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# Nanowarriors: Military Nanotechnology and Comic Books

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In February 2002, the Massachusetts Institute of Technology submitted a proposal to the U.S. Army for a new research center devoted to developing military equipment enhanced with nanotechnology. The Army Research Office had issued broad agency solicitations for such a center in October 2001, and they enthusiastically selected MIT's proposal from among several candidates, awarding them $50 million to kick start what became dubbed the MIT Institute for Soldier Nanotechnologies (ISN). MIT's proposal outlined areas of nanoscience, polymer chemistry, and molecular engineering that could provide fruitful military applications in the near term, as well as more speculative applications in the future. It also featured the striking image of a mechanically armored woman warrior, standing amidst the monuments of some futuristic cityscape, packing two enormous guns and other assault devices (Figure 1). This image proved appealing enough beyond the proposal to grace the ISN's earliest websites, and it also accompanied several publicity announcements for the institute's inauguration.

*Figure 1: ISN Soldier of the Future. 2002. Reproduced with permission.*

As this image disseminated, it wasn't long before several comic book fans recognized similarities to the comic book *Radix,* created by the fraternal team of Ray and Ben Lai (Figure 2). The ISN illustration appeared to be a composite of *Radix*'s fictional heroine, Valerie Fiores, striking her cover pose from *Radix #1* (2001), wearing a helmet featured in many issues of this series and superimposed on a cityscape seemingly translated from elsewhere in the same book (Lai and Lai). The ISN illustration had reassembled these fragments from *Radix* while adding novel flourishes of coloration, background detail, and overlay material. News of this ISN illustration quickly reached Ray and Ben Lai, who threatened lawsuits, stating that MIT had dislocated the futuristic soldier from its real origin in a comic book to the market of nanotechnology research and military investors: "They're selling this as science fact while we're trying to sell it as science fiction . . . And people don't even know that we created it in the first place. People might even think we're copying them" (Ray Lai qtd. in Shachtman).

The altered image even implies that soldier nanotechnologies are stepping between fictional and real worlds, for the warrior emerges forth from a more transparent area in the background towards a place of more opaque robustness, as if materializing from an ephemeral comic book directly into the battlefields of real science. Or perhaps it's the other way around. Actually, the direction of travel between fiction and reality is not at all clearly indicated by the ISN drawing. But this is no fault of representation, for the image's social context animates such ambiguity. Indeed, the history of nanoscience has depended upon careful navigation of the fault line between

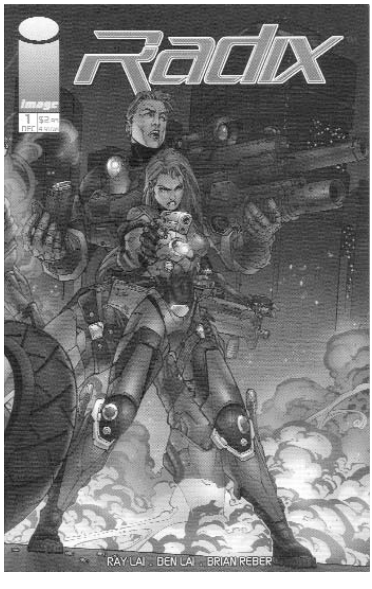


*Figure 2: Radix #1, by Ray Lai and Ben Lai. ©2001. Courtesy of Ray Lai.*

novelty and banality, radical visions and technical immediacy, science fiction and science (Milburn, "Nanotechnology"; Hayles; Hessenbruch; Schummer; McCray). Allegorizing this fault line, the ISN drawing effectively serves as a conceptual bridge between the actual and the possible within the arena of nanotechnology (López).

Lawyers for MIT responded that ISN's sampling from the Lais' image fell under legal standards of "fair use" for academic and educational purposes. Moreover, the misappropriation had not hurt sales of *Radix;* if anything, the resulting scandal only brought new attention to the comic book. The Lais might claim that MIT's representation of their "fantasy" world as "reality" would malign their status as creators of fictions—a grievance noted by the Lais' lawyers in a "cease-and-desist letter" sent to MIT—but recontextualizing "science fiction" as "science fact," according to MIT's legal team, is fully permitted by copyright sanctions for scientific research (Holden; Shachtman). Nevertheless, the ISN illustration was quickly removed from all MIT websites and publications, and on August 30, 2002, Edwin Thomas, the director of ISN, issued a public apology to the Lais through the MIT News Office:

> I am writing to apologize publicly to you both [Ray and Ben Lai]. . . . [I]f I had known it was your work, I would not have used it. MIT strongly supports the rights of creators and greatly regrets using the image without permission or credit. I am very sorry that this occurred; it won't happen again.
>
> Here is what happened. As my team and I were putting the finishing touches on the proposal, we decided to include a drawing of what the soldier of the future might look like. It was a last minute decision, and I asked my daughter, a graphic artist, to provide an image. We put the image into our proposal to the Army in late February. In March, the Army made its announcement and MIT included the image in its news release.
>
> I didn't know until after your attorney contacted MIT at the end of April that the image apparently was based on your character. As soon as we heard about that, I had it removed from the ISN web pages, notified all of those involved not to use the image for any purpose, and MIT also ordered the image removed from all MIT web sites. (Thomas)

The ISN used the image without knowledge of its science-fictional origin. MIT spokesman Ken Campbell said, "It was an innocent use . . . We didn't know it was from anyone else's artwork" (qtd. in Frost). Elsewhere, Thomas had asserted that his daughter's interpretive drawing was simply an effort to transform his words into graphics, without any apparent intent to plagiarize: "She did it [the drawing] in a couple of days, and was just trying to illustrate what I had been describing to her" (Kary).

So here the issue has been laid to rest, with the Lais claiming ownership and origin of the image—authorship, that is, of "science fiction"—and Thomas claiming ownership and origin of the technical "description"—

authorship, that is, of "science." The picture and the writing are rendered absolutely separate, the one becoming just a convenient "illustration" of the other. Moreover, we are reassured that the science stands completely on its own, for the written elements of the proposal comprise its real "merits" and its real "substance." MIT attorney Ann Hammersla said, "The proposal was peer-reviewed on its technical merits, and the award was not based on that illustration" (qtd. in Russell). An Army spokesperson confirmed that the grant was completely "based on the substance of the proposal, and no illustration was required" (qtd. in Russell; Shachtman). That is, the proposal had been evaluated on the meritorious substance of its words, not on the superfluous excess of its images.

With both parties now appeased, the creators of science and the creators of science fiction can then continue with their own businesses. Comic books and nanotech go their separate ways, as if this chance encounter had been nothing but a strange twist of fate, an accident, a regrettable mistake, a random meeting of words and images without deeper significance.

And yet, while coming down to a case of "illustrative" pictures versus "substantive" words—or even to a case of the profession of science versus the profession of science fiction—this event also manifests the nonlocal cultural mythologies that frame both military technoscience and comic books, exposing their interdependence. Now, there seems little reason to doubt that Thomas's daughter simply landed on the *Radix* drawing by serendipity, adapting it in all "innocence" as mere "illustration" for her father's description of soldier nanotechnologies, as nothing more than a visual interpretation of the words by whose merits alone the technical application was supposedly judged—an extraneous supplement, that is, to the self-contained text. But we must nevertheless ask why this image seemed for the daughter to be such an appropriate illustration, such an appropriate simulacrum, of otherwise "external" words. Why did her sampling, or poaching, from preexisting images seem to illustrate the description given her so perfectly that the military and the ISN would disseminate this image widely as "a drawing of what the soldier of the future might look like"?

That the cartoon and the text seem to "fit" each other so perfectly—as if they could have been made for each other—should make us suspicious to claims for either scientific or science-fictional autonomy. For both professions here are deeply inhabited and surrounded by traces of a larger media ecology that powerfully informs and motivates them. After all, when Thomas describes his program of soldier nanotechnologies—a program supposedly only illustrated, as if from the outside, by the comic book image—he puts it in the following words:

> Our goal is to help greatly enhance the protection and survival of the infantry soldier using nanoscience and nanotechnology. . . . This will be achieved by creating, then scaling up to a commercial level, revolutionary materials and devices composed of particles or components so tiny that

> hundreds could fit on the period at the end of this sentence. The idea is to incorporate these nanomaterials and nanodevices into the future soldier's uniform, and associated equipage like helmets and gloves. . . . [I]magine the psychological impact upon a foe when encountering squads of seemingly invincible warriors protected by armor and endowed with superhuman capabilities, such as the ability to leap over 20-foot walls. (Qtd. in MIT News Office)

Thomas depicts the development of soldier nanotechnologies as progression from a present "idea" toward a future "goal." In the process, he locates nanotech within the syntactical structure of printed language, imaginarily packing hundreds of nanoscale "components" and "particles" into "the period at the end of this sentence." It would be possible then to see the ISN as a producer of "substantive" text, engineering its very substance—nanotechnology—within the materiality of writing, as if grammatical sign and technical object were indexical. "The idea" of the whole project to incorporate nanodevices into military uniforms is explained through text alone, as a continuous inscriptional inventory that contains the present in itself—a conveyor of *present particles*—while simultaneously generating the scientific future and setting it off at a distance. We are asked to "imagine" the future of soldier nanotechnologies as a culmination of alphabetic writing, a giving-forth or materialization of the technical substance abiding within. "Imagine the psychological impact": imagine the invincible powers enabled by those invisible particles at the hypothetical end of this sentence, those particles that are the "end goal" or the "referent" of this sentence as much as they might appear at the space of its final destination, its conclusive period, its full stop. We are directed to think textually, to visualize nanodevices through the medium of print and the analog unreeling of its content towards a deferred future.

But at the same time, certain elements of Thomas's description seem to "leap" out at us from another order of narration entirely, one perhaps defined less by analog progression toward an inevitable period than by fragmentation and radical juxtaposition. Even the imaginary abutment of nanoparticles with their material signifiers, where the future goal and the period of writing overlap in space and time, exceeds the notion of self-contained text; it is instead more like the conjunction of text with its own illustration. There is a conceptual practice involved here for which the idea of a substantive writing—a writing with "no need of illustration"—appears insufficient. This impression deepens when we read the ISN's published research mission:

> [T]he ISN's research mission is to use nanotechnology to dramatically improve the survival of soldiers. The ultimate goal is to create a 21st century battlesuit that combines high-tech capabilities with light weight and comfort. Imagine a bullet-proof jumpsuit, no thicker than ordinary span-

> dex, that monitors health, eases injuries, communicates automatically, and maybe even lends superhuman abilities. It's a long-range vision for how technology can make soldiers less vulnerable to enemy and environmental threats. (Institute for Soldier Nanotechnologies).

Associations spring to action from these descriptions with every insistence that we should imagine, as if we could imagine, as if perhaps we have already imagined something very much like this "long-range vision" many times before. The ISN has made efforts to locate its research practices in the medium of "substantive" text and thereby dissociate itself from the realm of "fantasy" images—especially after exposure of its comic-book infringement, its incursion into the proper frame of a comic book which, nonetheless, we are assured remains inconsequential for the proper "idea" of soldier nanotechnologies, a purely marginal illustration which, we are promised, was expeditiously excised from the text without any resultant loss for science. But let's connect the dots. Bulletproof "spandex" jumpsuits? "Invincible warriors" able to "leap over 20-foot walls," clearing tall structures in a single bound? "Superhuman" abilities? Very clearly, we are deeply submerged in the media regime of *comic-book superheroes.*

Everywhere in the discourse on soldier nanotechnologies we are directed to think of supermen, their wondrous superpowers, and their stunning costumes. In their pop-science book *Nanotechnology and Homeland Security: New Weapons for New Wars* (2004), nanoscientist Mark Ratner and nanobusiness entrepreneur Daniel Ratner tell us, "The tasks of modern soldiers might well be called superhuman and thus require superhuman characteristics to accomplish them" (Ratner and Ratner 55). So just in the nick of time to save the day, "[n]anotechnology provides the only likely solutions to these problems" (55). We learn that the future soldier's uniform will be made from flexible nanofibers that "instantaneously can become stronger than steel," protecting against bullets, explosive blasts, toxins, electromagnetic pulses, and other threats of postmodern battlespace (51). Nanowarriors will have super-vision, super-hearing, and super-strength; they will directly access environmental information down to the molecular level; they will sport a colorful uniform—a "coat of many colors" (49)—stronger than kevlar, stronger than steel, that will also heal wounds (49–55). The soldier of the future thus mimics Superman, the "Man of Steel," thanks to nanofabrics and biomechanical outfits with "direct interface between the human nervous system and electronics" (55). Of course, extraordinary powers always require extraordinary sartorial innovations. As Scott Bukatman's cultural studies of the hypermuscular superhero body have suggested, "superheroes don't wear costumes in order to fight crime, they fight crime in order to wear costumes," precisely because the "costume is the sign and the source of power, the mark of *grace*" (216–17). Power must display itself on the surface of the body, and it moves in from the outside. Visibly, then, the "Army's overall technology strategy for applying nanotechnology to the soldiers'

ensemble" (U.S. Army Research Office 5) performs the long-abiding military dream of cyborg soldiers graced with all the qualities of superheroes (Gray, "Cyborg Soldier"; Garreau).

The superhero context of American military nanotechnology irrupts frequently in dispatches from the battlefields of science. In 2001, the National Science Foundation and Department of Commerce funded a workshop on human performance enhancement through convergence of nano with bio, info and cognitive science, or "NBIC convergence." In the proceedings, Michael Goldblatt—chair of the Defense Sciences Office at the Defense Advanced Research Projects Agency (DARPA)—announced: "DARPA has recently begun to explore augmenting human performance to increase the lethality and effectiveness of the warfighter by providing for super physiological and cognitive capabilities" (Goldblatt 337). These "super" capabilities would stem from biomechanical exoskeletons and musculature actuators, as well as metabolic redesign of the soldier's body against shock, trauma, and sleep deprivation. They could include psionic powers like telekinesis, for through a nanowired "brain-machine interface," a soldier might command peripheral computers, vehicles, and weapons with thoughts alone (Goldblatt 340–41). Telepathy too would become possible by nanowiring soldiers' brains; as Robert Asher of the Sandia National Laboratories suggested: "Not only intellectual data might be passed from one person to another without speaking, but also emotional and volitional information" (Asher 357). With bionanodevices and pathogenic threat-sensors embedded in tissues of the body—nanotechnologies currently being developed by the Department of Defense (Murday, "Science")—the supersoldier would approach the stamina and strength of a Spider-Man, as well as his tingling, early-warning "spider-sense." This new soldier would be an ultimate weapon, according to James Murday, Chief Scientist of the Naval Research Laboratory: "The confluence of the NBIC technologies will provide the future U.S. warfighter with the capability to dramatically out-fight any adversary, thereby imposing inhibitions to using warfare with the United States as a means to exert power and reducing the risk of U.S. casualties if war does occur" (Murday, "High-Performance" 352). If deterrence fails, send in the superheroes—a method of conflict resolution typically relied on by cartoon representations of war (Wright; Matton). As Ben Grimm (the Thing) of *The Fantastic Four* always says: "It's clobberin' time!"

So it seems that comics images "illustrate" the textual dispatches of military nanoresearch only to the extent that these texts themselves instantiate the content of comics images. Together they reproduce the superhero narrative, with all its conventional tropes, power fantasies, and associated iconography, as their common frame and their shared mythology. Comics images and the writings of nanoscience blend to create a hybrid media space for the imagination, a space for "long-range vision." The same space, that is, generated by the storytelling practices of comic books as such: the space where text and image intersect to produce graphic narrative.

Some comics creators have emphasized this zone of medial collision by adopting the term "co-mix" to describe their work; for instance, Art Spiegelman, creator of *Maus* (1986), has said: "I think of comics as co-mix, to mix together words and pictures" (Fein). Comics theorist Phillipe Marion calls this narrative co-mixing and drawing-together of images, texts, and other visual elements "graphiation." As the unified action of the visual field of enunciation, presenting itself to the reader as a narratological totality, graphiation produces meanings unavailable to any one element by itself by virtue of the reader's actively apprehending multiple aspects of the comics page altogether, or in various combinations (Marion). The fragments form material, spatialized assemblages that can achieve emergent significations or emotive effects due precisely to the blending of verbal and visual content (Eisner; Bongco; Varnum and Gibbons). But even as graphiation connects multiple elements in a semblance of formal unity, the impossibility of actively reading words while focusing on pictures at exactly the same time ensures a constant, irresolvable tension between them and a continual disintegration of the signifying field (Schmitt).

Yet it is precisely through this differential and productive play of continuity and discontinuity among its components that graphiation gives rise to the organizational effects of narrative, for in compositing disconnected elements into an implied sequence—one in which the gaps and fissures between pieces are the requirement rather than the failure of their merger—the logic of their arrangement appears as motion in space and passage of time. As comics creator and theorist Scott McCloud writes: "Comics panels *fracture* both *time* and *space,* offering a *jagged, staccato rhythm of unconnected moments.* But closure allows us to *connect* these moments and *mentally construct* a *continuous, unified reality*" (*Understanding* 67). The comics medium compels us to suture internal gaps with assumptions of spatial and temporal movement.

The ISN's 2002 research proposal would thus also be a kind of comic book, drawing together text and image into an implicit narrative about the development of military superheroes. Unlike an illustrated book, where text and image often appear to refer to the "same" content and where the illustration is understood as an excisable supplement to the static substance of the text—such as in a novel wherein an artist might have appended visual representations of specific scenes from the story, or in a scientific textbook wherein diagrams, photos, drawings, and words might all come together as a multimedia account of some single natural phenomenon (though of course, even in these examples, excision of the visual elements would have notable semiotic consequences)—the ISN document instead produces an essential motion-effect, a moving-between that cannot be localized to either the words or the picture in isolation. Rather, this conjuring of superhero narrative as the connective tissue between words and picture occurs as a function of their graphiation. By juxtaposing a written account for scientific research yet-to-occur with a drawing of "what the soldier of the future might look

like," the ISN proposal creates a real gap between text and image, and equally between present and future tense. But this gap separates only to connect. It performs identically to the "gutter" in comics—the blank space between panels—for it is a gap that exists only to be filled in, in itself triggering the imaginary response of suture or closure, generating a sense of narrative cohesion that spans the distance between here and there to become the measure and the machination of "long-range vision."

What therefore occurs in this internal fissure between the writing of the research proposal and the graphic of the future soldier, inside this medium space of "long-range vision," is the science itself. The benchtop research on soldier nanotechnologies—including polymer science, fullerine composites, molecular manufacturing, nanoelectronics, and quantum computing—might seem quite distant from superhero fantasies. But these tangible activities of the laboratory emerge laden with semiotic residue from the proposal's juxtaposition of words with cartoon. For the ISN constructs itself and its research as linking present and future; according to its own graphiation practices, it occupies that gap between substantive text and fantasy image. The ISN draws itself from the comic-book gutter. And so even from the moment of its inception, the ISN takes its place inside, not outside, the ecology of comic books.

It's not just that the ISN and related American endeavors in the fields of soldier nanotechnology rely on cultural familiarity with comic-book myths—for example, Superman's famed ability to "leap tall buildings in a single bound," or Captain America's "super-soldier" serum and patriotic spandex—to suggest that nanotechnology, in replicating or materializing these myths at the site of the soldier's body, can create "real" superheroes. More specifically, nanotechnology travels to the very center of the discourse on superpowers crossing both science and science fiction, to the extent that it is no longer easy to think superpowers without nano, and vice versa. In the world of comics, a new generation of heroes has risen who no longer require the improbable radiation accidents or the genetic mutations characteristic of an older generation of superfolk (Gresh and Weinberg). Instead, these new heroes are powered entirely by advanced nano, and they have deep connections to systems of military-industrial production. For example:

*Bloodshot* (1991–1996). Angelo Mortalli is abducted by a corporate military developer and injected with experimental nanites. These travel through his blood, constantly repairing damage, augmenting muscles, providing telepathic access to computers, and "teaching him to kill . . . increasing his senses . . . turning him into the *most* a human being could be" (Vanhook 24, ellipses and emphasis in original). This echo of the U.S. Army motto, "Be All You Can Be," underscores the supersoldier context. Yet Mortalli—now called "Bloodshot"—escapes the nanolab and takes up his own method of peacekeeping: "Angelo Mortalli died in that California laboratory. . . . But something good came out of it. . . . [A] better man took his place—one with a strong sense of justice—of right and wrong. Long live Bloodshot" (29).

*Xombi* (1994–1996). David Kim researches nanomedicine until demonic thugs break into his laboratory and murder him. Luckily, he injects medical nanobots into his blood before dying: "Inside his body, the nanomachines were moving fast and furious, busy, ever busy. Replicating themselves by countless generations every minute. Pulling raw matter from outside of his body, molecule by molecule and transforming it, building cells, tendons, bones, organs and blood vessels" (Rozum and Birch 30). Programmed to read his DNA and rebuild his tissues, the nanobots restore him to life and make him indestructible, immortal. Now dubbed "Xombi," Kim joins other heroes to protect our world against supernatural legions of evil.

*Hardware* (1993–1997). Scientific genius Curtis Metcalf is a disgruntled employee of the high-tech munitions manufacturer, Alva Industries. Metcalf uses his employer's resources to construct an elaborate cybernetic battle-suit and renames himself "Hardware." Figured as a "cog in the corporate machine [who] is about to strip some gears," a proletarian champion, he sets out to dismantle Alva's paramilitary operations from inside (McDuffie and Cowan). While his original armor in 1993 was respectably awesome, by 1994 his arsenal was upgraded to "true . . . superhuman levels" thanks to recent nanoscience: "[T]he new armor also incorporates advances in technology from the past year, including a new programmable polymer technology that allows for true strength enhancement and superhuman levels for the first time" (Van Meter and Cowan 34). Hardware's belated induction to the ranks of true superheroes thus owes to this new exoskeleton, a shell of nano-robotic "liquid metal" and "programmable polymers": "The nanorobots are microscopic machines whose single purpose is to replicate themselves into pre-programmed forms that create the external units of the armor" (35). Presaging ISN exoskeletal designs, this programmable molecular armor makes Hardware "a truly devastating weapon" (34).

*Tom Strong* (1999–present). The members of the crime-fighting Strong family are all rendered superhuman by techno-enhancements. Tesla Strong uses nano devices—including a nano-fog, like the one theorized by nanoscientist J. Storrs Hall (see Hall)—to fight neo-Nazi villains (Moore and Sprouse). That the technological peacekeeping methods of the Strongs frequently verge into reactionary politics, even as they work to stomp out fascism, exposes the ideology behind many superhero fictions; like other series created by Alan Moore, *Tom Strong* self-reflexively critiques the politicized history of superhero propaganda (Klock 103–11).

Ben Templesmith's *Singularity 7* (2005). Nanites from space descend on Earth and transform the world, turning humans into cyborg killing-machines who spread apocalyptic genocide. It seems an alien race wants to take over our planet, and rather than sending in their own army, they simply unleash nanites to convert people into remote-controlled nanowarriors, conscripting civilians as militarized slaves for a literally alien political system.

Nanowarriors have also appeared in other forms of representation that recycle and reform the media-characteristics of comics through the process

of "remediation" (Bolter and Grusin). In the medium of print novels, we find superheroes and comic-book narrative conventions in Dean Koontz's *By the Light of the Moon* (2002), where three friends are infected by a nanotech virus that gives them highly improbable superpowers. They quickly organize themselves as a crime-fighting team akin to the X-Men or the Justice League (Koontz). In video games, *Nano Breaker* (2005) depicts a nightmarish future where nanites escape from an island laboratory operated by the U.S. National Nanotechnology Initiative. These nanites infect multitudes of people and transform them into mechanoid monsters. The purpose of the game is to guide a military cyborg against the monsters while traveling to the source of the problem, the nanolab itself. In the game *Xenogears* (1998), nano battle-suits known as "gears" provide player-characters with fantastic fighting abilities, while the game *X-Men Legends* (2004) features the uncanny heroes equipping suits of flexible "nanofiber armor" that might have sprung directly from an ISN drawing board.

In multiple media, classic superheroes and supervillains from comics past regularly upgrade with nanotechnology for the new millennium. For example, the 2002 *Spider-Man* film adaptation (dir. Sam Raimi) not only replaces the 1962 comic book's radioactive spider with a genetically modified spider, but also reimagines Spidey's nemesis, the Green Goblin—originally turned supervillain by a secret chemical formula (Lee and Ditko, "Grotesque Adventure")—to derive his power from nano. Norman Osborn is a military nanoscientist developing "human performance enhancers" that enter a soldier's body by "vapor inhalation," conferring an "eight-hundred per cent increase in strength" along with side effects of "violence, aggression . . . and insanity" (*Spider-Man*). These nano vapors are part of a project for integrating the supersoldier with an armed "exoskeleton." When the military threatens to pull funding, Osborn inhales the vapors and turns into the Green Goblin, appropriating the nanotech combat systems for his own criminal purposes. Likewise in *Spider-Man 2* (2004), Doctor Octopus is revisioned as a nuclear physicist and nanoscientist, and his machinic tentacles now plug directly into the Doc's central nervous system via nanowires: "These smart arms are controlled by my brain through a neural link. Nanowires feed directly into my cerebellum, allowing me to use these arms . . . in an environment no human hand could enter" (*Spider-Man 2*). Nanowiring fuses machine intelligence with the body to overcome limitations of the human form, producing a supercreature capable of surviving, and fighting, even in the most extreme conditions.

Similarly, in the 2003 *Hulk* film (dir. Ang Lee), Bruce Banner's transformation into the Hulk—caused in the original 1962 comic book by radiation from a "gamma bomb" explosion (Lee and Kirby)—now triggers through nanotechnology. Banner is a nanomedicine researcher exposed to "nanomeds" by malfunctioning lab equipment. These nanomeds, stimulated by his anger and a uniquely modified immune system, turn him into a hulking monstrosity which the military hopes to exploit as a weapon. The

military goal for nanoscience in the film is an army of Hulks and squadrons of "GI's embedded with technology that makes them instantly repairable on the battlefield. In our sole possession" (*Hulk*).

Increasingly, superpowers are thinkable only along with nanotechnology, and Cold War heroes of the bomb can come out of retirement to fight again in our molecular future. Testifying to what critic Brooks Landon has called the "insistent allure of nanotechnology narratives in science fiction," comic books and their remediations in films, novels, and video games incorporate nanotechnology as the primary excuse for superhero adventure, displacing and supplanting older sciences and technologies as the presumptive origin of superhuman beings.

Even so-called "real life" mirrors this trend. Researchers at the University of Manchester Centre for Mesoscience and Nanotechnology have fabricated self-cleaning, re-attachable dry adhesives that could enable super wall-crawling abilities; in fact, "the research team believes it won't be long before 'Spiderman' gloves become a reality—particularly useful for rock climbers and window cleaners" ("Spiderman"). In publishing their research, the scientists embedded a photograph of a toy Spider-Man clinging to a glass ceiling by virtue of the nanoscale adhesion forces of their "gecko tape," thus effectively remediating comic-book graphiation and an implicit narrative of the superhero future in the technical report (Geim et al. 463) (Figure 3). Anybody can be Spider-Man in the nanotechnology era! Indeed, technological convergence on the nanoscale offers so many super opportunities that comic books start to seem our best guides for this onrushing future. Appropriately, then, the notion that nanoscience could create superpowers like those of Spider-Man—as well as those lethal augmentations wielded by the Green Goblin—inspired Boston University nanoscientist Raj Mohanty in 2002 to advocate a nanotech-ethics drawn directly from Spidey's famous motto: "With great power, there must come great responsibility" (Mohanty qtd. in Walsh; originally from Lee and Ditko, "Spider-Man!" 11).

So while nanotech images proliferate within comic books and kindred media, it becomes clear that comic-book superheroes predate the scientific field of soldier nanotechnologies—and here I mean "predate" in both its temporal and predatory senses, for while some nanocomics precede the earliest military nanoscience research and affect its reception, others simply feed off military nanohype to fuel their own plots. The text-image ecology centering on the superhero draws science and science fiction together, maintaining a symbiotic relationship between pop-cultural mythologies and techno-scientific research. This phenomenon is by no means unique to the rise of nanotechnology: military science has long been guided by the science-fictional imaginary, and various cyborg worlds of military research have been deeply inhabited by futuristic totalitarian fantasies often given their fullest expression in science fiction (Edwards; Franklin, *War Stars;* Gray, "There Will Be War!"; Sofia). Narratives and technologies circulating between military science, science-fiction texts, and consumerist technoculture have

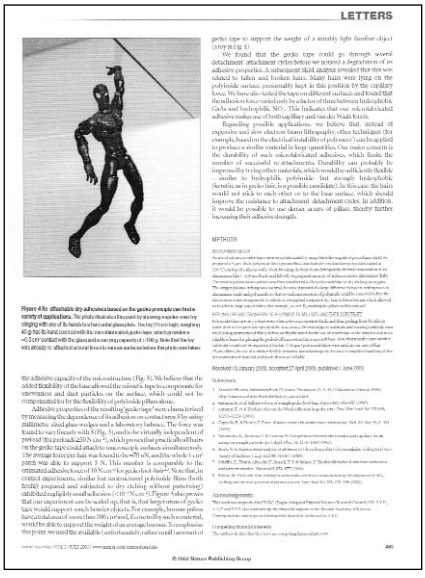
LETTERS

*Figure 3: Spider-Man meets the University of Manchester Centre for Mesoscience and Nanotechnology. Reprinted by permission from* Nature Materials *(Geim et al. 2003). ©2003 Macmillan Publishers Ltd.*

become so ubiquitous that historian of science Timothy Lenoir sees this "military-entertainment complex" as complicit with an epochal erosion of distinctions between virtuality and materiality, suggesting the arrival of a posthuman worldview ("All but War"). The intimacy between soldier nanotechnologies and comic books would therefore be continuous with this longer history and this larger complex.

Moreover, figurations of nanotech superheroes, such as those appearing in the ISN research proposal and other nanocomics, bear traces of cyborg warriors from elsewhere in the contemporary technocultural imagination. Foremost, they recall associations from across the history of comic books—probably the site of cultural production most active in exploring the heroics, psychologies, and social consequences of technologically enhanced supersoldiers since the debut of Captain America in 1941—including such iconic characters as Iron Man, Deathlok, War Machine, and Wolverine (Oehlert). They also point to Robert Heinlein's novel *Starship Troopers* (1959), with its vividly depicted powered armor and its heroic (if quasi-fascistic) mobile infantry; significantly, the intense opening scene of this text features the mobile infantry using the "jump gear" of their exoskeletons to "leapfrog" over walls on an alien planet, clearing even entire buildings with ease. Other likely associations would be the *RoboCop, Terminator,* and *Universal Soldier* films, along with their intertextual comics extensions by Avatar Comics, Dark Horse Comics, and Now Comics. Contributing to this media ecology as well are prominent Japanese manga and their anime versions like *Super Dimension*

*Fortress Macross* (1982) and *The Guyver* (1989), where even battles of the planets can be waged on a personal level thanks to transforming "mecha" and "bio-booster armor" that traverse interspatial zones with impunity.

This whole genre of image, transvecting through comics, literature, film, animation, and back again, forms a powerful conceptual linkage with military nanodiscourse towards the social production of supersoldiers. Consider the alien technologies pictured in the *Predator* films and comic books. Predators wear machinic exoskeletons that make them lethal hunter-warriors, as well as offer the power of invisibility by refracting light and camouflaging with the environment. Transplanted to the U.S. Army Soldier Systems Center in Natick, Massachusetts, images of this alien costume not only serve as aesthetic guides to supersoldier design, but also provide a functioning imaginative context, as systems engineer Jean-Louis "Dutch" De Gay explains: "With a uniform like *Predator*'s, our soldiers would really have a lopsided advantage"—just like the aliens do in the films and comics—and thanks to nanotech research, this image from "science fiction is rapidly becoming reality—and that could change forever the way wars are fought" (qtd. in Port). Designs for reverse-engineering an alien technology are drawn up, and the resultant illustrations and nonfunctional costume prototypes of a "Future Warrior" instantiate conceptual bridges between fiction and fulfillment (Figure 4). At the moment of seriating Predator images with soldier bodies in a plotline of future war, numerous mediating elements make themselves available for closing gutters and finding narratological unity. Even the nickname of project engineer "Dutch" De Gay is the same as that of the Arnold Schwarzenegger character in the first *Predator* film (dir. John McTiernan, 1987): the nearly superhuman Major "Dutch" Schaeffer, who trounces the Predator in primal combat.

The juxtaposition of graphic image with nanotechnological research summons forth a militaristic desire for a superhuman or posthuman future, a "lopsided" distribution of power; and in response, engineering designs, exploratory sketches, illustrations, and other diagrammatic productions of the nanotechnology laboratory emerge to connect the dots. These diagrammatic materials concretize the vector of "long-range vision." This abstract line therefore appears in the radical collision of different media and different fields of knowledge to sew up sequential gaps, for example, between *Predator* and nanoscale polymer science, between *Radix* and molecular electronics, co-mixing them into the same imaginary space. Although typically invisible, the vector strikingly reveals itself in the emblem coin of the ISN, where the sketch of a Future Warrior adjacent to a carbon nanotube (turned so that we might look down its barrel) directs us to read the narrative between them as both a scaling-up and a scaling-forward, a fictive closure of the gutter by the sweeping curve of technoscientific progress (Figure 5). Time is spatialized and the skewer of narrative comes to light in drawing nanoscale object with costumed crusader.

*Figure 4: "Future Warriors," U.S. Army Natick Soldier Center. 2003. Two Future Warriors—both, in reality, Sergeant Raul Lopez of Natick Soldier Center's Operational Forces Interface Group, posing in a mock-up costume—are here superimposed on a digitally-rendered battlefield, replete with CGI cartoons of autonomous mobile weapons systems, an armed aircraft drone in the sky (looking much like the "Hunter-Killer" drones from the Terminator films), and three flying surveillance microrobots (perhaps controlled telepathically by the nanowired supersoldiers). Courtesy of Natick Soldier Center.*


*Figure 5: "Enhancing Soldier Survivability." ISN Emblem Coin. 2002. The sequential curve links nanoscale object to supersoldier, the present to the future (left); the ISN crosses the gutter between points on this curve, suturing them together with a cross-stitch "x" (right). Courtesy of the MIT Institute for Soldier Nanotechnologies.*

But if such co-mixing or graphiation focuses the disparate scatter of scientific disciplines, military-industrial funds, inspirational fictions, and visual iconographies of soldier nanotechnologies into the linearity of a narrative and the vectoral lines of a diagram, then it begins to seem that the field of soldier nanotechnologies itself functions according to essential comic-book operations. Indeed, I would suggest that the process of image transvection and spatial linkage across media formations that we have seen working in military nanoscience, generating plots and graphs to draw the pieces together in narrative cohesion, describes a cultural reading practice conditioned by the medium of comics.

Marshall McLuhan has argued that the depth involvement required to draw narrative connections between a sequence of medial units and decode their temporal flow is a historical effect of the comic book, which entrains strategies for understanding the syntax of media mosaics—including television, the medium that turns other media "into a comic-strip world by simply featuring them as overheated packages" or discrete units strung discontinuously along the cool televisual signal (McLuhan 167). But where television operates according to the single dimension of linear broadcast, a one-way onslaught of information projecting from the screen and for which the viewer needs only fill in breaks in visual resolution and sequence—gaps in the "comic-strip" of medial packages—the comic book expands outwards from the strip and the broadcast to involve multidimensional reading. As Scott McCloud has shown, "in the temporal map of *comics,* every element of the work has a *spatial relationship* to every *other* element at *all times*" (*Reinventing* 215), and narrative coordination of the elements concerns not only the planar page layout but also the depth dimension of the book across its archaeological strata of pages. Or even beyond the closure of "the book" itself. For almost any individual comic book demands anterior knowledge of other comic books, whether continuing issues of a series, or elements from entirely disconnected comics or other media.

A panel from *Hardware* exemplifies this process. In this panel bearing the supertitle "On the Drawing Board," engineering diagrams for nanowarrior armor, weapons, and vehicles stand at the intersection of a TV screen projecting the image of a cyborg on the right, scientific textbooks on the left, computer graphics workstation in the foreground, scrawled notes and typed letters pasted in random places, and all drawn together within the comics frame. Textual commentary explains the vector that crosses through this multimedia mélange:

> Curt [aka Hardware] maintains a completely equipped design center . . . [where] he developed the original concepts for much of [his] equipment . . . Curt translates his preliminary designs from his original sketches and drawings to a high speed Silicon Graphics workstation. . . . [T]hose images can be transferred via dedicated data line from his home-office to any one of the Alva Industries supercomputers for final output to one of Alva's robot-controlled

> milling and manufacturing units. These . . . take the electronic data and turn it into a fully functional prototype. (Van Meter and Cowan 47)

The "data line" passing through the plane of the superhero "drawing board" and condensing in the nanotechnology laboratory is a clear analogue of "long-range vision," the graphical link between contemporary media mosiac and future technology. The panel is thus an allegory of its own reading. For the data line, collapsing the multimedia design space—the "drawing board"—into an information stream that produces the nanowarrior at the other end, figures the narrative vector the reader must decipher from sequencing the co-mixed media inside this panel, the storyline of Hardware's production process. It is therefore also an allegory of the technoscientific practices of soldier nanotechnologies at large.

For the field of soldier nanotechnologies requires not only from its practitioners, but also from its audiences, consumers, or receptive publics, a certain level of "comics literacy," an intuitive ability to perform radical transmedia linkages and achieve imaginary closure of the transvectional science-fiction image with anticipatory scientific research. Such comics literacy involves these interpretive practices as well as familiarity with the plots, generic conventions, and reading-frames native to comics (Pustz). As we have seen, the mythology of superheroes bridges the gutter between techoscientific research and futuristic graphics: it is the second-order semiological system that gives form to the fragmentary field of soldier nanotechnologies, capturing its pieces altogether, naturalizing their collective meanings (cf. Barthes; Reynolds). This mythology moreover naturalizes the transmedia co-mix, for superhero stories depend upon the possibility of titans from different fictive environments meeting each other on the same four-color battlefield. The ubiquitous "versus" in comics discourse signifies the co-mix as such, the "crossover" of media domains in conflict that produces narrative synthesis. Tacit knowledge of the mythology and mediality of superhero comics, the "versus" and the "co-mix," the "crossover" in all its senses, enables fanboy debates about speculative match-ups between favorite costumed heroes (Pustz 113) and structures texts like *Superman vs. the Amazing Spider-Man* (1976) and the *Aliens vs. Predator* saga (1989–present). These and other complexly seriated narratives like Alan Moore's *League of Extraordinary Gentlemen* (1999–2003), where characters from Victorian print fictions join in comics battlespace, assume a readerly depth involvement with the intertextual materials and an understanding of comics' ability to draw into itself other media domains and remix them, sample them, revision them in ways that preserve the differences between media while also using those differences, and their gaping interfaces, as the mechanism for plot generation. This tacit knowledge is equally presumed in the works of soldier nanotechnologies that co-mix research disciplines and various media objects into the vector of "long-range vision," naturalized by crossing through the plane of superhero myth.

We see such agonistic crossover operations at work in the Ratners' *Nanotechnology and Homeland Security,* where immediately after being told of "superhuman" powers and cyborg interfaces (55), we are shown a picture of the unmanned aircraft drone developed by General Atomics: the "Predator" (58). The Predator aircraft has nothing to do with nanotechnology, and the Ratners reluctantly admit as much. But they embed this image of aeronautical "reality" (58) within textual speculations on military nanoscience to suggest an "interesting trend" (58) toward autonomous technologies and even "artificial intelligence" (59). Rather than a non sequitur, the juxtaposing of Predator image with descriptions of a nanotech "man-machine interface" implies that "it may be possible to use more and more mechanization to fight future wars" (58). The reader is thus asked to imagine a plotline of future war in which cyborg nanowarriors, Predators and AIs all clash together. The reader's ability to close the narrative gaps in this media montage is likely facilitated by the overdetermination of the aircraft's name, which makes citationally available other discursive realms where the signifier "Predator" already suggests exactly this kind of futuristic battle royale.

For example, the serialized graphic novel *Aliens versus Predator versus The Terminator* (Schultz and Rubi). Here, three different media franchises blend in a cartoon montage of automated technologies, AIs, cybernetic organisms, Predator heroes, and supersoldiers. A media-savvy reader familiar with each franchise is capable of imagining them together in the diegetic space that emerges under the signifier of comics linkage, the "versus" that violently transmediates and synthesizes different fictive domains. Suggestively resonating with the technoscientific practices of soldier nanotechnologies, this story involves human soldiers allied with Predators, using their superior technologies to win the day against an army of hybrid creatures biomechanically engineered from co-mixed scraps of aliens and cyborgs.

The comics functions of co-mix and crossover, the bridges of transmediation and the conflictual synthesis of the "versus," produce an imaginary bricolage of different cultural discourses, iconographies, technologies, sciences, epistemologies, and values. Assembling them all within the same graphiational space, the comic book experiments with possible futures or social consequences emergent from particular concatenations. By virtue of its ability to perform exploratory link-ups and exploiting the ambiguous space of the gutter, comics is a particularly rich medium in which the cultural meanings of technoscience can be worked through and negotiated (Locke). Perhaps this is why Patrick Salsbury, Senior Associate of the Foresight Institute—a major site of nanotechnology research and speculation—after reading an issue of *Tom Strong,* suggested that comics might be the best medium for presenting nanotech concepts to the public: "I think comics are an excellent way of reaching youth and presenting 'far out and fantastic' notions to an audience that is already clearly receptive to such ideas as living in space, genetic engineering, futuristic materials science and tech-

nology, life extension, etc. Might be worth exploring how we could utilize this vector to reach more young people" (Salsbury).

Employing these comics techniques and vectors, the field of soldier nanotechnologies is similarly able to investigate the effects of various combinations of images, technologies, narratives and visions for producing the "soldier of the future." The unrealized nanowarrior can be tested out on the drawing board, connected to other graphics that might in themselves serve as design-ahead engineering diagrams (such as pictures of the Predator or Valerie Fiores), thereby exploring possible technologies and possible cultural meanings. The nanowarrior emerges at the intersection of the images, texts, and technologies pieced together on the drawing board, a diagrammatic drafting of the cyborg soldier's body and its social contexts in advance. The superhero future is drawn to order, inventoried as standing reserve, in the act of linking texts and technologies from one realm of cultural production to texts and technologies from other realms.

This kind of crossing-over may bring any individual component into the resultant virtuality system regardless of whether or not the various creative actors involved—scientists, artists, authors, military officials—are aware of their participation or complicity. The function of comics to summon resources of various media components, or reserves, into a graphiational unit draws them into contexts and associations they may not have voluntarily signed up for, but thereby creates a semiological unit supported by the linkages that close up gaps in the ranks and turn the loose array into a cohesive assemblage. Even a fighting force of superheroes. The comics drawing board, then, is also a draft board.

So when MIT's Institute for Soldier Nanotechnologies gets inadvertently drawn into the media ecology of comic books by tracing a comic-book image into a technical research proposal—a replication or retracing that itself already bears traces from elsewhere—this is also when *Radix* gets inadvertently drawn into the media ecology of soldier nanotechnologies. It would appear that the intersection of military nanoscience and comic-book culture goes deeper than a shared mythology of superheroes. For both operate according to the logic of the draft.

The logic of the draft entails both the diagramming of future exercises as well as the drawing of elements of one text, system, or population into the compulsory service of another, pressing them into heroic movements, conscripting them into super-scripts. It describes not only the functional operations of the media ecology of soldier nanotechnologies, but it also appears at the level of representation, as a self-reflexive element of discursive content. In the comic books, for instance, nanowarriors are frequently forced into their cyborg condition by organizations, corporations, governments, political systems, or autonomous nanotechnological collectives that aim to secure power, often with aspirations of world domination. The protagonists in *Radix, Bloodshot, Xombi,* and *Singularity 7* are all abducted or compelled

into combative service as human-machine hybrids, drawn suddenly into enigmatic wars without possibility of protest. Even a character like *Hardware,* who initially seems to originate as vigilante resistance to the machinations of corporate militarism, later proves to be the collaborationist product of the very systems he thought to resist, always already a "cog in the machine." The same theme informs comic-book remediations like Koontz's *By the Light of the Moon* and video games like *Nano Breaker,* with their many superhuman hero-victims of nanotechnology.

This technological capture of unwilling soldiers or civilians that transforms them into literal killing-machines could be called the "machinic draft." In their representations of machinic draft, nanocomics channel earlier texts with similar plots of people conscripted into militaristic service by the mandates of high technology. Examples include *RoboCop* (dir: Paul Verhoeven, 1987) or *Universal Soldier* (dir: Roland Emmerich, 1992), or Orson Scott Card's novel *Ender's Game* (1985) or Joe Haldeman's *The Forever War* (1974). In these texts, otherwise "innocent" human beings are transformed by combat technologies, restructured as automated weapons systems, without consent or awareness of the cause for which they are fighting. Looking back to the Cold War fiction of Richard Condon's *The Manchurian Candidate* (1959; filmed 1962) and redeploying its story of impressment and brainwashing now in the context of advanced cyborg programs, most of these narratives contain barely concealed metaphors for the American experience in the Vietnam war and the role of the machinic draft in that era. *Universal Soldier,* for example, depicts the fate of a reluctant American soldier who nearly completes his tour of duty in Vietnam, only to be killed by his own superior officer and brought back to life as a piece of remote-controlled hardware. In many ways, the operations of the Vietnam War can be seen to epitomize the machinic draft, not only setting in motion the computerized algorithms of the selective service system, but also becoming an early historical example of "postmodern war," characterized by the rhetorical replacement of humans with machines at the center of warfare and the simultaneous transformation of soldiers' bodies by technological means—experimental bionic implants and performance-enhancing drugs, prosthetic replacements of body parts during live combat, and the integration of real soldiers and machines into simulated electronic battlefields (Gray, *Postmodern War* 46 150–67). Recalling Vietnam in order to address postmodern warfare more broadly in the present day, these narratives of the cyborg soldier reflect a social anxiety about the machinic draft, compulsory service under the political regimes of technoculture, and the systemic forces beyond the self that make resistance impossible, even in death.

Soldier nanotechnologies, according to the logic of the machinic draft, might seem even more irresistible because invisible nanomachines could infiltrate and cyborganize the soldier's body less as a contagion from the outside than as a reconstruction of molecular infrastructures already from the inside. In nanocomics, the incorporation of human beings into the war-

machine occurs via particulate devices infiltrating bloodstreams and cells not only through prosthesis or injection, but even through inhalation and osmosis. As described in *Singularity 7,* where the entire human population is either destroyed or biomechanically restructured by nanodevices flowing in the atmosphere: "Some that were left . . . they tried to fight back. But it was useless. How do you fight something that is in the very air? That deconstructs you on a molecular level?" (Templesmith 12, ellipses in original). In these comics, war seeps into your bones via the technologically saturated air. Here, there is no escape from the chill currents of the draft.

The transformation of an unwilling civilian into a nanowarrior, as depicted in *Bloodshot, Xombi,* and *Singularity 7*—where death becomes mere prelude to a posthuman immortality in which wars are both unending and unavoidable—encapsulates current fears of machinic draft politics in the age of nanotechnology and postmodern war. These affective contexts manifest in a 1993 issue of *Bloodshot,* in which the CIA sends our hero to present-day Vietnam to assassinate a "terrorist" drug dealer who is murdering people all over the country by distributing poisoned dope. Traveling under the pseudonym "Michael Lazarus," Bloodshot tracks the drug dealer to abandoned Vietcong underground tunnels and kills him. The dealer turns out to be an American soldier, "only eighteen when he was drafted in '69," who has been murdering civilians in Vietnam for the past three decades as part of the CIA-sponsored "Operation Phoenix" (Vanhook and Perlin 11, 22). Postmodern war here appears as the automated reproduction of an operation that always comes back from the dead, resurrected like the Phoenix (a "forever war," in the vocabulary of Haldeman's novel). After Bloodshot learns the truth of his mission, he turns from the CIA in disgust: "You didn't *care* that he was a pusher. *You* were more concerned that the *truth* might come out. The *evidence* is down in that little hole. All about the people he *killed* in the name of *Operation: Phoenix* . . . . . People that *weren't* soldiers" (28, emphasis and ellipses in original). The undying war and its underground drafting of noncombatants explicitly parallel the figure of Bloodshot himself, the undying nanowarrior, the self-styled Lazarus, who finds himself unable to escape revivifications of the machinic draft.

*Bloodshot* implies that the indestructible nanowarrior, deployed and recycled in an endless series of battles, always resurrected by the technological enframing of his body, is merely the symptom, or at most the fulfillment, of a much deeper logic of the postmodern war machine where everyone is always already drafted, where soldiers and civilians are in a constant state of "forever war"—the state of the "universal soldier," where everyone is a soldier, at all times, even in the afterimage of war, even in the postmortem. The comic book suggests that war is no longer anywhere, because it is everywhere, fragmented and molecularized across virtual terrains now mapped by the concept of "terror." The fantasy of the nanotech superhero instantiates *in itself* this molecular and interminable condition of postmodern war precisely because the linkages between them have become diagrammatic.

Comics, superheroes, and science fiction form the environment that American militarism has inhabited since at least the outset of the Vietnam War, and it becomes increasingly difficult to distinguish them (Franklin, *Vietnam*). They predate each other in a cycle of total consumption, co-mixing the plotline of future war and the anticipatory zone of terror: the machinic draft as such.

But if nanocomics express anxieties about the machinic draft, about the potential futures made possible in the juxtaposition of science-fiction images with nascent technologies, about the condition of the "universal soldier" imagined as the alibi and the motivation of the war machine, so too does the scientific field of soldier nanotechnologies. While the possibility of nanowar makes ethical discussions necessary and perhaps calls for active nanotech arms control (Altmann and Gebrud), it is rare in the technical discourse of military nanoscience to find plans for offensive weapons. The violence immanent to nanotech instead channels through the pumped-up body of the supersoldier—as violence usually does in superhero comics—and the scientists involved in developing the technology focus on this extraordinary body and emphasize instead the protective goal, which the Army Research Office defines as "enhancing the individual dismounted soldier's survivability in the battlespace" (U.S. Army Research Office 5). Defense of the individual's body and will—the individual's *survival* as such—seem to be paramount targets of military nanoscience. The ISN's motto is "Enhancing Soldier Survivability." Ned Thomas has said: "This is about the survivability of soldiers. It's all defensive, and can be applied to police forces and the general public. . . . I don't imagine a university would ever want to work on offensive technologies." Moreover, while integrated nanosystems might seem invasive of the soldier's body and emblematic of the machinic draft, Thomas has said that even for special-operations soldiers, "[t]hese things are going to be on a voluntary basis. . . . Is this ever going to reach an Orwellian level? No, the United States would never go there" (Kary).

Such affirmations of personal agency and subjectivity, seeking to protect what remains of the human in the high-tech battlespace—protecting, that is, human remains from total exploitation by the machinic draft—constitute a discursive reaction to military technologies that threaten transformation or takeover of the soldier's body. Certainly, representations of cyborg systems in military rhetoric and speculative fictions often insist upon the freedom of the body and the freedom of choice, the persistence of the humanist subject, even when agency and subjectivity are evacuated by the very usages of such technologies (Hantke).

But even if voluntary action might be wishfully asserted for the nanowarrior himself, at the same time, the cultural anticipation of nanowarriors and nanowar also effectively produces an intensified ambient fear, channeling local "nanophobia" (Toumey) into atmospheric currents of "nanoterror." As critical theorists Luciana Parisi and Steve Goodman have argued,

nanoterror exhausts resistance in advance, for it transforms a politics of deterrence into a politics of "pre-emptive engineering" which penetrates human and biotic systems at all levels, an expansion of the immobilizing security state even into the molecular structures of our bodies (Parisi and Goodman). Nanoterror thus becomes a controlling tool of the machinic draft, for as a consequence of imaging and imagining nanowar, and preemptively engineering our cities and ourselves in defense against it, protecting our bodies and our homeland from threats of molecular invasion—or even complete disintegration (Milburn, "Nano/Splatter")—we begin to link images of military nanotechnology to our currently lived realities, closing the gutter between them.

The Ratners have written that, for the sake of "homeland security," our urban infrastructures will be protected by the same nanotech defenses as our soldiers: "It is important to protect a soldier in his uniform, but better defenses are also required for buildings, vehicles, and other installations" (Ratner and Ratner 44). Like the adaptive bulletproofing of the Future Warrior's exoskeleton, the "same kinds of hardening processes could also be implemented for key infrastructure like water, electricity, subways, mail centers, and communications. In these cases, the upgrades are not really optional" (72). The Ratners also tell us that we can now buy stain-resistant nanofiber pants from clothing companies like Eddie Bauer or the Gap that instantiate "an evolution" toward the "smart material" nanofabrics our soldiers will be using: "only nanotechnology can combine the properties of comfortable cotton fibers with the desirable properties of . . . smart material in soldiers' uniforms" (44). Today, you can walk into a Gap store and purchase "Nano-Tex" pants—I am wearing my own pair of Gap nanopants even now—which would, according to the rhetoric of military nanoscience, fill in the space between the civilian and the soldier, the present and future, as yet another coordinate in the evolutionary vector of "long-range vision." The Gap fills in the gap between an immediate, tangible consumerism and the speculative superhuman horizon. "Fall into the Gap," as the old ads used to encourage. We are sutured by this and other gaps that separate only to connect—these gutters between our wardrobes of nanofabrics, our appliances that increasingly feature "nano inside," our buildings coated with bulletproof spandex, and every site of our entertainments—to the military nanotechnologies that they trace and that bear their traces. Our cinema technologies and video games have long been complicit in the military-entertainment complex (Virilio; Lenoir, "Programming"). But what happens now that, in the interests of "homeland security" and "survivability" in the nanotech era, every aspect of our lives begins to be co-mixed with the fantasy productions of military technoscience, drawing us all together into one colossal nanowarrior comic book?

Have we already been drafted?

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