward operating base, and a Bagram Air Force Base setting."[29]

The initial design reported by *Bravemind*'s developers consisted of trauma-relevant virtual scenarios based on narratives provided by "returning soldiers and military subject matter experts."[30] These narratives, however, were derived from secondary literature:

> For example, Hoge et al. (2004), in their study of self-reported anxiety, depression, and PTSD-related symptomatology in returning Iraq War veterans, present a useful listing of combat-related events that were commonly experienced in their sample. These events provided a useful starting point for conceptualizing how relevant trigger stimuli could be presented in a VR environment. […] From this and other sources, we have begun with our initial effort to conceptualize what is both functionally relevant and pragmatically possible to include as trigger stimuli in our current clinical interface.[31]

Thus, its virtual worlds are conceptualized as "trauma-relevant environments" shifting between the "functionally relevant" and "pragmatically possible." Such a conceptualization calls attention to critical issues involving both the level of individuality in treatment and the representation of traumatic situations. Compared to approaches of *in vivo* or imaginal exposure therapy, *Bravemind* "averages" the spaces of traumatic (re)experience to 14 scenarios derived from secondary sources before an individual soldier enters therapy. While *in vivo* exposure allows patients to choose between different places or

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[29] Ibid.
[30] Ibid.
[31] Citing a study by Hoge et al. (2004), Rizzo et al. further list "commonly reported events," including, "*Being attacked or ambushed, Receiving incoming artillery,, rocket, or mortar fire* […] *Shooting or directing fire at the enemy, Being responsible for the death of an enemy combatant, Being responsible for the death of a noncombatant* […]." Albert Rizzo et al., "From Training to Toy to Treatment: A Virtual Reality Exposure Therapy Application for Iraq War Military Personnel with Post Traumatic Stress Disorder," in *Novel Approaches to the Diagnosis and Treatment of Posttraumatic Stress Disorder, Proceedings of the NATO Advanced Research Workshop on Novel Approaches to the Diagnosis and Treatment of Posttraumatic Stress Disorder, Cavtat, Croatia, 13–16 June 2005*, ed. Michael J. Roy (Washington D.C.: IOS Press, 2006), 244. Also see Charles W. Hoge et al., "Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care," *New England Journal of Medicine* 351 (2004): 13–22, citation above from page 18.

situations, and imaginal exposure relies on the patient's capacity to (re)imagine their own experiences, *Bravemind*, by design, limits the range of traumatic stress triggers. We might also note how *Bravemind* implies that a given traumatic situation is *representable* according to shared features that are experienced or remembered by several individuals. Hence, if a patient's own traumatic experience does not map onto those derived from others, or if a patient is unable to adapt (so as to be triggered), that patient is not considered treatable.

One exemplary scenario is shown in video material published by the Institute of Creative Technologies, illustrated in the screenshot below (fig. 2).

Fig. 2: Screenshot from a promotional video by University of Southern California Institute for Creative Technologies depicting a typical *Bravemind* virtual scenario from the perspective of a user wearing a head-mounted display.[32]

From the user's perspective, the simulation visualizes a U.S. Army vehicle exploding in what is designed to look like typical Middle Eastern desert scene. Taking this screenshot as an example of the visual design for this specific virtual scenario, it is striking how well organized and "clean" the simulation appears to be, even though the trigger (exploded vehicle) is in the frame. The scenario and its objects are clearly identifiable, and the graphics are reminiscent of virtual scenarios in popular video games.[33] Furthermore, the characters in the simulation are U.S. Army soldiers who control the situation.

[32] "Virtual Reality Therapy: Bravemind and Strive."
[33] On the use of video games for training in the U.S. military, see also Corey Mead, *Video Games and the Future of Armed Conflict* (Boston/New York: Eamon Dolan, 2013).

The graphics are centred on the destroyed and smoking scrapheap in the middle of the frame, which, even as a smouldering wreck, blends into to the overall visual design. Both spatial and colour-coordinated compositions suggest that this foreign body is actually part of a well-structured landscape with tufts of grass and blue sky. *Bravemind* also includes more visually disturbing scenarios:

Fig. 3: Screenshot from a promotional video by University of Southern California Institute for Creative Technologies showing a virtual scenario of a bomb explosion in an apartment block.[34]

Fig. 4: Screenshot from a promotional video by University of Southern California Institute for Creative Technologies illustrating a visualization of a disfigured dead body.[35]

[34] "Virtual Reality Therapy: Bravemind and Strive."

Part of the same promotional video, the sequences (above) simulate an explosion inside an apartment block with market stalls in front of it. The user's perspective is directed toward the inside of the building and, as the sequence unfolds, brings the user into contact with a disfigured dead body (fig. 4).

The visual impression coming from the virtual scenario in the video is disturbed by slight delays in the simulation, perhaps caused by some technical malfunction which, nevertheless, suggests the instability of the visual impression. The incorporated virtual objects and scenes appear too detailed to be smoothly rendered and visualized continuously. Therefore, it is hard to tell whether the simulated dead body (fig. 4) is accurately rendered and, therefore, presented as a trauma-relevant trigger or simply a glitch.

Fig. 5: Screenshot from a video by University of Southern California Institute for Creative Technologies illustrating the design of virtual Arab characters in *Bravemind*.[36]

Aside from this promotional video, other publically available videos give an impression of *Bravemind*'s virtual worlds: split between detailed, technically ambitious simulations that are visually well-organized but nevertheless limited in content. For example, the faces of what are presumably meant to represent Arab characters are very rarely visible, their clothing stereotypical (fig. 5).

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[35] "Virtual Reality Therapy: Bravemind and Strive."
[36] "Bravemind Collected Scenes," IEEE Computer Society, accessed March 15, 2016, https://www.youtube.com/watch?v=HSPDomDAigg&feature=youtu.be.

Marisa Brandt's empirical study on the design process of *Virtual Iraq* and *Bravemind* offers a possible explanation. Brandt finds that, in the process of designing *Bravemind* on the basis of *Virtual Iraq*, several gaps had to be addressed. One was the diverging view by designers as opposed to clinical psychologists on what elements to include in those virtual worlds.[37] While designers thought more about the consistency of the virtual experience, for clinicians it was more important to get patients engaged in a stressful situation through certain visual triggers that would not necessarily need elaborate visual representation (if they proved to work in the *Virtual Iraq*).

Another difference was the integration of virtual elements described as "Arab people." Brandt reports that "[o]ne designer explained how, for example, in a real market-bombing scenario, a crowd may be mixed in diverse ways, including number of men, women, children, military, and police, and requiring the clinician to control each of the characters would make the system both unusable during therapy and extremely time-consuming to engineer."[38] As every virtual character could potentially have a trigger effect on patients' symptoms, it would need to be both codified as a dynamic entity on the level of software as well as integrated into the clinician's control interface to be employed during the session. As the above-cited explanations by the designer in Brandt's study indicate the diversity of virtual characters was limited due to technical considerations as well as the effectiveness of usability. These practical and economic considerations during the design phase delimit the diversity of virtual characters, and, therefore, what might be considered to be a trauma-relevant scenario.

Furthermore, Brandt found that, beyond just the set of virtual Middle Eastern characters that the ICT art team created, there would also be

> the possibility of purchasing a "package of Arabic characters." Due to the large number of government-sponsored digital media projects that take place in virtual environments, several companies—such as the New Orleans-based company TurboSquid—have recently begun dealing in three-dimensional digital assets (such as meshes and textures) representing people and objects associated with the war on terror, including

[37] Marisa Renee Brandt, "War, Trauma, and Technologies of the Self: The Making of Virtual Reality Exposure Therapy" (PhD diss., UC San Diego, 2013), 234, footnote 166.
[38] Ibid., 236.

> characters and buildings stereotypical of those in Iraq and Afghanistan.[39]

Often the designers had never themselves served in the military, let alone spoken to PTSD patients about their experiences and impressions. Indeed, it is hardly surprising that they have relied on stereotypical features of an ethnical group, integrated into a readymade "package of Arabic characters."

The ability to purchase sets of virtual characters designed to embody stereotypical ethnographic features gestures to the interchangeability of attributes for VR objects—a technical as well as economic consideration. It has not been reported to what extent stereotypical civilian characters contribute to triggering therapeutically "relevant" reactions. Regardless, the design of stereotypical characters relies on a racial stereotyping wherein certain communities can be identified by their appearance.

Tensions between design conventions and therapeutic rationales notwithstanding, there is the shared presumption that a traumatic experience is a collective phenomenon that can be replicated as representation within media technologies. In *Bravemind*, mediated decisions and conceptions of design seem rather to form a quite de-individualized, albeit "pragmatically possible," therapeutic subject.

3.3. Immersion and Sensory Feedback

Beyond just the design of virtual worlds, Sherman and Craig's other key elements of VR include immersion, interactivity, and sensory feedback. Immersion, suggest the authors, relates both to physical (or sensory) and mental immersion.[40] They "refer to physical immersion as the property of a VR system that replaces or augments the stimulus to the participant's senses."[41] Mental immersion, on the other hand, is defined as a "state of being deeply engaged; suspension of disbelief; involvement."[42] These two aspects of immersion are not mutually exclusive. Rather, for virtual reality experiences, it is mandatory for users to be both physically and mentally immersed and engaged with the VR system and its virtual scenarios.

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[39] Ibid. According to TurboSquid's website, customers can buy, for example, the 3D model "Arab Civilians x8 Rigged." As stated, it is a "high detail low-impact Arab civilian model collection, in traditional dress." (http://www.turbosquid.com/3d-models/arab-rigged-3d-model/389201).
[40] Sherman and Craig, *Understanding Virtual Reality*, 9.
[41] Ibid.
[42] Ibid.

To accomplish this, *Bravemind* employs various technological strategies.[43] More than the visual content of its worlds, as detailed above, the dispositive of the therapeutic setting, including the sensory feedback, are key elements in stimulating a confrontation with traumatic experiences that evoke emotional responses. The *Bravemind* system is composed of features made to ensure physical immersion and sensory feedback: "In addition to the visual stimuli presented in the VR head-mounted display, directional 3D audio, vibrations and smells can be delivered into the simulation."[44] One such sensory feedback device is a *vibrotactile platform* that requires assembly by the therapist when purchasing *Bravemind*. This "'rumblefloor' […] simulates the vibrations of vehicle engines, explosions, gunfire, etc. The patient will stand or be seated in a chair atop the platform."[45] This form of sensory feedback is designed to provide physical sensations in close relation to actions within the virtual scenario. If, for example, the patient is called upon to experience a Humvee ride (short for High Mobility Multipurpose Wheeled Vehicle), they can sit on a chair mounted to the top of the *rumblefloor*. The rumble, even though not generated by an actual, physically present, Humvee, affects the whole body, thereby potentially triggering a bodily memory and habituation—being on patrol in a location where the traumatic events *took place*, literally and figuratively.

To foster a sense of mental and physical immersion in conjunction with interactivity, the patient is sometimes also provided with game controllers. These controllers are either gamepads, such as an *Xbox* gamepad, or mini

[43] Virtual Therapy for combat-related PTSD gained wider public attention through the video installation *Serious Games* (2011) by media artist Harun Farocki. See, for example, Orit Halpern, "The Trauma Machine: Demos, Immersive Technologies and the Politics of Simulation," in *Alleys of Your Mind: Augmented Intelligence and Its Traumas*, ed. Matteo Pasquinelli (Lüneburg: Meson Press, 2015), 53–67.

[44] "Bravemind: Virtual Reality Exposure Therapy," USC Institute for Creative Technologies, accessed December 15, 2015, http://ict.usc.edu/prototypes/pts/. In Bravemind's precursor application, *Virtual Iraq*, olfactory stimuli included "the scent of burning rubber, cordite, body odor, diesel fuel, Iraqi spices and gun powder were deployed." The potential benefits and effects of including olfactory stimuli into VT settings are the subject of only a few clinical studies, even though it is noted that the "connection between olfaction and emotion has been established […]; accordingly, odor can elicit emotions, which may in turn help to facilitate or create a sense of presence." Mary P. Aiken and Mike J. Berry, "Posttraumatic Stress Disorder: Possibilities for Olfaction and Virtual Reality Exposure Therapy," *Virtual Reality* 19, no. 2 (2015), 97.

[45] "Virtual Reality Exposure Therapy Application for Post-Traumatic Stress Disorder 'Bravemind' User Manual, Version 1.0, March 2014," University of Southern California Institute for Creative Technologies MedVR Lab, accessed February 24, 2016, ftp://128.125.133.25/arizzo/Manual/Bravemind%20Manual%203-2014.pdf.

gamepads mounted on mock-up machine guns to navigate through the virtual scenario (fig. 6).

Fig. 6: Screenshot from a promotional video by University of Southern California Institute for Creative Technologies depicting a typical dispositive of *Bravemind* with a patient wearing a head-mounted display and carrying a machine gun mock-up.[46]

The "M4 Training Rifle (Inert; plastic polyurethane with the same weight as a real rifle)" is designed "[f]or use with mini-gamepad for dismounted movement within the virtual environment. Choose the black color option instead of blue to increase the immersive effect."[47] As machine guns used in the U.S. Army are usually black, therapists are encouraged to select the black model, designed also to be as heavy as their standard-issue weapon. Carrying a combat rifle is not only part of being a fully equipped combat soldier; it addresses an embodied memory of moving through terrain with a particular material affordance attached to one's body.

In my view, VRET's rationale for combat-related PTSD designates the patient as a soldier, and it is this ongoing classification that renders them treatable as such. Indeed, the subject addressed by these types of VR experiences is one who can only act and respond as a soldier. Hence, there is no alternative world other than that which gestures to the war, and which renders the soldier present. Trauma, triggers, and therapy remain in the physical or virtual worlds as war zones, which do not offer an alternative perspective for patients—like relating to situations in more common scenarios, such as

[46] "Virtual Reality Therapy: Bravemind and Strive."
[47] "Bravemind User Manual," 10.

witnessing a car accident. Patients must identify as soldiers who know and remember their duties rather than as civilians. Even if VRET follows the logic of exposure therapy by exposing patients to scenarios that are particularly stressful and evocative of traumatic memories, it is crucial to note that this therapeutic logic "re-boots" patients identified as soldiers first and foremost.[48]

Apart from the specific function of the HMD, if *Bravemind* relies on the rationale of exposure therapy it goes beyond by targeting specific synaesthetic experiences, involving patients in media-technological dispositives such as the use of machine gun mock-ups for tactile sensation, as well as sensory input devices for olfactory stimuli and auditory input. As the experience of physical spaces is relatively limited in a VRET session, much sensorial and mental attention can be directed towards virtual scenarios based on the strategies of mental and physical immersion. And as most of the physical and sensorial input is induced by sensory mediators, the HMD's function is crucial for inducing and adapting synaesthetic and, therefore, trauma-relevant sensations.

4. Interfaces of Therapeutic "Command and Control"

As detailed above, the therapeutic rationale of VRET for combat-related PTSD is based on the basic principles of VR experience. Such an entanglement of media technologies and therapeutic objectives becomes even more crucial when exploring the different interfaces that structure and control (1) the interaction between patient and virtual scenarios, and (2) between therapist and patient. By drawing on existing studies that critically review the traumatic effects of screen-based media for audiences, and by relating these findings to the functional and visual design of interfaces in *Bravemind*, I describe the adaptive intimacy of stereoscopic visuality inside HMDs, as well as the function of clinician control interfaces. In doing so, my attempt is to uncover how media technologies are employed as strategies of therapeutic "command and control."

4.1. The Intimacy of Displays

Immersing people in virtual environments designed neither for entertainment nor educational purposes, but rather to re-enact scenarios that serve as stimuli for traumatic memories, is based on displacing agency over imagination to virtual scenarios inside HMDs, and, moreover, by shielding visual perception from external input, creating an intimacy with these scenarios patient. As *Bravemind* developers put it, "Immersive VR can be produced by combining

[48] I am addressing the underlying logic of subjectivization and do not intend to comment on the individual benefits of VRET for PTSD treatment.

computers, head-mounted displays (HMDs), body tracking sensors, specialized interface devices and real-time graphics to immerse a participant in a computer generated simulated world that changes in a natural/intuitive way with head and body motion."[49] The sheer proximity of stereoscopic visualizations inside HMDs (such as the *Oculus Rift* "Crescent Bay") forces a patient's visual perception, and attention, to be focused primarily on scenarios of violent content. With a simultaneous shielding from other visual input as a result of opaque display and a limited field of vision, the HMD is both in a perceptually as well as physically "intimate" relationship with the user and enables basic conditions for constituting emotional engagement through virtual scenarios.

Earlier analyses of screen-based media, in particular film and television, have shown the emotional and even traumatic effects of watching violent and disturbing scenarios.[50] For example, anthropologist Allan Young has studied how the steady influx of catastrophic images on television screens after September 11, 2001 invoked (secondary) traumatization in broader segments of the population.[51] Indeed, communication studies scholar Amit Pinchevski coined the term *screen trauma* to stress the intrusive and traumatic impact of watching screen-based violence. Taking the example of drone pilots, Pinchevski states that "Remote-controlled warfare gives rise to a new constellation of psychology and technology, one that fuses extreme visibility with extreme distance. […] [T]he situation of drone operators is about seeing distressing things happening to far-off strangers because of me."[52] Pinchevski stresses the dispositive of remote-controlled warfare, as well as other forms of "traumatic media exposure," in causing PTSD.[53] Even though operators are witnessing violent events at a great distance, screen-based media narrows the perceptual and emotional gap to a minimum and compels physically

[49] Rizzo et al., "Virtual Reality Exposure for PTSD," 256.
[50] The functional and political role of screens and the "screenness" of media practices are producing theoretical attention. See, for example, Alexander Styhre, "Screenness and Organizing: Sociomaterial Practices in Mediated Worlds," *VINE* 43, no. 1 (2013): 4–21; Nanna Verhoeff, *Mobile Screens: The Visual Regime of Navigation* (Amsterdam: University of Amsterdam Press, 2012); Brit Ross Winthereik et al., "Attending to Screens and Screenness," *STS Encounters* 4, no. 2 (2011): 1–6.
[51] Allan Young, "PTSD of the Virtual Kind—Trauma and Resilience in Post 9/11 America," in *Trauma and Memory: Reading, Healing, and Making Law*, ed. Austin Sarat, Nadav Davidovitch, and Michal Alberstein (Palo Alto: Stanford University Press, 2008), 21–48; also see Allen Meek, *Trauma and Media: Theories Histories and Images* (New York/London: Routledge, 2010).
[52] Amit Pinchevski, "Screen Trauma: Visual Media and Post-traumatic Stress Disorder," *Theory, Culture & Society* 33, no. 4 (2016), 65.
[53] Pinchevski, "Screen Trauma," 52.

inaccessible spaces to converge with the user's own physical space, a move which ultimately leads to instances of PTSD.[54]

Both HMDs and the designated virtual scenarios employed in VRET attempt to bridge the gap between inaccessible locations and the user's physical location by substituting the former with visualization. More than for drone pilots, however, patients in VRET are confronted with screens *before their eyes*, with the HMDs attached to their heads producing stereoscopic visualizations that mimic personal perspective. By establishing a dispositive in which the patient's memory is triggered by very close and adaptive visualizations, the display derives its own instructional status. The display is not just as an extension of vision, but rather the only possible mode of visualization; as such, it claims a particular status in the broader dispositive of VRET. The relation of vision, bodily experience, moving images, and identification (as well as imagination) within HMDs is intended to acquire agency over patients' memories and narration so to offer a virtual world that is presumably more "controllable" than the flashbacks of traumatic situations, or perhaps more "accessible" than imagining these situations through narration.

Accordingly, *Bravemind* developers highlight a major advantage of VRET in comparison to "talk therapy":

> Now rather than relying exclusively on imagining a particular scenario, a patient can experience it again in a virtual world under very safe and controlled conditions. Young military personnel, having grown up with digital gaming technology, may actually be more attracted to and comfortable with a VR treatment approach as an alternative to traditional "talk therapy."[55]

As mentioned in section 3.1, the operational fusion of imaging and imagination on the basis of virtual scenarios and HMDs is intended especially for those patients who are "unable" or "unwilling" to "effectively visualize" their traumatic experiences. The adaptiveness of HMDs to user vision and bodily movements is a feature that constitutes a primary objective of the designers of virtual therapy applications; namely, to be able to trigger patient memories by creating an almost-realistic experience in VR. The HMD's head-tracking

[54] Derek Gregory studies the tension between a remote physical space and screen-based proximity, one that nevertheless constitutes a sense of "intimacy" with distant places and people, in his study of the visual regimes of drone operators. Derek Gregory, "From a View to a Kill: Drones and Late Modern War," *Theory, Culture & Society* 28, no. 7–8 (2011): 188–215, see esp. 197–200.

[55] "Bravemind: Virtual Reality Exposure Therapy."

system, with its related real-time renderings of virtual scenarios, does not only affect visual perception but also functions as a phenomenal and spatial interface with virtual worlds. Digital technology attached to the body establishes a common spatial coordinate system that functions as a grid on which the patient's physical actions are translated into virtual actions.[56]

But this kind of adaptiveness does not only guarantee a smooth transition between phenomenal experience, vision, visualizations, and display, but also a kind of "symbiotic architecture between humans and computers"[57] with regard to the difference between imaging and imagination. The idea to distribute agency between human and computational processes by integrating them at screen-based interfaces can be traced back to the early days of interaction design. In 1960, Joseph C.R. Licklider pointed toward the division of labour between humans and computers regarding quantitative and qualitative operations. As Licklider writes, "Men will fill in the gaps, either in the problem solution or in the computer program, when the computer has no mode or routine that is applicable in a particular circumstance."[58] Though Licklider addresses what were at that time the state-of-the-art computer interaction settings, a similar division between computer imaging (displayed virtual scenarios) and the ways they are perceived by humans persist in VRET today. The adaptivity of HMDs relies on a mutual relation with the user to provide an immersive and therefore therapeutically relevant experience. Where digital technologies are not (yet) sufficient to provide an immersive virtual experience due to technical difficulties such as visual latency, the patient's imagination needs to "fill in the gaps" by imaginatively bridging the links between the technologically possible, collective assumptions, and individual experiences in order to be treatable by means of HMD-based VRET. Thus, the HMD, as an adaptive stereoscopic screen, is not "a terminus of perception."[59] Indeed, adaptivity in this context not only addresses a media-technological feature of tracking technology for generating an immersive experience, but also extends to

[56] Pasi Väliaho explores the VRET application *Virtual Iraq* through Harun Farocki's installation *Serious Games* (2011). Following Farocki's theoretical work, he states that "Operational images take up the work of tools, more precisely, tools of power that impose a grid through which the world becomes visualized, intelligible, and, crucially, an object of manipulation." He further explores the relation between virtual therapy and the application of operational images in the form of video games for the training of soldiers. See Pasi Väliaho, *Biopolitical Screens* (Cambridge: MIT Press, 2014), 64 and 65ff.
[57] Joseph C.R. Licklider, "Man-Computer Symbiosis (1960)," in *The New Media Reader*, ed. Noah Wardrip-Fruin and Nick Montfort (Cambridge: MIT Press, 2003), 77.
[58] Ibid.
[59] Nigel Thrift, "Beyond Mediation: Three New Material Registers and Their Consequences," in *Materiality*, ed. Daniel Miller (Durham/London: Duke University Press, 2005), 235.

applying VRET as a form of feedback loop—a psycho-technology between human and machine, patient and virtual scenario.

4.2. Remote Triggering and Controlling: Clinician Interface

Even though *Bravemind* as a psycho-technical dispositive might give the opposite impression, its therapeutic setting does not exclude verbal interaction between patient and therapist. Nevertheless, the therapist's attention is not fully focused on the patient and his or her narration. Rather, the therapist (a clinical specialist) needs to control a graphical user interface (GUI) for manipulating the virtual scenarios (fig. 1).[60]

> Clients can be immersed in simulations of trauma-relevant environments in which the emotional intensity of the scenes can be precisely controlled by the clinician to customize the pace and relevance of the exposure for the individual client.[61]

Several aspects of this statement by *Bravemind*'s developers are puzzling: first, the idea of a monocausal, yet somehow functional, relation between the intensity of emotional reactions and the virtual scenes in *Bravemind*; second, that manipulating this relation through visual input would be within the therapist's full control; and third, that a deterministic system, namely the software code underlying *Bravemind*, could be targeted at individuals during the session by means of controller interfaces (fig. 7).

Figure 7 shows a screenshot of the clinical controller GUI for the scenario "Iraq Rural Driving" from *Bravemind*'s User Manual.

[60] Marisa Brandt remarks in her ethnographical study of *Bravemind*'s design process: "This was the clinician interface, which Rizzo's lab referred to in papers as the 'Wizard of Oz' display because it allowed the clinician to teleport the patient to another world from behind her controls, like the Wizard who sends Dorothy back to her home in Kansas in the 1939 film. Considering the world presented in Virtual Iraq, I wondered how to interpret this comparison. Was Iraq 'home' or would interaction with Virtual Iraq allow those with PTSD to finally fully come home, stateside, no longer haunted by their traumatic memories of war? Or was the issue of home even relevant? Perhaps the moniker was only supposed to be a reference to the power of the man behind the curtain using controls to produce meaningful illusions." Brandt, *War, Trauma, and Technologies*, 34.

[61] Rizzo et al., "Virtual Reality Exposure for PTSD," 257.

Fig. 7: Screenshot of a typical clinical controller graphical user interface for the *Bravemind* scenario "Iraq Rural Driving."[62]

In conversation with the patient, the therapist is able to choose between several settings within the virtual scenario—in particular, the parameters of multi-sensory input, e.g., engine sound (first row left side), and virtual characters, e.g., soldiers in vehicle (first row left side, square in the middle). Only volume and brightness can be controlled while all other parameters simply have an on/off choice. The notion of *control* over the patient's emotional reactions gets even blurrier in this instance. Even as the visual design of the GUI suggests the possibility of adding layers of traumatic simulations to the virtual scenarios according to the patient's responses and therapeutic needs, this seems to obscure the fact that such manipulations are limited to the realm of *Bravemind*'s algorithms and code. What is considered to be a traumatic event relies not on the patient's narration but rather on *Bravemind*'s available, *coded*, features. The application's setup determines the patient and therapist's perspective on what is considered to be the (virtual) re-enactment of a traumatic event. In this respect, *Bravemind*'s designers and programmers contribute on a fundamental level to what is considered to be both conceptually and pragmatically therapeutic. In contrast to traditional forms of exposure therapy, designers and programmers arise here as new actors, influencing formal and

[62] "Bravemind User Manual," 65.

deterministic layers of media technologies, and setting a framework in which patients will be able to experience and express their own traumatic memories and feelings. Media technologies thus gain an active, and yet restrictive status, and it is doubtful to what extent an individual traumatic experience can be addressed and expressed by deterministic software applications and their technical features, such as GUIs.

As media theorist Wendy Chun notes, "GUIs have been celebrated as enabling user freedom through (perceived) visible and personal control on the screen. This freedom, however, depends on a profound screening: an erasure of the computer's machinations and of the history of interactive operating systems as supplementing—that is, supplanting—human intelligence."[63] The idea that the therapist could fully control emotional intensity through a GUI suggests its own underlying paradox. What *can* be controlled is the aesthetic output as determined by encoded algorithms and data. What *cannot* be controlled is its effect on human perception and, therefore, emotion.

As an algorithmically-determined system intended to be widely applicable, *Bravemind* assumes that every soldier (patient) with combat-related PTSD shares a common repertoire of perceptual and sensorial memories that are experienced as equally traumatic. Without this assumption, a common repertoire cannot serve as a basic model for designing and programming. Again, the notion of an individual or individually treatable patient seems to draw on the "collective" of soldiers. This is not to say that soldiers, as individuals, do not share certain experiences, but rather that it restructures the very notion of the individual according to the world of war. An individual identified as a soldier is the subject of military command and control—still in the ranks, as it were, even in therapy.

5. Conclusions and Prospects

The analysis of virtual worlds and feedback strategies in virtual therapy demonstrates the inseparable coaction of media technologies and psychotherapy. Digital technologies are attributed with their very own therapeutic agency to effectively trigger emotions and memories that are in theory treatable by applications such as *Bravemind*. The idea that traumatic memories and related triggers are not only representable, but also codifiable, and finally controllable, is foundational and based on the design and application of software, HMDs, and GUIs as therapeutic media.

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[63] Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge: MIT Press, 2011), 59.

From a critical perspective, it is clear that the discourse on the effectiveness of VRET (and, in particular, *Bravemind*) carries multiple connotations based on specific notions of both subjectivity and treatability. First, the visual design of virtual scenarios replicates traumatic experiences in a game design style that includes stereotypical virtual character designs. Here, the tension between what is possible design-wise and what is therapeutically necessary is drawn into the open. Effectiveness, in this sense, relies on collective and disciplinary negotiations of interpretive authority, both in visual design as well as in the political assertions these designs convey. Second, the application of multi-sensory input, such as olfactory input and rumble floors, sheds light on a form of "somatic effectiveness." As in traditional exposure therapy, virtual therapy tries to involve as much of the patient's sensorium as possible, even if the main stimuli and triggers rely on visual input. Nevertheless, psychotherapy here extends to triggering somatic and phenomenal affects to address embodied memory. The focus of psychotherapeutic techniques seems to shift from the psyche, or even the brain as the locus of emotion and memory, toward a more holistic view.

Recent developments, however, testify to an almost contradictory perspective. The Institute for Creative Technologies promotes a new virtual therapy application—or, rather, new virtual *training*. The application *Strive* (an acronym for Stress Resilience in Virtual Environments) is described as a "story-driven approach to using virtual reality (VR) for understanding and training psychological resilience in service members prior to combat deployment. The goal is to better prepare our troops for the emotional challenges of war, potentially reducing the later incidence of Post-traumatic Stress Disorder (PTSD)."[64] This approach *anticipates* PTSD and *pre-emptively* addresses it, prior to any combat experience: resilience training for soldiers against trauma prior to deployment carries the promise of reduced indications for PTSD therapy post-mission. Therapy that starts before soldiers are physically engaged in combat should, argue its proponents, better help them to cope with stress as they have virtually "seen it all before." The temporal dimension of the effectiveness of such pre-mission VT applications like *Strive* is meant to train soldiers to be "less traumatized." Again, HMDs and virtual scenarios are considered to be the basic media technologies necessary to this effort, and are intended to function as psycho-technologies on a neuro-ontological level.[65]

[64] "Stress Resilience in Virtual Environments (STRIVE)," USC Institute for Creative Technologies, accessed March 31, 2016, http://ict.usc.edu/prototypes/strive/.

[65] A $7,500,000 USD research proposal by the University of Southern California Institute for Creative Technologies in collaboration with the Brain and Creativity Institute (BCI) puts it this

Surely these new developments require further research, but they also extend conceptual ideas that are already installed in *Bravemind*. That is to say, not only a bio-ontological notion of PTSD, but the *presumed inevitability of combat-related PTSD*.[66] The use of virtual training for "immunization" against trauma suggests that, with virtual therapy, the codification of traumatic experiences, with their associated stress symptoms, could be controllable—almost calculable—as if "trauma" were a neuro-ontological phenomenon located at a certain spot in the brain, and as such could be targeted in therapy. Finally, this points toward the applicability of new technologies for a civilian population. What traumatic experiences might the general public need to be "immunized" against? And who would benefit from populations effectively prepared to be "resilient" in coping with highly stressful or even traumatic situations?

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way: "The BCI […] uses advanced brain imaging and cutting-edge neuroscience to discover how the human brain processes emotions and applies the resulting knowledge to solutions for both biomedical and socio-cultural problems. The primary aim of the […] research collaboration between the ICT and the BCI [is] to develop an accurate and objective diagnosis of PTSD and to understand changes in the brain reflecting the efficacy of treatment. […] The knowledge accumulated through this program will have an immediate benefit to the military population, but also will have applicability to the general civilian population as well." Office of Senator Dianne Feinstein Fiscal Year 2009, Appropriations Request Form, accessed March 20, 2016.
ftp://ftp.ict.usc.edu/arizzo/Galen/Def.Institute%20for%20Creative%20Technologies.BRAVEMIND.FY09.doc(WHD_5598370_1)1.DOC).

[66] On the relations between PTSD, *Virtual Iraq*, and brain plasticity, with reference to the writings of Catherine Malabou, see Pasi Väliaho, "Affectivity, Biopolitics and the Virtual reality of War," *Theory, Culture & Society* 29, no. 2 (2012), 83ff.