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Perfect Incommunicability: War and the Strategic Paradox of Human–Machine Communication

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INTRODUCTION

From a military perspective, human–machine communication is a strategic problem, a technical solution, and a field of battle. Battlefield communication has been a primary consideration of military practitioners and strategists for centuries. The historical innovation and ongoing strategic importance of these developments in HMC are addressed in this chapter as a means for stressing the importance of acknowledging military prominence and of assessing inevitable ethical considerations. In wartime, the chain of command is characterized by unique challenges of meaning production and signal certainty that have always been dictated by the capacity of media technology. In fact, a great deal of military communication is precisely designed to be impenetrable, imperceptible, or improperly decoded. In this domain meaning is not merely cryptic, but encrypted. This complicates considerably the work of a field primarily motivated by "the creation of meaning among humans and machines" (Guzman, 2018). Further, much military communication is meaningless without the technical capacity to separate signal from encryption-amplified noise. While this makes machines necessary to military C4 (command, control, communication, and computers), they also serve as a point of strategic vulnerability.

Regardless of the communicative dynamics present during warfare, the underlying technical properties and the basic telos guiding human–machine communication (HMC) are nearly universal. They are, in the words of Lucy Suchman, the successful transfer of signals between human and machine to insure "the mutual intelligibility of action" (Suchman, 1987). This is true in civilian and military situations, regardless of the complexity or impossibility of the task (Peters, 1999). This has led to extensive overlap and transfer between civilian and military realms in terms of HMC development, research, and practice. While Friedrich Kittler's claim that all modern communication systems arose out of three wars (the American Civil War, WWI, and WWII) has been criticized for being overly deterministic (Winthrop-Young, 2002), John Durham Peters suggests it is "a useful antidote to a myopically civilian approach that has marked most of our media histories" (2010).

The emergence of a global digital infrastructure that continues to network an ever-higher percentage of the people and machines populating the Earth and its thermosphere, is a direct result of military-developed technologies such as ARPANET, GPS, satellites, fiberoptics, and various forms of AI. Apple's Siri is a perfect case in point. Originally developed as part of DARPA's

Personalized Assistant that Learns (PAL) initiative and presented to the world as a friendly face of AI (Guzman, 2013; Reeves, 2016), Siri was initiated and funded by the US military through one of its favorite partners the Stanford Research Institute (SRI) which sold it to Apple in 2007. Using machine-learning, PAL attempted to "make information understanding and decision-making more effective and efficient for military users… enabling smaller, more mobile, less vulnerable command centers" (DARPA, 2011). The notion of a mobile command center, conceptualized as a techno-empowered individual soldier, is consonant with the Revolution in Military Affairs (RMA) that rose out of the post-cold war logic of netwar and popularized in the 1996 RAND publication *The Advent of Netwar*. Hence, the formation of a new kind of warfare and attendant strategy provided the impetus and funding for the development of new forms of AI and HMC that would come to prominence as a feature in the smartphones civilians use to access data circulating through a network devised to survive the nuclear weapons developed for use in WWII. Both of Kittler's theses that military conflict induces media escalation and that civilian media result from the "misuse of military technology" provide insight into the martial origins (and diverse surveillance potential) of Siri, Alexa, and similar devices (Reeves, 2019). It also highlights the fact that the most expensive U.S. military project in history, the F-35, has been outfitted with Adacel's Voice Activated Cockpit, which, according to the promotional hype, "enables the pilot and the aircraft to talk to each other" (Silicon Review, 2017). Such systems remain important on land, as well, because "you can't exactly tuck your weapons away and remove your gloves to use the on-screen keyboard while bullets are flying over your head" (Medeiros, 2019).

Yet from a military-strategic perspective, this process is absolutely crucial. In fact, the immediate stakes of miscommunication can be catastrophic and can even pose an existential threat if communication in the nuclear chain of command goes awry. The Cuban Missile Crisis is just one of several examples where the meaning-making of machine-processed artifacts (satellite photos and 1590 pages of letters, telegrams, translations, and other correspondence that first passed through typewriters, teletypes, and radio transmission before reaching Kennedy and Krushchev) would determine whether Mutually Assured Destruction (MAD) would be unleashed. In contemporary military strategy, this process has reached a perplexing level of complexity. Because of the strategic competition involved in military HMC, the most forward-reaching designs for military technology are guided by the fantasy of absolute communications security. This fantasy reaches its paradoxical fulfillment in the ideal of perfect incommunicability – that is, in autonomous machines which are impenetrable to any and all intrusions of human communication, whether from friend or foe. Human communication, recognized to be infinitely slower and less precise, is viewed as an obstacle to be overcome through the application of machine-driven communication processes (Packer & Reeves, 2020).

In addressing the interrelationship of war, technology, and human–machine communication, we find ourselves at two impasses. First, under the sign of total warfare (which has become global in a metaphorical sense, such as in the twentieth century's "world wars," as well as in a technological sense, in which satellites and kindred data-tracking technologies have enveloped the world as a potential war-space), all machines, all humans, and all their interactions are potential sites for military-strategic advance (Dreisziger, 1980). Second, the horizon of autonomous weaponry may refigure the limits of human–machine communicative capacity, as attempts to make machines wholly autonomous expose some of the dangers that were present from the first moment that humans began communicating with machines. In short, we turn our attention to the paradoxical military drive to both create perfect human–machine communication and perfect human–machine incommunicability. To do so, we will explore three trends that characterize this drive within the military: first, machines and humans become interchangeable because military signaling isn't about semantics, but about the Signal Corps' motto of "getting the message through"; second, the advent of nuclear threat shifts the onus to technical media which independently monitor and create an understanding (meaning) of situations using signals sent by machines; and third, the rise of artificial intelligence and weapons autonomy demands that machines become "incommunicable" – that is, to be secure from hacking and other acts of human interference, the strength of AI weapons' machine-to-machine communication – in the form of swarm intelligence – is being strengthened in order to endow AI weapons with communicative insularity vis a vis their human collaborators.

This chapter takes up these questions by delving into the historical basis of the human–machine communicative couplet as a central tenet of military strategy and tactic. We begin with the US Signal Corps and its founder Albert Myer who developed signing systems for the deaf in his medical dissertation. The Corps worked extensively to integrate humans and machines into a secret signaling system in which the signers themselves need not know the message. We then analyze the military development of IFF, which turns meaning-making over to machines, and to ARPANET as the backbone for networking global HMC and as the terrain upon which (cyber) war is conducted (Arquilla & Ronfeldt, 1996; Van Creveld, 1985). This is particularly telling from a military perspective in which communication and control are inseparable (Bousquet, 2008). While we wouldn't want to over-simplify the similarity between signaling and ballistics as two effective means for altering the behavior of others, Marshall McLuhan (1964) described guns as media technologies; as extensions of fists. This terrain further exposes the dual imperatives around communication and its opposite. Finally, we look at the development of autonomous military technologies and the strategic necessity of creating "perfect incommunicability" between humans and machines to assure full autonomy and protect from hacking. Further research into HMC within military settings must attend to the potential fallout resulting from such machine autonomy, even as the field attempts to grapple with how AI reorients the very conceptual vocabulary of HMC: as Lewis, Guzman, and Schmidt (2019, p. 4) put it, "the underlying, but often unacknowledged and unquestioned, theoretical assumption in the majority of communication research is that it is humans who are communicators and machines that function as mediators… [W]ithin HMC this assumption is challenged by asking what happens when a machine steps into this formerly human role." This chapter provides some historical examples of how these assumptions have been challenged in military settings for more than 150 years.

SECRET SIGNALS IN THE HUMAN–MACHINE COUPLET

One of the fundamental problems faced by all military endeavors is summed up by Friedrich Kittler's claim that "Command in war has to be digital precisely because war itself is noisy" (Kittler, 1997, p. 119). Clausewitz's famous notion of the "fog of war" similarly describes the perceptual and cognitive difficulties created by the field of battle. The sense that signal certainty must be ensured against the backdrop of hostile conditions and even more hostile forces – both of which are conspiring to disrupt and steal signals – creates the conditions in which humans have turned to machines to counteract the many forms of "noise" and "friction" endemic to warfare. Kittler places profound emphasis upon war as the motor that has driven the development of increasingly advanced media systems and forms of human–machine communication. Geoffrey Winthrop-Young calls this Kittler's "war answer" and explains that, for Kittler, "the media a priori [is] collapsed into a martial a priori" (Winthrop-Young, 2011, p. 131). And as Kittler himself observes, the German invasion of France in 1870 marks a decisive moment in which the telegraph comes to reorient the distinct division of military signals from troops (Kittler, 1990). Military commands are finally freed from the necessity of humans (or trained animals) to physically move texts through space. This indexes a key conceptual turning point in warfare and human–machine communication. However, we might look backward a few years and across the Atlantic Ocean to the U.S. Civil War (1861–65) for further insight (Maddalena & Packer, 2014).

Dr. Albert James Myer, soldier for the Union Army, was the first signal officer and (as history has since named him) founder of the United States Signal Corps. It is not merely by chance that the military needed Albert Myer nor that Myer needed the military. In 1844, at the age of sixteen, Myer learned how to work a telegraph while at Hobart College. Four years later he completed a degree in medicine and made a special study of sign language for deaf mutes. At the time of his studies, Myer worked as a telegrapher at the New York Telegraph Company. His thesis developed a binary sign language that gave bodily life to morse code. As his thesis attested, "[i]t is not strange, therefore, that under such circumstances, I should not conceive the idea of aiding, with so simple a speech as can be founded on this principle, those whom the Deity has seen fit to deprive of the natural organ" (Myer, 1851, p. 774). Myer argued, "There is no thing or sight or sound or motion or taste or odor perception sensation or indication," he writes in his doctoral thesis, "but by which or through which ideas and meanings may be intelligibly transmitted and which may thus be used for signal communication" (Myer, 1851, p. 56). Myer's system for the deaf binarized signing into two simple distinct movements: one equated with a dot, another a dash. Myer suggested that sight, hearing, and touch could all interchangeably be made to sign with equal semiotic efficiency. For Myer, the corpus of human sensation was an untapped cornucopia of semiotic capacity that could produce digital certainty.

Myer conceived of his signal system for the military – an application of the same concepts that he had used in his dissertation – while he was serving at Fort Davis, in Texas (History, Army Times). According to the Army's official history (1961), Myer exploited non-verbal long-distance techniques he had seen Native American scouts using for signaling and realized that a visual signal system could be applied by the U.S. military as well in its attempt to settle what was perceived as wide-open terrain. He apparently developed, deployed, and promoted his system himself – he taught it to his own unit in Texas, and it was authorized by the Union War Department in 1858. Myer was made Signal Officer – a position invented for him – in 1860, and as soon as the war broke out, Myer positioned himself and the Signal Office as an important Union advantage over the Confederacy. Myer's system was called Wig Wag and involved a set of coded form of flag waving whose semiotic choreography is absolutely dependent upon the soldier's body. The body's arms move the flag and are the primary (though impermanent) inscription. The body's coronal plane (line of symmetry) becomes key to the system's binary code. The body's eyes become the receiver, the body's brain becomes the processor, and the body's hand records the interpreted message for storage (on the material, non-human medium of paper). So, the entire process of remediation – from what Myers himself calls "transient signal" to "permanent signal" – depends upon the soldier's body. Further, this media solved the unique set of problems endemic to warfare; overcome time and distance (thus visual flags or sonic telegraphs), mobility (thus modular and attached to the railroad), secrecy (thus encoded), and precision (thus binary/mathematical).

More importantly, this system, similar to others developed for long distance signaling such as Chappe's telegraphic system in France, disarticulated the signal from the semantic capacity of the sender and receiver by turning humans into signaling machines as opposed to "speaking" or "communicating" subjects. The humans doing the signaling need not, and in many cases could not and should not, be able to decipher the messages which they were sending. In warfare, signal certainty, not human comprehension, is paramount. Kittler suggests the important distinction derived from the telegraph is that signals could travel separate from humans. An equally important development was the determination that in war, humans could be turned into signaling machines. In terms of military signal strategy, this makes humans and machines interchangeable. Signaling, not the signaler, became paramount. Myers recognized that sight, sound, taste, and touch were interchangeable when digital signaling was the goal. So too humans and machines. Wigwag turned humans into machines – into technical media by dissociating their semantic language with their signaling capacity. This replaceability with machines for humans and humans for machines exposes some of the conceptual slippage (from a Luhmanesque perspective) of differentiating between human and machine. It is in the end, just communication, just signaling, from the perspective of the guided missile.

SIGNAL UNCERTAINTY AND NUCLEAR ANNIHILATION

For thousands of years humans used simple and complex machines to amplify their perceptual capacity to detect enemy signals and threats. Guided missiles have merely complexified the task. Spotting enemies was accomplished through the use of towers, telescopes, conch shells, hot air balloons, airplanes, and eventually cameras that extended human perceptual capacities by amplifying and capturing auditory and visual signals. (Virilio, 1989). With the advent of technical media, new bandwidths, such as the radio spectrum, are used to make meaning and aid in detection. Warfare was no longer a game of cat and mouse, but rather a game of machine and machine. This is to say that the signals produced and those detected were machine signals using visual and auditory spectrums that were often beyond human perceptual capacity. Machines can and do signal, communicate, with each other in ways that are imperceptible to humans. Humans had to learn to "trust" what machines were telling them even if it contradicted human perception and expectation. The Japanese "surprise attack" on Pearl Harbor did not surprise technical media which announced the attack, rather humans chose to disregard and ignore the warnings of their machines (Buderi, 1996).

Radio waves are an easy and important example that leads to "Radio Detection And Ranging" (RADAR). Radar is a meaning-making machine. It sends and receives radio waves that "tell a story" about what is happening "out there" in the space beyond human perception. Radar divides the world into presence and absence, thereby turning space into battle-space. Radar necessitated more sophisticated forms of machine to machine communication so that friendly blips on a radar screen could be separated from enemy blips on a screen. Called Identification, Friend or Foe (IFF), technical processes were created by which machines identify themselves to other machines. The political act of distinguishing friend from foe was ceded to machines.

During the late stages of WWII, networked radar and analog computers automated communication processes and "decoded" machine threats in ways that pushed the limits of machine perception, computation, interconnection, and recollection. Shortly thereafter, following the Soviet Union's successful atomic bomb development in

1949, the U.S. military embarked on the largest computational project in history (Edwards, 1996) to replace a human-based anti-aircraft surveillance system (The Ground Observer Corps) with a semi-autonomous network of machines dubbed SAGE (Semi-Automatic Ground Environment) that would scour the skies of North America for enemy bombers (Packer, 2013). By the time it was operational in 1959, SAGE was so complicated it exhibited qualities typically used to "distinguish(es) organisms from machines" (Dyson, 1997). It was later used as the test-bed to experiment with Leviathan, an early 1970's RAND attempt to create an AI capable of inventing and testing military strategy. In each of these scenarios, humans were seen as imperfect communicators. Humans could fail to recognize bombers or produce false positives. Once sighted, the human chain of command was often slow, inadequately dispersed, and incapable of surpassing the speed of bombers, let alone ICBMs. Humans were also deemed incapable of addressing the full-complement of attack scenarios that would unfold in a real-time attack. Machines on the other hand were promoted as ideal communicative agents, accurate, extensive, and fast enough to counteract the onslaught of nuclear attack (Packer, 2013).

Nuclear war spurred the most far-reaching alteration to HMC by developing ARPANET as a means to maintain signal certainty following nuclear annihilation. The technical and protocological progenitor of the contemporary internet rose out of the imaginary ashes of a post-nuclear world (Levine, 2018). Further, nuclear threat continued to push the development of autonomous forms of computation and communication, including the capacity for signaling to continue following a nuclear attack, even to the point of a "dead hand" (that is to say an inhuman or machine "hand") "pulling the switch" to launch a nuclear counter-attack after all humans capable of doing such work have been killed (Elam, 2018). These machines communicate with each other, tirelessly, ceaselessly, and at a tempo impenetrable to human comprehension. It is only on special occasions, when a potential threat appears, that machines decide human communication is necessary. The ability to decipher between human and machine, as with Turing's famous test, is lost. Everything is communicated via machines, hence the adversary may at any time be a machine.

NETWORKING MACHINES

Faced with this shifting technological landscape, in 2010 then-Secretary of Defense Robert Gates ordered the Army and the Air Force to develop new multi-aircraft piloting technologies. In response, the Army – which deploys its drone pilots to overseas bases – has developed a system by which pilots can oversee two vehicles at once. In 2015, therefore, the Army began to field multi-aircraft control for their cutting-edge drone, the MQ-1C Gray Eagle (Scharre, 2014a, p. 17). This advance in unmanned warfare has been made possible only because the craft possess a remarkable degree of autonomy, having the capacity to take off and land on their own, for example (Center for a New American Security, 2014). Yet this step forward in the autonomous operation of aerial vehicles creates a deluge of additional vulnerabilities. The Gray Eagle's present data transmission systems, for example, are highly sensitive to enemy hacking. Just as telegraph cables and then wireless radio transmissions enhanced the potential for message interception, drones' complex systems of satellite-based communications are highly vulnerable to penetration and sabotage. In fact, in order for drones to operate in the air, unmanned systems require constant, assured communications to remote pilots (Scharre, 2014a, p. 31). This communication link, therefore, is an Achilles Heel of unmanned craft: as former Deputy Defense Secretary Robert O. Work and military strategist Shawn Brimley point out in *Preparing for War in the Robotic Age*, "An actor who dominates in cyber conflict can infiltrate command-and-control networks, generate misinformation and confusion, and potentially even shut down or usurp control over physical platforms. This will be especially true for unmanned systems" (2014, p. 23). As the authors make clear, however, ultimately new transmission media are not radical enough to solve this problem in all its complexity. At least as far back as January 2001, DoD has been worried about terrorists and rival militaries attacking US SATCOM capabilities. At that time, Defense Secretary Donald Rumsfeld warned about a looming "Space Pearl Harbor" (Wirbel, 2004, p. 78). while his colleague Admiral David Jeremiah argued that hostile states – and even the mythical Osama bin Laden – could hack our satellite systems.

While at this time only humans are officially entrusted with "kill" decisions based upon these data, this DoD policy is contradicted by autonomous media/weapons like Raytheon's new Close-In Weapon System, the Phalanx (Stimson Center, 2014, p. 71). To compensate for the data vulnerability, physical impracticality, and financial cost of keeping humans in the command chain, the Phalanx and similar technologies empower computing systems to make kill decisions based on algorithmic determinations of enemyship. Thus, in tracing the history of how communication technologies and humans have cooperatively communicated to overcome military challenges, we have been telling a story that has built more or less logically to the computerized automation of enemy epistemology – and hence, eventually, to the pure fulfillment of what Katharine Hall Kindervater calls “lethal surveillance” (Kindervater, 2017).

In one of the major developments of this military technical revolution, the figure of the “network” has transformed into the figure of the *swarm*. While swarm warfare has important precedents in military history – such as in Alexander the Great’s Central Asian campaigns, the Mongol invasions of Asia and Eastern Europe, Native American attacks on the western frontier, and postcolonial guerilla resistance in Asia and Africa (Arquilla & Ronfeldt, 2000; Edwards, 2005) – logics of robotic autonomy have revolutionized the potential of the swarm. Faced with the failure of networks to solve the problem of overcentralization, military strategists have begun to realize that traditional models of intelligence and command – based, that is, on human cognition and human communication – are inadequate to the challenges of twenty-first-century warfare. The next step in the revolution, therefore, relies on the development of nonhuman models of knowledge and communication. Observing this transition to animal intelligences, military strategist Paul Scharre has remarked that forces will shift “from fighting as a *network* to fighting as a *swarm*, with large numbers of highly autonomous uninhabited systems coordinating their actions on the battlefield. This will enable greater mass, coordination, intelligence, and speed than would be possible with networks of human-inhabited or even remotely controlled uninhabited systems” (Scharre, 2014b, p. 8). While humans could retain a degree of supervisory contact with the swarm, “the leading edge of the battlefront across all domains would be unmanned, networked, intelligent, and autonomous” (Work and Brimley, 2014, p. 29). In military parlance, these stages of swarm warfare constitute the “kill chain” of twenty-first-century autonomous missions: Find, Fix, Track, Target, Engage, Assess (United States Air Force, 2014). Today, military AI projects like the DoD’s Project Maven capitalize on the mnemonic labor carried out by previous missions, allowing the kill chain to grow faster, smarter, and more precise with every deployment (Tucker, 2017).

With its extraordinary capacities for intercraft cooperation, the swarm is seen as an ideal technological arrangement for dispersing the fog of war. Upending the metaphorical connotations of Clausewitz’s “fog,” swarms operate through a “combat *cloud*” that is driven by collective interoperability (Stimson Center, 2014, p. 26). Traditional military networks, of course, had to safeguard their principal nodes of intelligence against enemy attack. But with swarms, this epistemological center of gravity is a thing of the past. In a radical departure from human–machine command and control, which requires communication between psychically isolated cooperating subjects, the swarm cloud possesses a continuously refined, emergent collective intelligence that is far beyond the grasp of humans’ physiological capacity. These swarms continuously reorient their collective intelligence – they are even “self-healing” in the event of companion loss, which they compensate for by readjusting the epistemological topology of the swarm (Rubinstein & Shen, 2008; Scharre, 2014b, p. 32). These decisions for topological restructuring can be accomplished by the use of “voting” mechanisms, which could allow swarms to achieve a decentralized epistemology that is inconceivable among networked human combatants (Scharre, 2014b, p. 26). This emergent intelligence is made possible by what military strategists call “implicit communication,” which is modeled on the cooperative epistemologies of flock and school animals like birds, ants, and fish. Although the RAND Corporation and the U.S. government have been funding military research in “microrobotics” since the early- and mid-1990s (Solem, 1996), new manufacturing technologies, such as 3-D printing, have made it possible for DoD affiliates to develop swarms which take the physical form of dragonflies, “robobees,” houseflies, remoras, hornets, eels, and other animals that cooperate with distributed intelligence. This development could allow DoD to deploy thousands or even billions of tiny, cheaply produced, cooperative drones that could be released into the field of combat in order to carry out reconnaissance and locate enemy combatants (Scharre, 2014b, p. 20).

PERFECT INCOMMUNICATION

Outfitted with sophisticated onboard sensors, these swarms can perform attack assessments before they strike, thus enabling them to collectively refine their knowledge of the enemy and coordinate their attacks accordingly. As these developments and related escalations suggest, the fog and chaos of the battlefield really only have one solution: machine epistemology. We have finally reached the situation foreseen by Manuel Delanda, who feared that “in the modern battlefield, full of noisy data, commanders will feel only too tempted to rely on the accumulated expertise stored in [machines'] arsenals of know-how, and will let the computer itself make the decisions. Further, only computers have fast access to all the 'perceptual' information about a battle, coming from satellite and ground sensors, so that a commander confronted by the noisy data emanating from the battlefield might … allow it to mutate from a mere smart prosthesis, a mechanical adviser, into a machine with executive capabilities of its own" (Delanda, 1991, p. 81). Formerly prosthesis, the machine is stepping into its more fitting roles of sage, executive, and executioner. By computational necessity, these intelligent weapons will only be able to follow kill commands devised by machines, based upon coordinates formulated by machines, targeted at the enemies of machines.

With digital military media, incommunication is often used to assert control over particular domains. No fly zones, for example, establish spaces in which enemy craft cannot – either legally or technically – operate. Geofencing, too, establishes these boundaries by erecting a digital domain in which unapproved craft cannot receive incoming communications. For unmanned vessels, this means that remote control ceases and that craft-to-command communications abruptly halt. With geofencing, therefore, corporations and governments can create domains of exclusive communication and command. And because warfare has gone so thoroughly digital, cutting off an enemy's C4 capacity prevents the vast majority of activities that are now intelligible as war.

There are other ways, too, that ultimate success in digital warfare demands the establishment of perfect incommunicability. Because this ideal can only be accomplished through the communications perfection offered by robotic autonomy, the drone must be able to freely choose how best to carry out its mission. Human communicative fallibility (with its narrow bandwidth, faulty memory, slow and irrational processing, and weak signaling) must be removed from military communications for the drone to truly fulfill its mission. Zac Kallenborn, of the National Consortium for the Study of Terrorism and Responses to Terrorism, describes how unmanned launch platforms can be used to aid in overcoming these vulnerabilities: "Unmanned launch platforms are useful over manned, because there is lower risk to manned operators and it allows much greater system integration. The unmanned ship might provide recharging, communication, and data processing for the larger swarm" (Hambling, 2021). For Kallenborn, the system integration allowed by automating all aspects of communication provides a substantial advantage over current human-centered control strategies. By offloading all these capacities to an integrated machine system, the bungling human can be sidestepped in favor of a more flawless internal command system. And this emphasis on internality, of course, is a deliberate attempt to create a space of human incommunicability – a space where human commands, hacks, and distortions cannot threaten the system.

Robert O. Work, who was U.S. Deputy Secretary of Defense under Obama and Trump, argues that commanders will have to gain comfort "delegating" more and more tasks to machines. For Work, "The problem is that when you're dealing [with war] at machine speed, at what point is the human an impediment? … There's no way a human can keep up, so you've got to delegate to machines" (Fryer-Biggs, 2019). Because we have allowed media escalation to produce a situation in which carbon-based impediments cannot "keep up" with machines, Work argues that we will now have to tolerate them processing information that is too esoteric for human organs. Robert Brizzolara, who works in the Office of Naval Research and leads the Navy's Sea Hunter AI project, explores this problem from a similar vantage point. According to Brizzolara, command will simply have to "trust" military AI to carry out its duties: "Sailors and their commanding officers are going to have to trust that the autonomous systems are going to do the right thing at the right time" (Fryer-Biggs, 2019). Because human approval and human command would prevent the machine from carrying out its mission at the highest speed and efficiency, command must cut the cord of human oversight and empower the machine to do what it perceives to be "the right thing at the right time."

These developments are indicative of a broader trend in the military/media relationship. As Geoffrey Winthrop-Young describes, we are now in a situation in which media are "moving ever farther away from their human subjects" (Winthrop-Young, 2017, p. 2). Drone swarms are simply a stark illustration of digital media's rapidly accelerating departure from the realm of human collaboration and human perception. For Winthrop-Young, the story of digital media's infiltration into our lives, and especially into our military command, is a "tale of deception…. The ability of digital media to store, process, and communicate levels of the real inaccessible to human perception comes at the cost of humans no longer being able to determine whether that which is allegedly processed by media is not in fact produced by them" (Winthrop-Young, 2017, p. 2). Digital media have pushed information processing into a realm insensible to humans: as Kittler would have it, they simply "fool" us into thinking that they share communicative capacities in common with us, while in fact they operate "in frequency ranges that exceed human perception thresholds, that is, in those domains where technological media operate simply because otherwise they would not be able to systematically fool our eyes and ears" (Kittler, 2017, pp. 12–13). Media technology, in other words, is in the business of deceiving us into thinking it operates according to humanistic perceptual categories. It specializes, rather, in an esotericism that straddles the line between deception and incommunication.

The greatest trick that digital military media have played on the fools, therefore, is that it has convinced us that we are its partners in command and control. Yet at the same time, it has gradually taught us that warfare is no longer a suitable domain for human communication. Various military blocs, their citizens and their policy makers are assured that to insist on human communication with the machine is to risk being obliterated by the Russians or the Chinese or the Americans. Under this imminent threat, escalation is the only answer. And accordingly, any trace of the human is an insidious infection, a threat to the security and intelligence – to the very life – of the autonomous system. While a postoperative surgeon may check "the margins" in a search for remaining malignant tissue, humans may not be able to properly sense the ripple effects of their own presence in the system, however diminished. In that sense, humans cannot be counted on to remove all that is "human" from the drone. Only the drone is capable of that.

CONCLUSION AND FUTURE WARNINGS

HMC in the historical context of warfare highlights dueling desires and imperatives that have arisen when enmity, not cooperation, rule. We have chosen to focus on three moments in which the relation between humans, machines, and the capacity or desirability to make meaning and communicate has been uprooted. In the first moment of flag-based semaphore, humans are turned into machines that signal, but do not themselves make meaning. The presumed roles of human and machine are overturned. The second moment sees the development of increasingly sophisticated machines that communicate with and about other machines in bandwidths and at speeds beyond human perception. Humans are seen as inferior to machines in the realm of military communication. Finally, in our third moment, truly autonomous machines, those which cannot be communicated with by humans, are presented as the only solution to the problem of human communicative meddling into machine warfare. Human–machine communication is seen as a threat and as such must be evacuated.

A future featuring perfect incommunicability as a military desire is one that highlights some of the challenges facing HMC scholars in a world in which animosity is the guiding principle for the development of many communication techniques and technologies, particularly those involving HMC. Warfare, and its attendant subdisciplines spy craft, propaganda, and disinformation, present the human and machine as operating in a field of constant struggle in which miscommunication or the *inability* to properly know, understand, or alter the intentions of another are desirable features, not signs of failure. HMC scholars might even be seen as "enemies" within such a framework as their telos is one of understanding, decoding, and making visible that which is unseen.

Conversely, recognizing the centrality of HMC to contemporary and future warfare should also suggest that knowledge produced about HMC opens new avenues and routes for its application to warfare. As Julie Carpenter's research with the U.S. military's Explosive Ordnance Disposal units clarifies, "each bit of gained insight into the human side of human-robot interactions contributes to an understanding and influence of controllable variables (e.g., design, training) for the most positive intended outcomes of human-robot teamwork" (Carpenter, 2016). As we have argued at length (Packer & Reeves, 2020a, 2020b), the epistemological, technical, and strategic capacities created by new communication technologies and techniques have historically and will necessarily continue to produce new capacities for engaging in warfare. From this perspective, HMC scholars are active or unwitting "friends" of the military whether they are funded by DARPA or the International Peace Research Association. This is not a critique of HMC scholarship per se, but rather an acknowledgement that communication has been and will remain a vital feature of military capacity and strategy. All knowledge that can produce strategic advantage will be applied by military operatives. Christopher Simpson's research clearly established that the CIA, Pentagon, and numerous U.S. security agencies were central to the establishment of modern communication research and the distinct discipline of communication (Simpson, 1996). The lessons from this militaristic past should be especially resonant within the HMC scholarly community as communication research is not only important in ideological struggles as it was in the past, but rather is the very backbone of military C4 capacity. As such, its prominence as a strategic nodal point cannot be understated.

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