Silhouettes of War: Technologies of U.S. Soldiering and Surveillance

By Jessica J. Behm

Abstract

This paper forwards a *theory of silhouetting* in relation to technological augmentation in U.S. Military uniforms and suggests that the increasing utilization of metamaterials, nanotechnology, and surveillance technologies operates under a rhetoric of invisibility that complicates the technologies' visible destruction. Methodologically, the paper attends to three general technological developments in the evolution of the U.S. Army uniform: the design of the new Army Combat Uniform (ACU); the technological advances in the uniform, including embedded wearables, biometric identification devices, and 3D combat enhancement systems; and the bio-networking, GPS, and digital communication arrays that physically link digital uniforms to a larger geopolitical network of U.S. military strategy and surveillance. Throughout, the work traces the aforementioned theory of silhouetting in relation to select sociopolitical consequences of linking digitally enhanced soldiers into a transnational grid of surveillance.

Keywords: Surveillance, U.S. Military, uniform, technology, silhouetting, invisibility, cartography

There is no need to fear or hope, but only to look for new weapons.
~Giles Deleuze, Postscript on Societies of Control

The unity of complex phenomena appear…to be things quite apart from the direct visible truth.
~Albert Einstein

Introduction: Silhouettes of War

Invisibility in Strategy

In the late afternoon on November 5, 1937, Hitler convened generals of the Reich Chancellery in secret meeting (later designated the Hossbach Conference) to articulate Germany's expansionist need for, and entitlement to, greater geo-ethnic territory.[1] The minutes' transcript, presented as evidence at the Nuremberg Trials of 1945, identifies cases for the occupation of Austria and Czechoslovakia as well as the compulsory emigration of their inhabitants. Hitler speculated on plans to impair France's lines of communication, push back lines of occupation in Austria, and draw lines of allegiance with Italy — all strategies to preserve pure lines of descendency in Germany and further state autarchy. Colonel Friedrich Hossbach records that prior to beginning his address, Hitler requested, "In the interests of a long-term German policy, that his exposition be regarded, in the event of his death, as his last will and testament" (qtd. in Welch 1999: 191). If killed, it was imperative that his policies were followed — orchestrated invisibly by his will — by all generals present. Even in death, his presence would be traceable by articulated lines of war strategy, though he had himself disappeared.

Invisibility at Sea

Across the world a young MIT oceanographer, Athelstan Spilhaus, was dropping a small device into the Atlantic Ocean. The invention would revolutionize submarine warfare for the next fifty years as it combined measurements of oceanic temperature and pressure, recording what was called a "trace" on a carbon-coated card that would allow U.S. WWII submarines to seemingly disappear from sonar. Because oceanic temperature gradients create layers that change the properties of sonar refraction, as submarines descend through depths alternating warm with cool temperatures, they are alternately visible and invisible. Bathythermograph measurements thus allowed U.S. submarines to hide from Hitler's naval fleet by using the very properties of water against them. Having discovered how to manipulate the blind spot of the ocean the ships sank through thermoclimes, moving through a transparent sea that nonetheless concealed them. Even in the ocean the enemies' presence would be traceable by lines of sonar, though the ships had themselves disappeared.

Invisibility on Land

Addressing the U.S. Air Force Academy on June 2, 2004, President Bush compared Operation Iraqi Freedom to World War II, facilitating an alternate historiography that justified the Iraq War as one of "the great clashes of the last century between those who put their trust in tyrants and those who put their trust in liberty" (Bush: 2004). Despite the startling political, strategic, and operational differences between the wars, many U.S. neoconservatives have persisted in this rationalizing logic. Yet in Iraq, the tactics for identifying and evading the "enemy" have been radically transformed in the absence of a clearly defined military front.

The headline of *The New York Times* on the morning of November 4, 2006 was not particularly unusual: "Sniper Attacks Adding to Peril of U.S Troops". The U.S. was at war[2], yet columnist C.J. Chivers writes that U.S. Marines were, surprisingly, dancing — albeit uncomfortably. Chivers states, "In conditions where killing the snipers has proved difficult, the marines have tried to find ways to limit their effectiveness. Signs inside Marine positions display an often-spoken rule: *Make yourself hard to kill*" (Chivers 2006: 2). Chivers describes the dance of evasive maneuvers that the marines perform as "cutting squares". However, the marines' partners are invisible, watching their performance through the eye of a scope, while the marines stare "down their barrels at dozens of windows that face them, as if waiting for a ghost's next move" (Chivers 2006: 1). Attempting to diminish their visibility, the marines "zig and zag as they walk, and when they stop they shift weight from foot to foot, bobbing their heads. They change the rhythm often, so that when a sniper who might be watching them thinks they are about to zig, they have zagged. Now and then they squat, shift weight to one leg and stand up beside the place where they had just been" (Chivers 2006: 2). Yet as Chivers notes, this performance of disappearance is tiring. The marines cannot escape the inevitable — though the scope lines are invisible their targets and bodies remain resolutely present on terrain that is everywhere the "front": "As operations drag on, some marines begin to stop cutting squares. And sometimes even those that are moving are still shot" (Chivers 2006: 2). The laser of a military scope is termed a sight line precisely because it delineates an invisible line that will reveal, at the end, a visible target. Even on land our presence is surprisingly visible though we hoped to have disappeared.

I. Silhouetting Techniques

Historically, war has coveted appearance and disappearance: the tidal-tectonic patterns of the ocean harnessed to conceal naval weaponry, the properties of nuclear and atomic physics manipulated in order to evaporate entire cities, and the warmth of human bodies concealed in order to disappear from heat-seeking missiles. Enacting a double erasure, the records of technologies of disappearance are also often secreted: plans for mechanized death camps and atomic missiles disappear for decades or are lost forever. Yet 21st century technologies of war that operate under the guise of invisibility only momentarily delay the grim, eschatological inevitability — the technologies are frequently cloaked, in rhetoric and real-time deployment, to achieve greater destruction. In addition, the design, testing, and deployment of military technologies often complicates the "visibility" of the consequences of war. A rhetoric of invisibility thus operates at four distinct levels — in the design of technologies which explicitly forward the possibility of invisibility for the soldier, in the testing of technologies which may uncouple the technology from its visible or ethical consequences, in the deployment of technologies wherein concealment facilitates greater technical acuity, and in the discourse of technologies wherein ideas of invisibility conceal intentionality.

Adam Smith's "invisible hand" continues to wave in 2010, but this time it is not surreptitiously guiding self-interested capitalists toward economic nationalism; rather, the "invisible" market forces that operate in technology and military sectors are deliberately mapping technologies onto visible bodies and the hands are many. While Smith's theory imagines a collective of self-interested individuals that contributes, if inadvertently, to social welfare, *a general theory of silhouetting suggests it is possible to deliberately map seemingly invisible technologies that target bodies, territories, and spatial borders, creating a visible cartographic project that charts the technologies' strategic production and consequences. Silhouettes of war are thus those techniques and technologies that operate under the rhetoric of invisibility even as they catalyze visible destruction.*

Mapping a cartography of silhouetting processes is significant as it traces the very real ways in which the implementation of seemingly "invisible" technologies creates undeniably visible devastation for diverse communities and citizens. What is at stake in the rhetoric of invisibility is the denial of real, visible effects: the "invisible" sonar, infrared, surveillance, and nanotechnologies of military weaponry cannot also elide the destruction of visible targets. Likewise, what is at stake in the rhetoric of disappearance is the undeniable persistence of appearance: vanished "weapons of mass destruction", the removal of dictators, and evasive tactics of military hide and seek cannot also erase the body count these disappearing acts engender. This is the paradox of invisibility: its power derives from its ability, at any moment, to make itself or its target visible. And once the target is revealed, so too are the tangible implications of technologies and discourses of invisibility for international policies: *mapping invisible cartographies reveals visible ones*. As Virilio appropriately notes, "all techniques meant to unleash forces are techniques of disappearance" (Virilio 2002: 67).

Silhouettes of war are material techniques and technologies that may be specifically traced in processes of design, labor, manufacturing, and implementation, but which "silhouette" more complex and unexamined agendas by invoking ideas of invisibility. This project is distinctly not concerned with labeling discrete technologies as “bad” — as in antithetical to social and political goals of a humanist democracy — but rather in examining 21st century wearable technologies with attention to the silhouettes that accompany their production and performance. In this essay, the strategic, technical, and political silhouettes of war that accompany the design and deployment of 21st wearable military technologies will be restricted to an examination of the recent evolution of the U.S. Army uniform, increasingly imagined as a digitally enhanced, embodied bio “weapon” that is embedded within communication arrays that physically link ground soldiers within a larger geopolitical network of U.S. Military[3] strategy and surveillance. The term silhouette here takes on an additional valence as it refers to both an embodied soldier and the cultural “shape” of 21st century digitized uniforms.

Methodologically, this paper will attend to three technological developments in the evolution of the U.S. Army uniform. First, the design of the new Army Combat Uniform (ACU) which replaced both versions of the standard Battle Dress Uniform (BDU) as well as the desert camouflage uniform and was predicted to have 100% deployment to all Army personnel by December 2007 (TRADOC 2009). Second, the technological augmentations to the uniform, including embedded wearables, biometric identification devices, and 3D combat enhancement systems. And third, the bio-networked, GPS, and digital communication arrays that physically link digital uniforms to a larger geopolitical network of U.S. Military strategy and surveillance.[4] While the third section examines GPS networks, it is with an eye to analyzing their significance for the ground soldier. It is also important to note here that U.S. Military uniforms are not “standard” issue, but variously reflect the unique history, priorities, and cultures of the discrete U.S. service branches and indicate the more complex ways in which each service branch has historically embraced or rejected technologies best suited for their distinct service cultures.

This essay serves as a brief introduction to a theory of silhouetting in relation to technological augmentation of digitally enhanced U.S. soldiers within a transnational grid of surveillance. Yet silhouettes of war — techniques and technologies that operate under the guise of invisibility with visible effects — are inextricably linked to constitutive ethical concerns that, as the three introductory vignettes suggest, develop from specific, material conditions of production, labor, and geopolitical historicity. To engage in war we must distinguish our identity from that of a designated enemy and this requires some invocation of a border — whether it is geographically or ideographically constructed. A psychology of enmity is thus endemic to all constructions of conflict in war and the possibility for both conceptual and concrete invasion. Within academic discourses regarding border theory and the subsequent critiques of its varied postmodern incarnations, much border scholarship continues to examine geo-political boundaries as visible, often linear constructions, even if they are theorized to be shifting, perforated, transgressed, and contested. That is, though the solidity of the border is queried its silhouettes

— the techniques and technologies that shadow visible territorial, cultural, and socio-political demarcations — are less often traced. In many 21st century war conflicts the distinction between the rhetoric of solid borders and the persistent impression of silhouetting techniques is realized with devastating lucidity by new technologies. Techniques of war that rely on seemingly "invisible" technologies such as sonar, GPS, satellite, and surveillance techniques not only complicate ideas of the border as impermeable, or even semi-permeable to particular bodies, commodities, and information, but also challenge the very construct of a border.

Querying the rhetoric of a solid border should not undermine the complex and destructive ways in which the demarcation and patrol of borders — along very real physical lines — is enforced. However, when a border is monitored by GPS and satellite technologies that draw boundaries in space along invisible orbit lines, and patrolled by personnel that eliminate persons along invisible scope lines — it is no longer sufficient to discuss the permanence of a physical border, even as a perforated trajectory. Rather, silhouetting techniques — those that employ a rhetoric of invisibility — critically problematize the persistent notion of borders as terrestrial, if contested, demarcations of the nation-state because they operate along seemingly invisible trajectories (e.g. GPS satellite orbits) that nonetheless trace distinct, geopolitical borders and facilitate state military operations. As Seyla Benhabib suggests in her investigation of the constitutive elements required for a deliberative democratic society, "The modern nation-state system, characterized by the "inner world" of the territorially bounded politics and the "outer world" of foreign military and diplomatic relations — in short, the "state-centric" system of the nineteenth and early-twentieth centuries — is, if not at an end, at a minimum undergoing a deep reconfiguration" (Benhabib 2002: 179). Theorization of a uniformly visible border, in addition to providing false stability and referentiality, obscures the accompanying forces at work — silhouetting techniques — that create visible destruction via a rhetoric of invisibility. Silhouetting technologies designed for monitoring and military deployment that utilize sonar, radar, and infrared may be as devastating as their visible counterparts (e.g. hand-to-hand combat) but they are deployed, more insidiously, with an accompanying rhetoric of invisibility that may mask their visible effects. In the 21st century, U.S. Military ground soldiers occupy an uneasy position as they are increasingly conceived of and developed as potentially "invisible" digital weapons, despite the resolutely visible and embodied consequences of military conflict and combat for soldiers and citizens.

II. The Velcro Soldier

U.S. Department of Defense (DoD) projections for the next decade anticipate the design of nanotechnology uniforms that will digitally camouflage soldiers, visually erasing them from the battlefield, and simultaneously endow them with 3-D modalities, x-ray vision displays, embedded biometric sensors, and ultrasonic medical diagnostics. The DoD funds numerous R&D programs for advancing uniform technology, some of these have included the Digital Military Police Program, Special Operations R&D Support Element (SORSE), and the Education and Training Technology Application Program (ETTAP). New technologies have been implemented to both materially alter the standard BDUs, last changed in the early 1980s, as well as radically augment the technical capabilities of the military uniform — transforming it from standard issue clothing into a digitally networked version of the Ancient Egyptian *Ammon-Ra's* invisibility cloak, capable of disappearance and omnipresence at once.

However, although combat styles and the geopolitical terrain of military theater sites have changed radically, as of 2004 the traditional U.S. Military BDU had not been modified substantially in 25 years. U.S. Army Training and Doctrine Command (TRADOC) generates and distributes military training documents, many of which are approved for public distribution and available on their website. One can download unusually diverse documents, ranging from request forms for new military uniforms (TRADOC 248-RF); the official procedure for homosexuals in the military (TRADOC 600-26); and training aids for mine clearing lines, plastic rifles, and portable grave registration kits (TRADOC 350-9). These documents contribute to the institutional and operational bureaucracy that regulate military functions, and also provide textual discourse that informs device training, weapons use, and tactical maneuver strategies — in essence, basic requirements for participating in (and surviving) modern military life.

TRADOC publishes a list of all changes for the new ACU — which began replacing all BDUs for Army Active, Reserve and National Guard Soldiers in 2005 — as well as descriptions of the digitized camouflage pattern, care and wear instructions, and justification for discrete design modifications. The document states, "There were 20 changes made to the BDU. The bottom pockets on the jacket were removed and placed on the shoulder sleeves so Soldiers can have access to them while wearing body armor. Buttons were replaced with zippers that open from the top and bottom to provide comfort while wearing armor. Patches and tabs are affixed to the uniform with Velcro to give the wearer more flexibility and to save the Soldier money, also the cost to get patches sewn on will be eliminated." Additional modifications include improved desert boots and moisture wicking t-shirts and socks. A quote from Sgt. Maj. Of the Army Kenneth Preston affirms, "Every modification made on the uniform was designed with a specific purpose and not just for the sake of change" (TRADOC 2009: 1). (See Figure 1)

For civilian observers, the most conspicuous change was certainly the digitized camouflage print, phasing out the woodland camo (as well as the three-color desert combat uniform) that had defined the U.S. Army for decades. For the new ACU, the Army utilized a print already developed by the U.S. Marine Corps, and also removed black entirely stating, "Black is no longer useful on the Army uniform — it is not a color commonly found in nature, and it immediately catches the eye" (TRADOC 2009: 1). We may infer that it particularly "catches the eye" in the dominant biome of current U.S. combat — the Middle East.

Though highly publicized, the muted pattern of digitized camouflage is not a recent design. As early as the 1970s, a Dual Texture Camouflage (Dual-Tex) was utilized by the U.S. Army 2nd Armored Calvary Regiment in Europe (Cramer 2007). Developed by Lt. Col. O'Neill, a West Point professor in engineering psychology, Dual-Tex was determined to reduce detection by 50% in comparison to the 3-color NATO pattern also used at the time. However, some Army personnel resisted the idea that small squares provided better mimicry of natural environs, so the standard BDU persisted for three more decades (Cramer 2007).

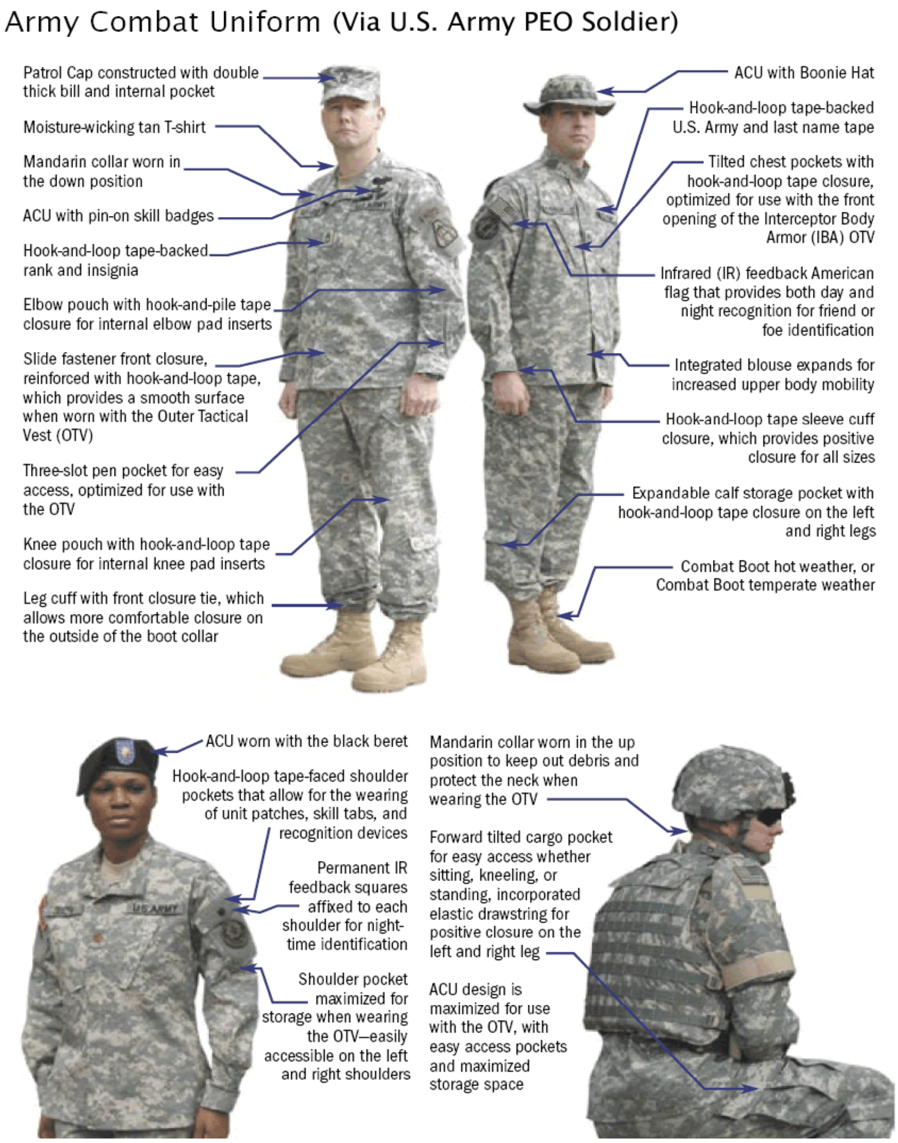

Figure 1. U.S. Military Army Combat Uniform, *Defense Industry Daily*, February 2, 2009

In addition to the pattern changes implemented to better suit the current environment of U.S. Military combat operations (the mixed desert and urban sites of the Middle East rather than Southeast Asian and South American jungles), fabric and functionality modifications were also developed. Rather than the 100% cotton of the standard BDUs, which were issued with Nomex fire-retardant for specific missions, the ACU has the same fabric content as the modified Enhanced Hot Weather BDU, a rip-stop nylon/cotton blend with an applied wrinkle-free treatment that has eliminated the time-honored tradition of pressing and starching one's uniform. New enlisted soldiers were predicted to receive four ACUs courtesy of the U.S. Army and it was suggested that, "soldiers will eventually reap gains in money and time by not having to take their uniforms to the cleaners or shine boots" (Uniform Market 2004). The life expectancy of the ACU uniform (not correlated to the life expectancy of the deployed soldier) is six months. Beginning in January of 2003, the first twenty-five prototype uniforms were tested on Stryker squads at the National Testing Center; twenty-one were then re-issued with modifications again to Stryker squads at the Joint Training and Readiness Center in Fort Polk, Louisiana; and finally, a third version was worn by a select group of Stryker Soldiers for testing in Iraq. The ACU uniforms began wide distribution to Army branches in 2005, with the gradual phase-out of BDUs based on stock depletion; the transition was expected to be completed by December 2007.

Why do these precise uniform changes matter? Simply stated, because some feel that the new uniforms have not worked particularly well, and that their failure may be partially attributed to sociopolitical discourses that inform the construction of uniforms as well as industrial design flaws. In his 2007 article, "New Army Uniform Doesn't Measure Up", active duty officer and Iraqi Engineering Commander Eric Coulson, describes "the good, the bad, and the ugly" consequences of the new ACU for soldiers stationed abroad (active duty soldiers deployed to Iraq were the first prioritized to receive the new uniforms). To begin with, the ACU, in an attempt to make the contents of modular pockets more accessible, replaced zipper and button closures with Velcro. However, under the heading "The Bad" Coulson writes, "This material [Velcro] is just not ready for combat. Putting anything of size or weight in the pant's cargo pocket will often cause the closure to fail if your Velcro has any wear and tear — which in Iraq, it does. Soldiers risk losing belongings" (Coulson 2007). Additionally, many patches, recognition labels and skill tabs — that is, official demarcations of authority, rank, and valor — are now adhered with Velcro. (At least until they fall off.) Here Coulson remarks:

> First patches are much more likely to be lost now that they can be easily removed. And, more obviously, Velcro repair kits are beginning to appear in the exchange shops — a tacit admission the Velcro does not last. Instead of shelling out cash to put new patches on the blouse, Soldiers now have to buy new Velcro to replace the material that failed. (Coulson 2007)

In the military, standards of perfect appearance — precisely folded bedding, spit polished shoes, and spotless uniforms — are legendary and also enforced by disciplinary regulations, even in Iraq. The ACU is now worn with a rough-boot that no longer requires polishing but this, suggests Coulson, is the only discernable "good" of the uniform. The new ACU itself "shows every last bit of dirt the Soldier's been exposed to. I never once saw my original BDUs stain like my ACUs have" (Coulson 2007). However, in comparison to the other difficulties of the material of the ACU, staining seems quite incidental. First, the uniforms are not lasting for their projected six-month life span; Coulson writes, "In more than 10 years of active and reserve service, I never once had a uniform "malfunction". Twice in my tour in Iraq I have had the crotch on my pants rip out. Embarrassment was the least of my worries. Had I not been near the end of a patrol it would have been a serious problem if my vehicle had gone down" (Coulson 2007).

Another difficulty has arisen with the camouflage pattern that, while perhaps tested effectively at home, is receiving negative feedback from deployed soldiers. Coulson remarks, "The pixilation assists in breaking up the shape of the Soldier — particularly through night vision — but in general it stands out against anything except a concrete wall" (Coulson 2007). Critically, the new material, in addition to having poor Velcro adherence, becoming more easily soiled, malfunctioning and, despite good testing, providing poor camouflage, presents a much graver problem — it is not treated with fire-retardant and has contributed to injury and death as a result of its high flammability. Coulson writes:

> The 50/50 blend of cotton and nylon does not appear to have the staying power or the protection of the old 100% cotton or the Nomex of today's flight suits. In fact, Soldiers and Marines that spend a great deal of time in vehicles in Iraq are being issued tan Nomex flight suits to protect them from the possibility of flash fires in their vehicles. The cotton/nylon blend burns very quickly and can add to the injuries sustained in a burning vehicle by melting to the Soldiers' skin. […] The extra cost of Nomex will be more than made up in savings for the treatment and care of burned Soldiers. (Coulson 2007)

The political economy of the uniform's garment production is similarly problematic. *The Washington Post* published a lengthy article in March 2006 after production for the new military ACU had begun with the headline, "Uniform Makers Pay Poorly, Union Says". By law, U.S. Military uniforms must be manufactured in the USA with American materials and labor. While the U.S. Bureau of Labor Statistics documents the average wage for U.S. sewing machine operators at \$9.24/hour, and the average wage of an industrial uniform sewer at \$6.55/hour, initial pay at the cited companies for military uniform sewers averaged \$5.49/hour, generally without health insurance coverage and benefits, and with high rates of layoff. The *Unite Here* report documents that underpaid military uniform sewers must depend on supplemental government programs including food stamps and Medicaid at an estimated cost to taxpayers, of \$45 million dollars (Joyce 2006)

The difficulties of the new ACU indicate not only material and design failures but are suggestive of more fundamental strategic and operational miscalculations

— a new "camouflaged cloak" has not proven to protect soldiers against Iraqi insurgent tactics. To this end, U.S. Military branches are not only redesigning the material uniform of the U.S. soldier, they have invested substantially in the last decade in nanotechnology and metamaterial sciences that prophesy soldiers may "disappear" on 21st century battlefields. The practical implementation of these technologies is yet years away, but the Army has simultaneously pursued multiple R&D projects to enable soldiers to transform how the bounds of their own material bodies function — to "wear" technology that radically augments their visual, communication, surveillance, and combat possibilities. As invisibility is only a trick of perception, if they can't really become invisible perhaps they may at least appear to.

As previously stated, the development of advanced wearable military technologies is often accompanied by a rhetoric of invisibility — institutional exposition suggests that a soldier may become "invisible" or so hyper-augmented as to no longer appear human, and thus vulnerable to the human predicaments of war. Yet this rhetoric obscures the political intent — what is at stake in the rhetoric of invisibility is the denial of visible effects: augmented technologies conceal a soldier temporarily in order to better eliminate the enemy permanently. And these technological adaptations (i.e. VR simulation training, live-feed helmet cameras, embedded wearables, invisibility suits, and globally networked surveillance techniques) are proving to have unexpected psychological and ethical consequences: there is a price for bodily augmentation — enhancing one's vision also confers the burden of witnessing and one's own invisibility does not elide the ongoing visibility of violence. As Rupert Smith asserts in *The Utility of Force*, the employment of force "has only two immediate effects: it kills people and destroys thing" (Smith 2005: 8). Virilio's suggestion in *Desert Screen: War at the Speed of Light* that as a result of advanced military technologies Desert Storm effectively did not occur beyond the television screen — a war reduced to miniature images of precision missiles guided by remote operators — is not applicable in the current Iraq war. The body count is simply too high to propose it is physically or theoretically screen-based. But military strategy has indisputably been reconfigured by new technologies and following Virilio, "one must innovate to conquer" (Virilio 2002: 91).

In *The Utility of Force,* Rupert Smith offers an unprecedented examination of military strategies that continue to inform the production of specific technologies and justify their use in diverse theaters — his work provides a critical backdrop for understanding how military institutional language and strategic inertia inform the perceived need for "advanced" technologies. And, if applied in the U.S., his analysis implies that the continuum of changes predicted to turn the U.S. Army uniform into a digitally enhanced, embodied bio "weapon" embedded within telecommunications arrays must be tempered by an assessment of the "utility of force" of the proposed 21st century digital warrior.

Smith begins by simply declaring, “War no longer exists”. This of course does not mean that there are not sustained, geopolitical conflicts that involve the engagement of both global and local military forces. It means that war, as it has been fought and is still imagined by militaries and civilians alike, no longer exists. Smith asks us to consider that the last “tank battle” (wherein two armies visibly maneuvered into strategic formation and faced off) occurred in the Sinai Desert during the 1973 Arab-Israeli War. In the chapter on modern operations he suggests that, contrary to the perceived functionality of a diverse array of weapons designed during the Cold War — including expensive air, ground, and sea combat systems — the most efficacious weapon in the last two decades has been the *machete*. He further asserts that even those military strategists who have recommended the adoption of rapid, light, and strategically mobile forces, still do so within the old milieus of war. However, industrial war, which relied on deterrence and technological innovation between superpowers — with temporary, site-specific conflicts that were seen to be resolvable with superior weaponry or political maneuvering — has been replaced in the 21st century by non-state combatant forces, geographically distributed and networked guerrilla and terrorist organizations, and individuals and geopolitical nation-states alike that operate entirely outside the “law” of international treaties and humanitarian policies. In the scenarios that Smith describes, it is not the sophistication of technology that is lacking — i.e. the lack of an advanced, biometrically networked soldier — but rather a sufficiently complex understanding of strategic action and consequences in rapidly evolving, geopolitical conflicts.

As example of this problematic, Smith argues that there is pervasive and “abiding” confusion among officials in the U.S., UK and in UN forums regarding the “*de*ployment” of force versus the “*em*ployment” of force. While this may seem a semantic quibble, for Smith it is constitutive of his broader arguments regarding the role of force in 21st century conflicts. To *deploy* force, in Smith’s framing, is to send or situate force in a conflict zone, but it does not imply that it will be used (we could say “fired”, to use a term that has become similarly antiquated in the era of suicide bombers, terrorist plane, subway, and train attacks, and military abrogation of rules on prisoner torture). In contrast, to *employ* force is to use it a manner that is not restricted to deterrence. Smith remarks that while the Commander of the 1995 UN PROFOR in Bosnia, he “spent a lot of time trying to explain to a range of senior figures…precisely this issue” (Smith: 6). The semantic distinction matters because, as Smith argues, it has constitutively informed the very real employment of violent military weaponry in scenarios where deployment (a deterrent role) would have sufficed, and conversely, has cost thousands of lives in theaters where deployment was used without the ability to employ force when it was critically needed (a combatant role). The current U.S. conflict in Afghanistan is arguably an example of the former, while Bosnia in 1995 is affirmatively an example of the latter. The title of Smith’s work arises from the impetus to understand *when* to use force, not simply *how* to effectuate it through technological development. The efficacy of applying Smith's arguments to technological development often appears absented from promotional narratives, such as that of the MIT Institute for Soldier Nanotechnologies which envisions soldiers wearing "a 21st century battlesuit that combines high-tech capabilities with light weight and comfort. Imagine a bullet-resistant jumpsuit, no thicker than ordinary spandex, that monitors health, eases injuries, communicates automatically, and reacts instantly to chemical and biological agents. It's a long-range vision for how fundamental nanoscience can make Soldiers less vulnerable to enemy and environmental threats" (MIT 2009). What silhouettes, we must ask, are "invisible" in this description of a U.S. Army uniform that will "help transform today's cotton/nylon fatigues and bulky equipment to a sleek, lightweight battle suit that provides everything from responsive armor to medical monitoring to communications – and more – in one integrated system" (MIT 2009). In addition to promotional language that, without reference to the suit's explicit function in warfare and engaged conflict, transforms a U.S. military *battle* suit into "sleek" utilitarian clothing with biomedical telecommunications — it is the dangling modifier "and more" that requires further interrogation. Herein rest the silhouetted techniques that implicitly shadow the stated applications of the reconfigured U.S. Army uniform.

III. The Digital Soldier

In the June 2007 issue of *The Atlantic Monthly*, Brian Mockenhaupt's article, "The Army We Have", examines recent shifts and historical trends in military basic training. In the article's caption he writes, "To fight today's wars with an all-volunteer force, the U.S. Army needs more quick-thinking, strong, highly disciplined soldiers. But creating warriors out the softest, least-willing populace in generations has required sweeping changes in basic training" (Mockenhaupt 2007: 86).

A U.S. infantryman himself, Mockenhaupt's states his ideological position clearly: "The further society drifts from the ideals of the Army — shared hardship, individual sacrifice for the collective good, institutionalized adherence to notions of integrity, loyalty, and duty — the more alien the world of military training becomes" (Mockenhaupt 2007: 89). His article, including interviews, personal experience and observation, military history, and critical commentary on DoD policy, works to create an image of U.S. Military basic training that is at once adapting to rapidly evolving combat and theater needs, and remains psychologically and physically unable to provide the rigorous training that is requisite for 21st century warfare. Mockenhaupt describes the difficulties and ongoing discourse for U.S. training as follows:

> Turning civilians into soldiers and teaching them to kill has always been difficult work, but the new challenges and demands have made it harder still, so the Army has made sweeping changes in the basic combat training every recruit must go

> through. […] To this end, the Army has shifted the culture of basic training away from the demeaning treatment and harsh indoctrination that have always characterized standing armies. [Yet] they'll slowly unlearn one of society's cherished mantras: Sometimes, they'll come to understand, violence is the answer. For all the evolution in military tactics, weaponry, and organizational structure, the basic aim of military training — producing strong, disciplined solders, skilled with their weapons — remains constant, and the core methods are simple. You must look like everyone else. You must act like everyone else. You must perform like everyone else. If you don't, you will be punished. Or worse, the group will suffer for your mistakes. (Mockenhaupt 2007: 90-92)

As example of the reaction to changes in basic training regimes which seek to ensure soldiers "act like everyone else" but via gentler training methods — what some view as a "softening" of military procedure — Mockenhaupt quotes an anonymous drill sergeant at Fort Knox who argues, "What are we trying to do here, produce combat-effective soldiers, or are we thanking them for joining the Army and letting them slip through the cracks because we need numbers?" (Mockenhaupt 2007: 94). One of the fundamental strategies for producing combat-effective soldiers that "look, act, and perform like everyone else" — thereby cohering group identity by eliminating individuality — has always been the uniform. As Jennifer Craik suggests in her work, *Uniforms Exposed: From Conformity to Transgression*, "In Maussian terms, the [military] uniform created a persona in individuals and a powerful collective presence. The uniform became a means of shaping actions — both physical and mental — and instilling new habits including movement and posture, developing an aesthetic sensibility, and inculcating new habits of cleanliness" (Craik 2005: 30).

In the U.S., the Army uniform functions to assimilate soldiers materially into military life, and yet provides immediate indication of rank, battle experience, and feats of valor through distinguishing insignia, patches, and slight changes in cut and style — it acts as both material cloak and political slogan. With the increased numbers of American enlisted women serving in Iraq, it has also become the "fabric" for arguments regarding women's participation in military combat. In her work on the evolving challenges for U.S. military servicewomen, Helen Benedict asserts:

> The military has a profoundly muddled approach to women's uniforms. On the one hand, women must wear the unisex combat fatigues, on the other, their dress uniforms are not pantsuits, as one might expect, but skirts to be worn with "flesh tone nylons" and jackets tailored in an exaggerated hourglass shape. Until recently, army women also had to wear a small, folded cap with their dress uniforms know as "the cunt cap" in army vernacular. They now wear the same beret as men. (Benedict 2009: 39)

More recently, however, the traditional uniform has become physically and strategically part of a defense system that moves beyond its old visual signification of disguise, defend, and defeat: it has itself become a digitally enhanced weapon. This section will examine three technologies — embedded wearables, biometric identification devices, and 3D combat enhancement systems that work to transform the uniform into a digitally integrated component of a unified global surveillance network — before attending to theoretical questions of the uniforms' physical and psychological consequences.

When the MIT Institute for Soldier Nanotechnologies (ISN) was founded in 2002, initiated by a $50 million dollar contract from the U.S. Army Research Office as well as private industry donations (e.g. DuPont, Raytheon, and Partners Healthcare), U.S. Army chief scientist Michael Andrews declared to the media that, "The idea is to develop high-tech gear that would allow soldiers to become partially invisible, leap over walls, and treat their own wounds on the battlefield" (Register 2003). The language of the press conference introducing the new collaborative project between MIT and the U.S. Army read much like a trailer for a big-budget, sci-fi film, emphasizing such innovations as an optically invisible suit, "live" sensory fabric that would respond to bullet impact, and self-tourniquetting clothing. Andrews stated that, "Instead of bulky bullet-proof vests made of Kevlar, scientists envision uniforms lined with a slurry of fluids that respond to invisible magnetic fields, creating an armor system that can go from flexible to stiff during combat" (Register 2003). Of note, MIT president Charles M. Vest claimed that he didn't wish for the center to "get tangled up in classified research", thus all technologies were to be made available for industrial as well as military applications. One of the center's proposed directors, Professor Edwin L. Thomas, also confirmed that the institute was to be "run on a business model, with regular milestone reviews" (Business Week 2003).

Today, the institutional tagline of the ISN is "Enhancing Soldier Survivability" and ISN suggests that, "because nanotechnology operates at length scales where classical Newtonian physics breaks down, it offers engineers the potential for creating unprecedented new materials properties and devices" (MIT ISN 2009). Military camouflage has always, of course, relied on the precarious claims of disappearance — temporarily disappearing oneself to better permanently disappear another — and collusion between university, private industry, and government agencies is certainly not new. Yet what is "innovative" in recent private, corporate, and university partnerships is the semantic and ideological turn the discourse has taken: invisible (or invisibilizing) technologies, many designed ultimately to evaporate rather than evade the enemy, now openly masquerade as unclassified research (compare for example, the historic secrecy of the development of the U.S. atomic bomb versus the business model slogans of 21st century academic institutes with military contracts). What is now affected — marketed even — is what Deleuze describes as "the introduction of the "corporation" at all levels of schooling" (Deleuze 1992: 7). What remains silhouetted, however, is the visible destruction of "invisible" technologies in this discourse — as if an "invisibility suit" might also disappear the reason for, and consequences of, the development of these suits for war. The rhetoric never hints at the establishment of technologies for peace; rather, a systems engineer at the U.S. Army's Soldier Systems Center in

Natick, Mass, Jean-Louis DeGay asks us to imagine that, "With a uniform like Predator's, our soldiers would really have a lopsided advantage. […] Science fiction is rapidly becoming reality — and that could change forever the way wars are fought" (Business Week 2003).

Increasingly, the U.S. Military uniform is being reconfigured not as a garment, but as a scientifically sophisticated, digitally augmented weapon in its own right. *Embedded wearables* refer to digital systems that are physically integrated into the soldier's uniform, transforming the material, helmet, mask, etc., and are generally embedded as part of a larger military technological system (e.g. military GPS surveillance). For example, camouflage fatigues will, if projected developments from research institutions such as MIT, the NASA Jet Propulsion Laboratory, and the University of Tokyo, continue as planned, soon be replaced by virtual and/or metamaterial forms of optical camouflage. *Metamaterial* generally denotes the recombination of extant elements to form a uniquely composite element with variant properties. For example, U.S.-British researchers in October 2006 developed a metamaterial that made a small object invisible to microwave radiation, foreshadowing the potential for objects to be rendered invisible to light, which occupies a different electromagnetic wavelength.

A crude version of an invisibility suit was proposed by science fiction writer Douglas Adams in *Life, the Universe and Everything* — which he christens the "Somebody Else's Problem Field". Adams suggests that since humans psychologically tend to ignore unexpected or unpleasant objects they cannot, or do not, wish to explain — literally rendering them invisible and "somebody else's problem" — it is feasible to build a shielding device which simply cloaks the desired object in a strange, unexpected "field": he proposes cloaking objects in large Italian running shoes, or painting them pink. Yet recent developments in military camouflage often appear even stranger than fiction. Technologies of digital optical camouflage are being developed to transform soldiers into mobile, 3D screens wherein the environment behind the soldier is video-captured by a backward-facing camera and then projected onto flexible, screen-like fabric of a soldier's uniform. In a description of this particular iteration of the so-called "invisibility suit", technology writer William McCarthy states, "Rather than one video camera, we'll need at least six stereoscopic pairs (facing forward, backward, right, left, upward, and downward) - enough to capture the surroundings in all directions. The cameras will transmit images to a dense array of display elements, each capable of aiming thousands of light beams on their own individual trajectories. And what imagery will these elements project? A virtual scene derived from the cameras' views, making it possible to synthesize various perspectives" (McCarthy 2007).

Phased array optics develop this schematic further, creating a 3D hologram image of the surrounding environment to be mapped onto the soldier. While natural parallax causes the accuracy of 2D projections to change based on viewing angle (to the human eye distance and orientation to an object transform the “reality” of its visual properties), 3D holographic projection has the potential for what scientists call a high index of true invisibility. Though real, like *Ammon-Ra* the soldiers will seem to have disappeared with only projected simulacra of themselves standing in their place.

The invisibility suits are part of a larger military project to create the “Future Warrior”. Uniform augmentation has also included a series of helmet-mounted displays equipped with digital maps, miniature enhanced laser scopes, and hands-free, screen-based instrument, maintenance, and training plans. While these digital helmets literally hook soldiers into a larger global grid of military defense information (real-time enemy location, injured vehicles, command communication, etc.) they also proscribe certain kinds of physical movement. For example, the Nomad Helmet-Mounted displays made by Microvision, which are a primary military contractor, allow Stryker soldiers to monitor both the physical horizon, outside of the vehicle, and the situational data (enemy positions, updated digital maps, etc.) projected on the interior of their helmet screens at once. However, because some of this situational data (monitored on Force Battle Command Brigade and Below, or FBCB2, computers) has historically been displayed on screens mounted inside vehicles, soldiers have to physically navigate both information systems at once. In his article, “’Tech Success: ‘Heads Up’ takes on a fresh meaning for Army”, Brad Grimes suggests, “If you want to know what it’s like to be a commander in a brigade of Army Stryker armored vehicles, do 70 knee bends. It’s not that commanders are exercise nuts…Rather, it’s that cutting-edge technology sometimes leads to unintended consequences” (Grimes 2004).

Not only do helmet-mounted systems potentially choreograph one’s physicality, they are allowing soldiers to record, reconstruct, and sometimes distribute combat reality in significant ways. In addition to receiving video and data streams, digital helmets are also being equipped with miniature video recorders that allow them to produce documentation and archival data with unprecedented results. Helmet-mounted “lipstick cameras” not only track soldiers’ eye movements, allowing them guided target precision, they also track the day-to-day events of combat. Video from helmet-mounted displays is increasingly being examined to strategize for future attacks and plan missions as well as provide visual accounting for legal purposes (this is of increasing importance in the current Iraq war); however, it is also being covertly posted or distributed to friends and family members as video memorials and documentation of tragedy and transgression. In an article published in *Military Embedded Systems* the CEO of VioTac, David Ollila, describes the feed of a helmet-mounted video capture system, “The footage is raw, intense. Soldiers duck to avoid oncoming shots, weave through their surroundings, and aim their weapons with deadly accuracy. The screen is ablaze with the sights of war, the echoes of gunfire and the barked orders of a Marine unit providing an eerie soundtrack to the action onscreen” (Ollila 2007).

A third application of helmet-mount technology is being developed for the military's mobile medical corps. In 2002, Microvision was also awarded a 3.3 million dollar contract from the Telemedicine and Advanced Technology Research Center (TATRC), a division of the U.S. Army's Medical Research and Material Command (USAMRMC), for designing a digital medical helmet that would monitor vital signs, provide ultrasound readings, and download patient data on a mounted 17-inch display screen. Rick Rutkowski, CEO of Microvision outlines the vision for the company's industrial application of Nomad to the military's INFOMEDIC program, "The INFOMEDIC concept represents the future of battlefield medicine, and indeed the future of personal information display. We are excited about the opportunity to demonstrate the advantages that our display technology can bring to this critical aspect of military operations" (Rutowski qtd. in Virtual Medical Worlds 2002).

Wearable medical technologies present unusual corporeal challenges in the field because they are often operated by medics who must perform surgery or attend to wounds under dangerous circumstances, while also navigating a technological interface. Medical sonography has received particular attention through the Air Force's diagnostic program (AFDMS), and preliminary research indicates that while embedded wearables offer sophisticated potential, they are yet hindered by basic operational difficulties. For example, medical sonographers generally operate the ultrasound transducer with their right hand, while navigating the keyboard and projected screen image with their left. However, the wearable sonography system was equipped with a keyboard mounted on the left forearm, which meant medics could not use the ultrasound transducer and type simultaneously. In development at the Worchester Polytechnic Institute is a voice activated keyboard and mouse to eliminate this difficulty (Vance 2007).

Mobile medic technology is being developed in tandem with wearable biometric systems that shift the role of the uniform from that of a digital soldier or doctor, to that of a digital police officer. Biometric surveillance has been highly controversial in the U.S. as part of a larger political and juridical discourse on immigration, privacy rights, and national security. Within the U.S. military, biometric scanning systems are rapidly transforming the capacity of officers to more efficaciously provide security, identification records, and track their own personnel, enemy combatants, and even detainees and casualties. Biometric systems converge with the previously discussed technologies: long-range retinal scanning devices are being covertly embedded into invisibility suits, mounted onto head displays, and integrated into the 3D training and combat enhancement systems). The new GRIDS (Global Rapid Identification System) "Jump Kit", designed jointly by Cross Match Technologies Inc. (a global biometric solutions firm) and Quantum 3D (architects of 3D military training systems) is described as, "For Use in War Theaters and Other Extreme Environments". The companies' joint press release states:

> GRIDS has been designed to be worn in combat zones, border operations, or by any individual operating in a harsh environment. The human wearable kit contains the THERMITE [2D/3D computer from Quantum 3D] with Cross match software, a Cross Match MV5X hand-held forensic quality fingerprint scanner, an iris camera, a digital camera, and GPS software to capture the latitude and longitude of the place at which each individual is being enrolled. […] Cross Match's earlier versions of the multi-biometric GRIDS Jump Kit are currently in use…for the enrollment and identification of military and governmental personnel, police, security forces, detainees, and casualties. (Cross Match 2005)

Biometric surveillance presents multiple ethical and legal complexities, outside the scope of this paper to discuss; however, it provides an important corollary to the rhetoric of invisibility already mentioned. Within the evolving discourse of military technologies one finds advanced bio-surveillance and documentation procedures — designed to make humans' biological, geo-political, and historical information increasingly "visible" — yet this occurs vis-à-vis technologies that increasingly employ distinctly "invisible" methods of monitoring.

The final technology to mention is a variation of 3D training and combat enhancement systems, currently produced by Quantum 3D; however, it segues into the final concern regarding the psychological (as well as physical, ethical, and political) consequences of the newly reconfigured digital soldier. Quantum 3D's mission is to bring "the recent state-of-the-art real-time 3-D graphics into the embedded environment" (Cross Match 2005). While developments in virtual training have been theorized for a number of years[5], virtual training has recently begun to be activated not only in the U.S, but also in the field. That is, while real combat is occurring, virtual embedded training is simultaneously being enacted. This scenario presents a disquieting variation to Baudrillard's now canonical description of simulation and simulacra — not only does the copy arrive in the absence of the original, it also occurs in the presence of the original. Thus, solider, simulation, and simulacra all operate coextensively.

Soldiers not only need to adapt physically to these new devices, the requirement to navigate multiple (virtual) data streams has discernable psychological effects. In a multi-disciplinary essay examining the physical, cognitive and social dimensions of wearable technology for the user, the authors suggest that, "Just as a wearable device can influence the physical configuration of the user, the ubiquitous nature of a wearable application can likewise magnify the effects of the technology on the cognitive processes of the user. […] Wearable devices offer the ability to interface more intimately with our existing cognitive processes" (Dunne et al. 2005: 7). However, "intimacy" also portends the complex psychological consequences for the soldier catalyzed by wearable technologies, particularly when those devices allow the soldier to experience and document graphic violence simultaneously, increase the resolution of a 3D interface with such accuracy that reality and representation may no longer be discernable, and effectively situate the soldier not only within the military's organizational structure, but within a global network of image production, scientific development, and warfare communiqué. The soldier is no longer the operator of a weapon but an embodied operand — one in the political and phenomenological process of becoming a body of sophisticated weaponry as well as a body in uniform.

The transition from military training to the metaphysical consequences of digital defense is necessarily an embodied journey. Even if the soldier has been uniquely refitted and reconfigured, the U.S. Military is not yet a phalanx of armed robots and, as such, even the most sophisticated digital soldier is yet vulnerable to basic physiological processes — like breathing. In his essay, "Breathing like a solder: culture incarnate", sociologist Brian Lande argues that, "Cultural patterning in the army is not an abstract intellectual process, but takes place at the level of the body as it engages in practical activity in the training environment, and becomes adapted to the military milieu" (Lande 2007: 95). His fieldwork in ROTC officer training camps is specifically focused on the way in which breathing — its patterning, habituation, control, and uniformity — provides philosophical indoctrination through strict physiological regimes. "Breathing like a soldier" he suggests, contributes fundamentally to a military *habitus* (following Bordieu) and military *techniques* (following Foucault) that place the body at the locus of social and symbolic divisions of military life. Recuperating the body, amidst many sociological studies that have focused on military cultures as sites of value production, ritualization, or identity production, Lande's thesis is that "Embodiment is thus a crucial but missing theme from sociological accounts of military life. In short, breathing is far from being a taken-for-granted physical activity. It is the social sinew that holds together social institutions by anchoring norms and beliefs in viscera" (Lande 2007: 97). Lande importantly links this physiological training to more precise techniques of psychological and philosophical control. As example, military marksmanship traditionally requires attention to four motions: breath control, trigger, position, and aim. Yet Lande traces the way in which these corporeal details are codified within military practices not only as gestures, but as coordinated movements that ensure soldiers embody norms and expectations of military culture as well as exercises of military corporeality. These seemingly simple physical events are important to examine amidst theoretical, industrial, and mediatic discourses that often privilege invisibility suits over inhalation, and virtual reality over the simple failure of Velcro.

IV. The Networked Soldier

This essay concludes with a brief glimpse into the technical and theoretical consequences of linking the U.S. ground soldier into larger, globally networked systems of information flow. It is impossible to discuss the possibility of a digital soldier without examining the global relay systems and geopolitical space through which telecommunication transmissions occur, as well as the consequences for the physically and politically embedded digital soldier.

In *Desert Screen: War at the Speed of Light* Virilio suggests, “Henceforth, the instantaneous speed of the transmission of data, as well as the extreme precision of the guidance and navigation of projectiles, will surpass the destructive power of conventional or non-conventional arms” (Virilio 2002: 79). Virilio continues to argue in the chapter entitled “June 1991: Desert Screen” that Operation Desert Storm represents an electromagnetic war, terminating at 2D television screens, rather than an environmental war waged on *terra firma*. He writes, “Thus, the military environment is no longer so much a *geophysical* one of the real space of battles…as a *microphysical* one of the real-time electromagnetic environment of real-time engagement” (Virilio 2002: 77). Virilio’s predictions of the control provided by the “efficaciousness of aerial power” (e.g. technologies of surveillance, satellites, and GPS) and the manner in which they “will come progressively to prevail over those of mass destruction: more precisely, those of land forces” (Virilio 2002: 81) has proven to be rather unique to the 1991 Gulf War. It does not apply to many facets of the United States’ prolonged, distinctly urban land warfare in Iraq. Virilio’s emphasis on the U.S. “satellite panoply” (Virilio 2002: 81) and commanders’ ability to follow the instantaneous speed of information in “real time” (84) at times overlooks the persistent “grounded” materiality and many errors of networked satellite technologies. Electromagnetic transmissions require space, physical conduits, and receivers to move through, and the force (institutional origins), energy (strategic operations) and power (terminal consequences) cannot be reduced to Virilio’s standard dromological equation of speed and collapsed time, physically or philosophically — his suggestion that, “It is easy to see that with this conflict in “real time”, we can no longer legitimately speak of a battlefield or of a “localized” war” (Virilio 2002: 84). Though it is theoretically engaging, based on the nature of electromagnetic transmissions, if not the continually violent, embodied effects of urban land warfare in Iraq in 2010, it is difficult to apply to the current conflict which has remained a distinctly *local* and *land-based* theater of war despite the ubiquity and posterity of electronic satellite images and communication. Virilio’s prediction here creates its own silhouette that absences the resolutely visible effects of the current Iraq War; following Smith, it also reduces the critical analytic and strategic distinctions that exist in different theaters of war, though they may be collapsed in the interest of ideology (for states) or theory (for scholars).

However, Virilio does astutely point out that in the 1991 Gulf War "*stealth [furtivité] of the material tends to supplant that of the speed [rapidité] of the weaponry"* (Virilio 2002: 78). Indeed, for the U.S. it is the possibility of concealment and disappearance, rather than simply speed, that is anticipated for the 21st century digital soldier networked into global communication arrays. Here, Virilio's argument finds stark continuity a decade later, "To no longer *lose sight* of the enemy is thus to *gain* the upper hand, or indeed even to win the conflict, this war in which disappearance from sight tends to prevail over the power of conventional or non-conventional explosives" (Virilio 2002: 78).

Operationally, soldiers move within very specific physical environs with unique spatial architectures, historically designated as "Theaters of War" since the turn of the 20th century. In military operations a theater is used to describe the site or geographic area in which strategic actions are coordinated by military personnel. The term is widely and diversely deployed; though it is often attributed to Carl Von Clausewitz in his canonical work, *On War*. The term gained wide recognition during WWII when it was used to broadly designate critical land and sea territories (e.g. the Mediterranean Theater of Operations, Pacific Theater of Operations, and European Theater of Operations) and the accompanying administrative activities needed to sustain operations in each.

In a common U.S. Military diagram from 1940[6] the war theater of operations is drawn almost identically to that of a proscenium space. The front line demarcates the invisible "fourth wall", separating the actors (waiting combat divisions) from the "stage" where war is actually occurring. As in a physical theater, the further back one is from the stage — in the drawing these sections are penned just as they would be on a seating chart and marked advance section, intermediate section, and base section — the further removed one is from actual battle. However, the physical conceptualization of a theater of war has changed radically, adjusting to the reconfigured geopolitical, spatial and technological realities of 21st century warfare. In a 2000 RAND publication on commercial satellite applications for the U.S. DoD, the authors describe the evolving geographic and equipment needs in modern theater operations:

> To construct a theater network, the theater commander must determine the people, vehicles, systems, and headquarters on the network, and their individual communications needs. […] The distinction between "within theater" and "outside of theater" may become increasingly arbitrary. The use of long-range forces from distant bases and "reachback" support tends to blur the theater boundary. The CRD defines notional major theater war (MTW) and small-scale contingency (SSC) boundaries as "2000 by 3500 km" and "1000 by 1000 km", respectively. (Bonds et al.: 2000)

As the geographic boundaries and combat communications of the theater have changed — particularly in Iraq where the combat "front" is frequently acknowledged to be everywhere and nowhere at once — so too have the consequences for soldiers who are increasingly networked into global telecommunication systems. Yet it is suspect to conclude that Internet, GPS, and satellite transmissions, all frequently described as "invisible" technologies because their transfer of data is imperceptible to the human eye at some point in transmission, can be theorized without greater attention to the complexity of their corporeal effects. As argued throughout, their role in drawing geopolitical borders and material cartographies, as well as their embodied consequences, can and should be critically traced. In the current U.S. conflict, they work to transfigure bodily identity, mobility, and performance for U.S. ground soldiers, and present discrete and significant differences in their use and application. For example, the apparatus of satellite technologies have become technically embedded — materially and metaphysically — in military uniform design, strategic operations, and combat warfare, and though they suggest a newly imagined ontology of the body, they also present very real consequences for specific bodies — soldiers, citizens, and their "enemies" — in real and virtual theaters.

The metaphor of a real net will serve us, momentarily, in tracing the relationship between visible and invisible networked technologies and the conceptual lines of thought that inform them. As Latour aptly observes, "Technological networks are nets thrown over spaces, and they retain only a few scattered elements of those spaces. They are connected lines, not surfaces. They are by no means comprehensive, global or systematic, even though they embrace surfaces without covering them, and extend a very long way" (Latour 1993: 118). The nets drawn by current technologies extend in every spatial direction — policing nations and territories with surveillance technologies, sonically patrolling underwater boundaries, surveying atmospheric borders by satellite — and they are continually being redrawn. This is both a phenomenological and practical reality: for example, GPS satellites use atomic clocks to calculate time based on the oscillation of an atom. Depending on your location, national borders, geo-political armaments, and military clearance, targets can thus be redrawn by the trilateration[7] of invisible radio waves with millisecond accuracy. In standard[8] GPS, each of approximately 24-30 satellites[9] broadcasts a unique "pseudo-random" code that is then compared to that of multiple base receivers to ascertain the signals' travel time. The system does not, however, provide seamless, synchronous readings — that is, it is not a continuous line. GPS communication is plagued by ephemeris errors — inaccuracies caused by gravitational pull as well as by the pressure of solar radiation. And like any wave traveling through space, GPS signals encounter many other unexpected detours: slowed speed from changes in the ionosphere and troposphere; multi-path errors ("ghost" reflections of the original signal); receiver noise; and clock errors. In standard GPS these speed bumps may cause up to 5 meters of inaccuracy.

The metaphor of a net cast wide becomes insufficient when examining many network technologies — not only are the "lines" invisible, they are also perforated and asynchronously interrupted: if it is a net, it has many tears. Ephemeris data, for example, is only updated hourly at some receiving stations. And prior to May

1, 2000, the U.S. Department of Defense intentionally introduced errors, known as SA's (Selective Availability) into the system, including inaccurate clock (and therefore location/distance) settings. As with physical, unmonitored gaps along geo-territorial borders, the inaccuracy of GPS signals literally draws discontinuous, interrupted mappings and creates blurred, "dark" spaces. Because satellites of any kind must obviously orbit to stay aloft, they are often only capable of gathering data from a specific location for fifteen to twenty minutes, and then sometimes only every few days. Thus, the emergent cartography is composed of many dotted lines (torn netting), and reflects not only the vulnerability of physically contested borders, but the discriminate power of invisible mappings: simply stated, control and surveillance of permeable, invisible borders is as important as that of visible ones. It is not a surprise that the catalysts for early cartographies were generally the result of ecclesiastic or sovereign concerns: maps are power — they provide sightlines for attaining geo-political domination.

The ownership of invisible mapping technologies and the spaces they inscribe has thus been aggressively contested in the last decade, shifting political alliances traditionally found on land into the air. Standard GPS was initiated by the U.S. Department of Defense in the early 1970s, launched in 1978, and was operational for civilian use by 1995. In response, the Russian military launched the first satellite of GLONASS; their satellite constellation reached its zenith in 1994 with 24 satellites, experienced a rapid decline post-Cold War era (as of September 2005 only 13 satellites were functional), and is now being revived by the Russian Aerospace Agency (24 satellites are again projected for 2011). Reflecting European concerns with U.S. governmental and corporate ownership of GPS constellation systems, Europe in turn launched Galileo in 2005, a global navigation satellite system (GNSS) designed explicitly as a civilian (i.e. commercial) system with enhanced error detection, navigational precision, and security protocols.

However, prior to the 2004 EU Summit the U.S. blocked Galileo implementation. Concerned that the system's Public Regulated Service (PRS) signal — encrypted for European military use and homeland(s) security — would interfere with the GPS M-2 military signal, the U.S. unilaterally refused to discuss other interoperability issues until the PRS-M code conflict was agreed upon. In 2002 Gilles Gantelet, an EU public relations representative for Galileo, declared that as a result of U.S. pressure, "Galileo is almost dead".[10] The EU conceded in 2004 to most U.S. demands and the projected date of activation is currently 2014. In particular, the U.S. military and NATO potentially retained the ability to jam select Galileo signals in the event of international conflict (the U.S. military is currently able to shut down GPS access in the event of a national security crisis). The U.S. insisted on maintaining control of invisible technologies in the event they would need them for destroying more visible targets.

While GPS technologies have invaded atmospheric space under the deliberate guise of surveying activities on land — to watch the target rather than the trajectory — the lines are increasingly as important as their terrestrial mappings. GNSS systems clearly represent the use of invisible technologies to target visible bodies and borders, but the system itself carves nationalist grids in atmospheric space. U.S. GPS satellites maintain orbital rotations on six planes, 60 degrees apart, with at least four satellites inclined at approximately 55 degrees in relation to the equator, and orbit at an altitude of 20,200km.[11] In contrast, 30 Galileo satellites (27 operational and 3 additional crafts) will operate at an altitude (the line) of 23,222 km, with an orbital inclination of 56 degrees[12]. Both satellite systems "share" the L1 band frequencies, transmitting at 1575.42 MHz, though the U.S. system also utilizes L2 frequency at 1227.60 MHz and has an L3 frequency used to monitor nuclear detonations. While resolution for the modernized civilian GPS system may be less than one meter, Galileo's technical specifications offer real time resolution capabilities, under advantageous conditions, of less than ten centimeters. While the EU occupies the atmospheric border at 23,222km at an inclination angle of 56 degrees, the U.S. patrols 20,200km at 55 degrees and Russia's GLNOSS system orbits at 19,100km at 64.8 degrees. India's Airports Authority and the Indian Space Research Organization (ISRO) have implemented their own independent satellite system. If it becomes fully operational, Indian satellites positioned in the Indian Ocean region between the orbital arc 48 degrees east to 100 degrees east longitude will provide coverage from the coast of East Africa to Australia. India has been hesitant to partner with EU's Galileo (in part due to security issues and China's substantial financial backing of $241 million dollars) preferring to maintain their political relationship with officials of Russia's GLONASS system (Deshpande 2006).

Far from uniformly eliminating spatial borders, as proponents of media and cyber globalization tend to prophesy, invisible technologies simultaneously re-inscribe them. It is true, as the editors of *Media and Globalization: Why the State Matters* suggest in their introduction that, "Although states have been endowed with the task of cordoning off communicative spaces, the control of these intangible borders is seen as a Sisyphean task in the face of media globalization" (Morris et al. 2001: viii). Yet the "intangible" borders the authors invoke can often be traced quite directly from their origin to their target (i.e. GPS surveillance satellite to Iraqi military target), and their apparent intangibility is an illusion — *technologies that operate under a rhetoric of invisibility carve out very real geo-spatial-political domains with the shifting, asynchronous permeability of their terrestrial counterparts.* Attending to the *silhouettes* of GPS, satellite, and telecommunication technologies is important to trace their consequences for global citizens and communities. In addition, the persistent trend to emphasize theoretical possibility — a networked, U.S. phalanx of robotically and bio-technically enhanced digital armies — over the day-to-day realities of technological performance advances scientific teleology and obscures political intentionality. And much like the failures of petite squares of Velcro, there have been many pedestrian obstacles for

GPS and satellite operations for U.S. ground soldiers. In his essay, "The Military Takes Stock in Iraq", Richard A. Muller, a Jason consultant for U.S. national security writes:

> The city environment also neutralizes much of our high tech advantage. GPS doesn't work indoors, and often fails outdoors in narrow alleys. Our high tech communications also have problems. Some of our radios use frequency hopping (rapid changes in frequency) to avoid detection and location, but they work only when there is good propagation at all frequencies, a condition often not met in cities. So after a few weeks urban fighting, some soldiers (and officers) had their families send them citizen band walkie-talkies from Radio Shack. When you are under fire, it may be more important to be able to call for help immediately rather than maintain covert communications. This experience is reminiscent of Gulf War I, when families sent soldiers cheap GPS receivers. (Muller 2004)

The threats to state sovereignty and individual autonomy from multinational telecommunications and global market economies are by now well tread, though certainly not resolved, arguments. But, following McLuhan, the emphasis is often on the sender, receiver, and the type of media, *not on who owns the medium it travels through*. The overt juridical and political emphasis has been on the *origin* of media technologies (e.g. state control by the U.S.) and the *positional identity* of the receiver (e.g. consumer audiences, military targets, and corporate clients), while the seemingly invisible lines *in space* that facilitate these networks have received less attention. Like the equation for electricity, which states that the current (line of electrons) is equal to the voltage (or "force" of electrons) divided by the resistance, the current of invisible technologies is imagined to be equal to the force of governmental and corporate power divided by various resistive strategies (of local municipalities, guerrilla militias, NGO's, consumer groups, etc.). But this equation ignores *control of the space* through which the current of invisible technologies passes. It has been theorized that media technologies bypass governmental autocrats thereby creating "technologies of freedom" or information democracies (Pool 1983), or conversely, bypass local community interests thereby creating hegemonic, flattening systems of generic globalization. Yet both paradigms may overlook the potential power of the space though which invisible technologies move (atmospheric, oceanic, ionic, etc.). Technologies of globalization may elide facets of state control, but they also offer complex (and potentially violent) opportunities to redraw the borders in atmospheric, oceanic, and satellite space. Various countries have attempted to "cut" these lines of invisible transmission — Iran banned satellite transmissions and Saudi Arabia banned satellite dishes in 1994, China blocked satellite broadcasts of the BBC news in 1993, and the U.S. attempted to purchase exclusive rights to Middle East airspace surveillance for Ikonos-2 — and these strategies all affirm what will become an increasingly complex "space" war of atmospheric territoriality and nationalism.

As suggested at the outset, a general theory of silhouetting suggests it is possible to deliberately map seemingly invisible technologies that target bodies, territories, and spatial borders, creating a visible cartographic project that charts the technologies' strategic production and consequences. While this essay has focused on 21st century wearable technologies such as the U.S. Army uniform, the cartographic project becomes increasingly complex as U.S. soldiers are required to "defend" not only terrestrial topographies, but become networked across cyber and atmospheric geographies. Territoriality, borders, and national state-formation inherently rely on linear demarcations — an invisible or literal line drawn in sand or space. And yet the hypostatization of geopolitical demarcations — our failure as citizens to distinguish between the rhetoric of invisibility and the sociopolitical realities it obscures — may impair our ability to critically transform seemingly invisible techniques and technologies into more visible and culturally productive analyses of the silhouettes of war.

Jessica J. Behm is the director of CITYatwork, an organization for technology and science education in New York City. She was on faculty at New York University from 2001-2005 and holds a Masters from NYU's Interactive Technology Program. She currently works as an interactive engineer and her research includes new media, meta-information technologies, and the development of corporeal U.S. Military technologies. E-mail: jessica@cityatwork.org

Notes

1 Complete Minutes of the Conference in the Reich Chancellery, Berlin, Germany, November 5, 1937, Held From 4:15 to 8:30 p.m. Written by Colonel Friedrich Hossbach on November 10, 1937.
2 Official U.S. Congressional policy has only formally declared war in five instances. Operation Iraqi Freedom was sanctioned as an extended military engagement by the U.S. Congress and is, like Operation Enduring Freedom in Afghanistan, not an officially declared U.S. war though it is often referred to as such in U.S. popular culture and media.
3 The term U.S. Military will be used throughout to refer generally to U.S. Armed Forces. It stands in for discrete service branches, including the U.S. Army, U.S. Marine Corps, U.S. Air Force, U.S. Navy, U.S. Coast Guard, and corollary Reserve/Guard branches. Each service branch has differentiated institutional cultures, historiographies of technological use, strategic philosophies, funding revenues, operational mandates, and corporate and academic partners that cannot, however, be collapsed.
4 This discussion pertains to technologies that are widely available to the U.S. public, if infrequently read in military and industry journals.
5 See Der Derian 2001, Virtuous War.
6 http://history.amedd.army.mil/booksdocs/wwii/orgadmin/chart12.gif
7 The term triangulation is often used to describe GPS satellite calculations; however, technically it is better termed trilateration (and it generally uses not three, but four satellites).
8 There are a number of GPS protocols and relay systems, including Differential GPS, which has more precise error-correcting capacities.
9 The US Navy-Tycho maintains current constellation configurations of satellites on their website; numbers vary as satellites are replaced. ftp://tycho.usno.navy.mil/pub/gps/gpstd.txt
10 http://www.wired.com/politics/law/news/2002/01/49778

11 http://msl.jpl.nasa.gov/Programs/gps.html
12 http://cs.astrium.eads.net/sp/SpacecraftPropulsion/Showcase/Galileo_ESA.html

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