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The Human Use of Human Beings: Suicide Bombing, Technological Innovation, and the Asymmetry of Modern Warfare

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ABSTRACT: Suicide bombing remains by far the most lethal weapon readily available to terrorist groups. The systematic means by which organizations pressure individuals into becoming living bombs demand that we understand suicide bombing as a technology, an alternative and relatively inexpensive means by which militants have been able to approximate the electronic control systems of states. Such an analysis of suicide bombing is consistent with the history of technology, in which human beings have repeatedly been used as data processing units. By recognizing how and why alternative technologies such as suicide bombing have become so effective we can begin to understand why the expensive and complex weapons deployed by states are sometimes ineffective for combating insurgency resulting in a tremendous mismatch in costs incurred by the two sides. To begin closing this gap state forces must recognize that complex machinery is not necessarily superior to simple devices, and should whenever possible pursue simple, robust solutions to the challenges of modern combat rather than selecting the most expensive and complex option by default.

Keywords: suicide bombing, terrorism, technology, history, modern warfare.

Introduction

Fifteen years after the devastating 9/11 terrorist attacks against the United States, suicide bombing remains by far the most lethal weapon available to terrorist and insurgent groups.[1] A recent analysis of data compiled by researchers at the University of Maryland's START Center reveals that after a brief decline between 2007 and 2011, the global number of suicide attacks has increased dramatically, reaching a historical high in 2015.[2] Significantly, while suicide bombings comprise a small percentage (less than

1 The ideas in this essay have been drawn from the Introduction to Jeffrey William Lewis, *The Business of Martyrdom: A History of Suicide Bombing* (Annapolis: Naval Institute Press, 2012). I am grateful to NIP for allowing me to republish, in revised form, key ideas from the book.

2 Institute for Economics and Peace, "Global Terrorism Index 2014: Measuring and Understanding the Impact of Terrorism" 32, http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014_0.pdf; also see the revised report with data for 2014, "Global Terrorism Index 2015," http://economicsandpeace.org/wp-content/uploads/2015/11/Global-Terrorism-Index-2015.pdf,

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five) of overall terrorist attacks, this relative rarity is offset by suicide bombing's lethality: since 2000 the average suicide bombing has killed 11 people, 4.5 times the number killed by any other form of terrorist violence.

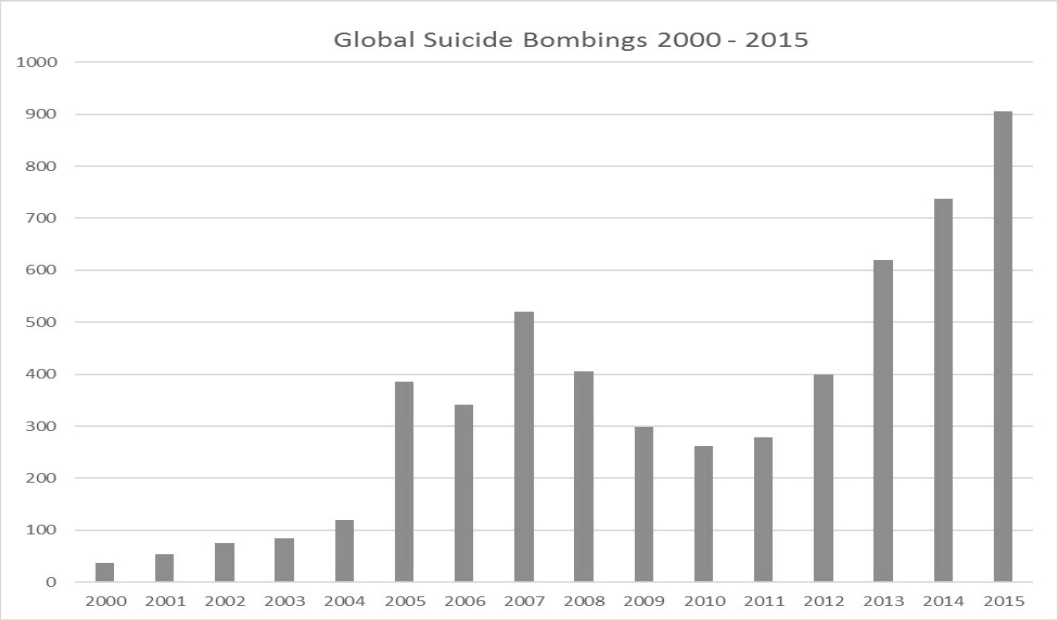

TABLE 1: Global Suicide Bombings, 2000-2015[3]

Suicide bombers are exceptionally lethal because they are able to affect the exact placement and timing of a bomb interactively, during the course of the mission, which greatly improves accuracy and impact. By concealing explosives either on their bodies or in vehicles, suicide bombers are also able to introduce their weapons into extremely vulnerable populations, while traditional bombers have been faced with the challenge of planting a bomb, leaving the area, and then detonating the weapon reliably via some form of remote control.

Nevertheless, understanding the nature of suicide bombing remains problematic. When radical groups such as Hizballah first began using suicide bombing, analysts tended to seek understanding by focusing on the psychology and radicalization of individual bombers. However, it is now very clear that the mindset of suicide bombers can vary immensely, from the willing volunteers who travel to the Middle East to be suicide attackers for Daesh to the young women abducted by Boko Haram and forced into becoming unwilling suicide attackers. Instead, we now recognize that the most important common factor in nearly all instances of suicide bombing is the role played by organizations.[4] Suicide bombing is therefore the organizational use of human beings as control systems for bombs.

The "suicide bomber as smart bomb" metaphor that we hear so often can therefore be taken literally and we should indeed understand suicide bombing as a form of technology. It is an alternative path toward developing control systems that approximate

3 For a detailed discussion of the sources for this graph, see "Appendix: Open Source Statistics on Suicide Bombing" at the end of this article.

4 Bruce Hoffman and Gordon H. McCormick, "Terrorism, Signaling, and Suicide Attack," *Studies in Conflict and Terrorism* 27 #4 (2004), 243-281; see esp. 255.

the capabilities of the electronic guidance systems produced by states. Suicide bombers are thus representative of a trend in the development of technology by non-state actors such as guerrilla and terrorist groups—the development of simple, robust, and inexpensive weapons that make up for in effectiveness what they lack in material sophistication. This alternative technological strategy has contributed significantly to the asymmetry in modern combat in which relatively poor insurgents have been able to challenge the multi-million (and in some cases multi-billion) dollar weapon systems of their state adversaries.

"Blind Spot"

In July 2001, FBI agent Ken Williams filed an electronic memo with his superiors in which he suggested that Osama bin Laden was making a sustained effort to send his followers to the United States to learn to fly commercial airliners at civil aviation colleges. The memo was based on fieldwork through which Williams had determined that an unusual number of individuals who were of "investigative interest" for the Bureau had registered for flight schools in Arizona.[5] In the aftermath of the 9/11 attacks, this report appeared to be prophetic, prompting inquiries into exactly why the FBI had not acted on the "Phoenix Memo." The Bureau's defense was that the memo had been little more than a hunch; Williams himself did not think in terms of hijacking, but rather believed that al Qaeda was planning a long-term infiltration of the civil aviation industry. Thus, even when presented with this information, the American intelligence community was unable to anticipate the nature of the threat posed by passenger aircraft used as weapons, despite the fact that al Qaeda had already repeatedly made use of suicide bombers for its most spectacular attacks. In its evaluation of the situation, the National Commission on Terrorist Attacks upon the United States (commonly known as the 9/11 Commission) attributed this lack of foresight to an overall lack of imagination on the part of intelligence agencies when dealing with the threat of terrorism.[6] This explanation is only partially true.

Analysts did indeed have difficulty imagining something along the lines of the 9/11 attacks, but this does not imply that they were not applying their imaginations to the world of terrorism and mass casualty attacks. Indeed, their imaginations were running wild, but down all the wrong paths. Since the second Bill Clinton administration, analysts had been certain that terrorists were on the verge of carrying out mass casualty attacks using so-called weapons of mass destruction—nuclear, biological, and chemical weapons. This obsession became so deeply ingrained in the thinking of the security community that analysts could no longer imagine the use of any other type of weapon for such a scenario. Timothy Naftali writes that as of 2001 "No one assumed that al Qaeda would press forward with a mass casualty event that required only conventional weapons."[7] This despite the

5 *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States.* Authorized Edition (New York: W.W. Norton and Company, 2004), 272.

6 Ibid, 339-48.

7 Naftali, *Blind Spot,* 318; George Friedman suggests that it was the inability of security officials in the

fact that al Qaeda had repeatedly used suicide bombers to carry out mass casualty attacks against the United States and had *never* used chemical, biological, or nuclear weapons.

Analysts in the American security community tended to be locked into a style of thinking which equated military power with technology, very narrowly defined. From this perspective technology consisted entirely of material devices independent of human context. Since technology could be understood exclusively in material terms, newer and more complex systems, understood as "high-tech," were taken to be inherently superior to less complex technological systems.[8] Analysts therefore projected their own thinking and biases regarding technology onto their adversaries, imagining that terrorist groups, like states, would need complex technologies to carry out high consequence operations. The 9/11 attacks proved all of these assumptions wrong.

Since American security officials tended to think of technology in terms of devices rather than people they could not recognize suicide attackers as a sophisticated form of guidance technology because physically there is little resemblance between a human suicide attacker and a satellite-guided bomb. Both systems nevertheless perform the exact same task—they both allow human intelligence to affect guidance and detonation of an explosive interactively in real time. In technology this is the yardstick that really matters—how well a particular system does a given job—not whether or not different approaches to the same job resemble one another physically.[9] Thus the tendency to understand technology in material terms that hampered analysts prior to the 9/11 has since blinded them to the true nature of suicide bombing.

Solving Problems

From a historical perspective equating technology with physical devices is relatively recent in comparison with a much longer tradition of understanding technology as knowledge. The root of the word is the Greek *tekhne,* meaning art, craft or skill. For centuries people understood technology as knowledge or doing, which was perfectly sensible since throughout much of human history the tools and devices at hand really were relatively simple and it was human skill that made them useful. By the nineteenth century, European users of the term still emphasized description or teaching about the arts, especially the practical arts. By the turn of the twentieth century this meaning began to change somewhat, and Europeans took to differentiating between *technique,* meaning procedures of working with material culture, including engineering, and *technology*, the

United States to understand how terrorists would solve the problem of guidance that prevented them from seeing aircraft as cruise missiles prior to September 11. George Friedman, *America's Secret War: Inside the Hidden Worldwide Struggle between America and its Enemies* (New York: Doubleday, 2004), 95.

8 Timothy D. Hoyt, "Technology and Security," in Michael E. Brown (ed.), *Grave New World: Security Challenges in the 21st Century* (Washington: Georgetown University Press, 2003), 26.

9 Steven Johnson, *Where Good Ideas Come From: A Natural History of Innovation* (New York: Riverhead Books, 2010), 16.

study of such activities.[10]

In the twentieth century, as tools and machines have become progressively more complex, and more important, as human skill has been transferred to machines as a consequence of mechanization and automation, machines came to be seen as technology whose purpose is to replace rather than to complement human skill. Despite the advances in machinery, automation, and control, however, the abilities of machines remained task specific and limited vis-à-vis human flexibility and creativity. Seeing machines as the sum total of technology, therefore, limited very dramatically how many people think about technology.[11]

There is, however, a well-established tradition in which technology is understood much more broadly. Leaders in the business world often define technology as an activity or a mode of problem-solving that involves the mutual interaction of ideas and material devices. Peter Drucker, an iconic figure in the study of business management, drew comparisons with human biology to conclude that technology was about human activity, not physical things.[12] Joel Mokyr began his highly regarded analysis of the modern information economy by writing: "Simply put, technology is knowledge, even if not all knowledge is technological," and continues "Hence useful knowledge…deals with natural phenomena that potentially lend themselves to manipulation, such as artifacts, materials, energy, and living beings."[13] Thomas Hughes, a widely respected historian, defined technology as "the *effort* to organize the world for problem-solving so that goods and services can be invented, developed, produced, and used."[14] This definition holds that much of technology—people and ideas—is intangible.

One of the most widely read texts about technological innovation in the business world, Everett M. Rogers' *Diffusion of Innovations,* takes a similar approach. Rogers' definition of technology incorporates Hughes' insight that technology is an idea or process with another important theme for the current analysis, control. Rogers argues that "A *technology* is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome."[15] This short definition links what technology is (i.e. ideas), with what technology is for (i.e. solving problems).

The Mechanization of Man

Throughout history human beings have been integrated into technological systems with

10 Eric Schatzberg, "*Technik* comes to America: Changing Meanings of *Technology* before 1930" *Technology and Culture* 47 # 3 (June 2006), 486-512, here 488-90.

11 Harvey Brooks, "Technology, Evolution, and Purpose," *Daedalus* 109 #1 (1980), 65.

12 Peter F. Drucker, *Technology, Management, and Society* (New York: Harper Colophon, 1977), 45.

13 Joel Mokyr, *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Princeton: Princeton University Press, 2002), 2-3.

14 Thomas P. Hughes, *American Genesis: A Century of Innovation and Technological Enthusiasm* (New York: Viking, 1989), 6.

15 Everett M. Rogers, *Diffusion of Innovations* Fifth Edition (New York: Free Press, 2003), 13.

the most common human use of human beings being slavery. Although its precise form has varied from time to time and from culture to culture, slavery—the use of involuntary human labor—is a technology whereby some human beings are used by others because of their ability to work, think, or otherwise act on materials and assist in creating goods, products, or services for human consumption. No less a figure than Aristotle said: "A slave is property with a soul," a "living tool." He compared human slaves directly with draft animals, and concluded that "the use of domestic animals and slaves is about the same; they both lend us their physical efforts to satisfy the needs of existence."[16] The technology of slavery resulted from a mental rather than a physical innovation—the perception that different human groups were not equal. This mental construct, racism, made slavery possible by allowing one group of humans to understand another group as being less than human and therefore subject to use by full humans.[17] Once this step was taken, the forced domestication of humans proved to be no more troubling to the conscience of the slaveholder than the domestication of animals had been to the farmer.

It is not only human physical labor that has been exploited in technological systems, but human mental labor as well. For nearly two and a half centuries, from the first recorded use of the term computer in 1646 until 1897, the tedious, repetitive calculations known as scientific computation, or as we would call it today, data processing, were done by human beings who were called computers.[18] The Oxford English Dictionary still defines computer first as "One who computes; a calculator, reckoner; *spec.* a person employed to make calculations in an observatory, in surveying, etc." The term was first applied to a mechanical calculating device in 1897. Only in 1946 was the term applied to ENIAC, the first large-scale, general-purpose electronic computer. [19]

By the late 1800s, people were being used as components within extremely sophisticated computational systems. Teams of people were used as living calculating machines to carry out the numerical computations increasingly required by scientific and military projects. Managers broke tasks down into discrete steps and then presented these steps to the "computers" who carried out repetitive mathematical computations by hand, eventually providing management with tables of processed data. In the years before electronic computers, human beings interfaced with mechanical devices in an increasingly professionalized and mechanized bureaucracy.[20] By the Second World War

16 Quoted in Donald Cardwell, *Wheels, Clocks, and Rockets: A History of Technology* (New York: W.W. Norton and Company, 1995), 18.

17 Alan Beyerchen, "Rational Means and Irrational Ends: Thoughts on the Technology of Racism in the Third Reich," *Central European History* 30 #3 (1997), 386-402.

18 David Alan Grier, *When Computers Were Human* (Princeton: Princeton University Press, 2005), 5.

19 Walter Isaacson, *The Innovators: How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution* (New York: Simon and Schuster, 2014); Chapter 2 (35-86) covers the development of ENIAC while Chapter 3 (87-130) covers the ongoing importance of human programmers as part of the overall system in a way that is consistent with this argument.

20 James R. Beniger, *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge: Harvard University Press, 1986) esp. 390-425; Martin Campbell-Kelly, William Aspray,

human and machine elements were integrated into hybrid control systems in which both elements, human and machine, were engineered and modified to improve system performance. Harold Hazen, an engineer at the Massachusetts Institute of Technology, summed up this approach in a memo to Warren Weaver, at that time on the National Defense Research Council. Hazen wrote "This whole point of view of course makes the human being…nothing more or less than a robot, which, as a matter of fact, is exactly what he is or should be."[21]

By the 1960s human beings were still being used in sophisticated control and computational systems, but they were increasingly becoming redundant design elements, that is, backups to be used in case the electronic computers failed, not primary computational elements. NASA engineers thought in these terms.[22] Their counterparts in the Soviet Union went further and began to use machine terms to evaluate potential cosmonauts and to engineer people through conditioning to fit mechanical systems. A Soviet cybernetics specialist, Igor Polatev, asserted that repetitive training was the key to mechanizing people and thereby avoiding human error. He wrote: "The less his various human abilities are displayed, the more his work resembles the work of an automaton, the less [the human operator] debates and digresses, the better he carries out his task." For their part, Soviet cosmonauts protested the "excessive algorithmization" of their behavior.[23]

A Behavioral Compression Algorithm

Recognizing suicide bombing as a form of control technology, therefore, draws on a long history of the human use of human beings as the data processing elements in technological systems. Although in many contexts, silicon-based electronics guided by software have innumerable advantages over people, in certain contexts human "liveware" can still offer an advantage relative to silicon-based hardware. This is especially true in suicide bombing, for by substituting human beings for electronic computers suicide bombing provides a dramatic increase in efficiency by charging its human computers with tasks for which they are very well suited, such as visual recognition, discrimination and decision making. Computers still lag behind people in these regards.[24]

The organizations that deploy suicide attackers obviously must restrict the bombers'

Nathan Ensmenger, and Jeffrey R. Yost, *Computer: A History of the Information Machine* Third Edition (Boulder: Westview Press, 2014), 21-40.

21 Quoted in David A. Mindell, *Between Human and Machine: Feedback, Control, and Computing Before Cybernetics* (Baltimore: Johns Hopkins University Press, 2002), 283-4.

22 Stephen B. Johnson, *Secret of Apollo: Systems Management in American and European Space Programs* (Baltimore: Johns Hopkins University Press, 2002), 125.

23 Slava Gerovitch, "Human-Machine Issues in the Soviet Space Program," Ch. 4 of Steven J. Dick and Roger D. Launius, eds., *Critical Issues in the History of Spaceflight* (Washington, DC: NASA Office of External Relations, 2006), 107-140; quote from 122.

24 Peter W. Singer, *Wired for War: The Robotics Revolution and Conflict in the Twenty-first Century* (New York: Penguin Press, 2009), 76-7.

behavior in significant ways to ensure that they will carry out their missions as planned. Limiting the freedom of the individual involves stripping away alternatives and leaving only a narrow mission scenario as the socially acceptable action for an individual or individuals. This behavioral compression is the true technological innovation of suicide bombing—restricting the behavior of certain human beings so that they can be used reliably by other human beings.

There is ample precedent for understanding a set of routines that transforms the behavior of an agent to be a form of technology, even if the set of routines itself is completely immaterial. Brian Arthur mentions digital compression algorithms as such a form of technology.[25] Digital compression algorithms, the best known of which is probably the MP3 format that compresses audio files without noticeable distortion, are a significant part of the technology of digital music and video storage and transmission. Without such algorithms, much of the consumer electronics market could not exist, yet by necessity these algorithms are invisible, executing their operations without altering the content of their subject files in any perceivable way.

Whereas the purpose of the MP3 format is to compress the size of audio files, the purpose of suicide bombing is to compress the space of behavioral possibilities available to individuals or small groups of individuals. Organizations that deploy suicide attackers have therefore developed a wide range of training procedures that allow them to control the behavior of prospective bombers in a systematic manner. These training strategies range from exploiting the enthusiasm of willing volunteers to compelling the acquiescence of unwilling victims.

The Spectrum of Self-Sacrifice

Since 2013 the most discussed national security story in the United States has been the growing power of the militant group Daesh (also referred to as ISIS, ISIL, or the Islamic State). In May 2015 the group captured the city of Ramadi, capital of Iraq's Anbar province, after nearly 17 months of conflict. The most important weapon in Daesh's arsenal during this offensive was the car bomb, with those driven by suicide attackers being especially devastating.

During the first three weeks of May 2015 alone Daesh deployed no fewer than 57 car bombs (vehicle borne improvised explosive devices—VBIEDs).[26] These bombs killed and injured hundreds. Many of Daesh's vehicular bombs were captured Humvees that had originally been given to the Iraqi military by the United States. Trucks deployed by

25 W. Brian Arthur, *The Nature of Technology: What It Is and How It Evolves* (New York: Free Press, 2009), 28; also see Jonathan Sterne, *MP3: The Meaning of a Format* (Durham and London: Duke University Press, 2012).

26 For a detailed analysis of recent attacks with links, see "Aftermath of the Fall of Ramadi in Iraq," Musings on Iraq blog, May 25, 2015, http://musingsoniraq.blogspot.com/2015/05/aftermath-of-fall-of-ramadi-in-iraq.html.

Daesh carried massive payloads—some of the blasts unleashed in Anbar province were as powerful as the Oklahoma City bomb detonated by Timothy McVeigh in 1995.[27] In addition to their power, vehicular bombs are very difficult to anticipate and intercept. According to Brian Castner, an American Explosive Ordnance Disposal officer in Iraq in the early 2000s, car bombs were the single most challenging weapon to stop. During his two full tours in Iraq Castner's team was only able to disarm one car bomb safely, and then only after they had killed the driver.[28] The combination of armored vehicles and jihadi suicide bombers has become so effective that JIEDDO (Joint Improvised Explosive Device Defeat Organization), the unit created by the Pentagon in 2006 to combat IEDs, is now hurrying to develop appropriate countermeasures.[29]

Like the drivers behind Daesh's car bombs, the majority of suicide bombers have been suicides in the truest sense, having been both willing and able to take their own lives. The willingness to die, however, need *not* be present in order for an organization to make successful use of human bombers, as demonstrated by the systematic use of child suicide bombers by the Nigerian radical group Boko Haram. In 2015 Boko Haram carried out 151 suicide attacks in Nigeria and surrounding countries. Of these attacks, roughly 20 percent were carried out by teenagers or children, 75 percent of whom were girls. The great majority of these child bombers were abducted by the organization and forced against their will to deliver bombs, in some cases against the children's own families or communities. To turn young children into human bombs the organization utilizes a range of vicious procedures, including physical coercion, intimidation, rape, and drugs, all of which are meant to destroy the freedom of the child so that he or she will carry out the will of the group's leaders.[30]

While shocking in its ruthlessness, the behavior of Boko Haram in this respect is consistent with the history of suicide bombing. Already in the 1980s Ariel Merari realized that at least some "suicide" attacks were really nothing of the sort.[31] Instead, drivers had been directed to deliver a bomb to a target, after which time the bomb was detonated by remote control without the bombers' consent. The Provisional IRA even tried a variation of this type of attack in 1990. In this instance, the IRA held the family of a 54-year-old man named Patsy Gillespie hostage in order to force Gillespie to drive a truck carrying

27 For detail on the different types of vehicular bombs deployed by Daesh, see 333Malcolm Nance, *Defeating ISIS: Who They Are, How They Fight, What They Believe* (New York: Skyhorse Publishing, 2016), 325-30.

28 Brian Castner, *The Long Walk: A Story of War and the Life that Follows.* (New York: Doubleday, 2012), 87.

29 Sean D. Naylor, "The Islamic State's Best Weapon Was Born in the USA," http://foreignpolicy.com/2015/06/04/hell-on--heels/?utm_source=Sailthru&utm_medium=email&utm_term=*Situation%20Report&utm_campaign=SitRep0605&wp_id_n=479522379.

30 Dionne Searcy, "Boko Haram turns Female Captives into Terrorists," *New York Times* 7 April 2016, http://www.nytimes.com/2016/04/08/world/africa/boko-haram-suicide-bombers.html?_r=3; "Boko Haram Crisis: 'Huge Rise' in Child Suicide Bombers," BBC Online 12 April 2016, http://www.bbc.com/news/world-africa-36023444.

31 Ariel Merari, "The readiness to kill and die: Suicidal Terrorism in the Middle East," in Walter Reich, ed. *Origins of Terrorism: Psychologies, Theologies, Ideologies, States of Mind* (Washington DC: Woodrow Wilson Center Press, 1990), 192-207; here 194-5.

a 1,000 pound bomb to a British Army checkpoint. When Gillespie was stopped by soldiers, IRA members detonated the bomb by radio remote control, killing Gillespie and five British soldiers.[32] Insurgents in Iraq used mentally disabled young women to similar effect in late 2007.[33]

Although Patsy Gillespie's psychological motivation differed enormously from those of Boko Haram's child bombers or Daesh's voluntary suicide bombers, they played the exact same functional role in their respective attacks. In all cases the bombers were merely components—the control systems—of a larger weapon whose complete destruction was a necessary and anticipated consequence of a successful mission. This weapon was in turn used by other actors—the leadership of the responsible organizations—who were not even physically present at the site of the attack. This relationship, the organizational use of human intelligence for purposes of weapon guidance and control, is the defining characteristic of suicide bombing and is therefore the key to understanding it.

Suicide bombing as a technology must therefore be understood in terms of the *function* of the human bomber—how the individual is used by the organization responsible for planning the attack. Such an emphasis on function reveals that suicide bombers are not agents of violence, nor can they be considered users of the weapons they transport. Instead, they are control systems—human liveware trained specifically to carry out the tasks for which most militaries use hardware and software. It is their intelligence—their ability to recognize and respond to the environment in real time, to discriminate and to make decisions—and not their fighting ability that contributes to the effectiveness of the weapon and to the potential success of the mission.

"Their Answer"

In recent decades the American government has invested billions of dollars into a host of artificial intelligence systems to replicate human powers of cognition. For example, research into artificial intelligence sponsored by the US Department of Defense has led to the creation of autonomous vehicles that can navigate unfamiliar terrain without human guidance in order to remove American military personnel from combat and therefore from harm. Unmanned aerial vehicles (UAVs), commonly called drones, have become commonplace on the modern battlefield. Both autonomous and remotely operated vehicles represent efforts to minimize casualties inflicted by relatively low tech insurgents. In the words of US Navy researcher Bart Everett, "To me, the robot is our answer to the suicide bomber."[34]

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32 Jamie Dettmer and Edward Gorman, "Seven dead in IRA 'human bomb' attacks" *The Times* October 25, 1990, and David McKittrick, "IRA's new tactic breaches security forces' defenses" *The Independent* October 25 1990. Also see discussion in Mia Bloom and John Horgan, "Missing their Mark: The IRA's Proxy Bomb Campaign," *Social Research* 75 #2 (2008), 579-614.

33 Steven R. Hurst, "2 mentally disabled women blown up," *Associated Press* 2 February 2008.

34 Quoted in Singer, *Wired for War,* 62.

Everett's words seemed strikingly prescient early on the morning of July 8, 2016. At that time, officers from the Dallas Police Department deployed a bomb disposal robot against a suspect who had killed five officers and injured seven others. The suspect, now identified as Micah Xavier Johnson, had barricaded himself in a building, refused to negotiate, and continued to fire on police officers. Given the danger of the situation, the officers decided to deploy the robot not to disarm a bomb, but instead to deliver a bomb. They attached an improvised explosive bundle to the robot's extension arm and then detonated the device by remote as soon as it was close to the shooter.[35] The use of a robot to kill a suspect was unprecedented in American law enforcement history, but is very much consistent with the use of automated lethal systems on the modern battlefield in that the motivation was to use machines to remove people from the risks of combat.

It is ironic that robots represent "our" answer to suicide bombing since suicide bombing itself was originally "their" answer to the high technology systems deployed by western nations and their allies. Indeed, terrorist groups have justified the use of suicide bombers for precisely this reason. In the context of the Israeli-Palestinian struggle, a member of Hamas' Izz al-Din al Qassam Brigades told the journalist Nasra Hassan: "We do not have tanks or rockets, but we have something superior—our exploding Islamic human bombs. In place of a nuclear arsenal, we are proud of our arsenal of believers."[36] Similarly, signs in the classrooms of Al-Najah University in Nablus in and the Islamic University of Gaza read: "Israel has nuclear bombs, we have human bombs."[37]

Technology—whether "their" answer or "our" answer—is thus the physical manifestation of cultural values.[38] When technologically advanced states employ their most sophisticated weapons they are carrying out military operations and at the same time they are also legitimizing their own societies and value systems. Airpower in particular has come to be nearly synonymous with Western military power not only because it allows the states that employ it to project force while suffering relatively little harm in return, but also because the technically sophisticated platforms of modern airpower are understood by their users to be evidence of a superior educational, research, and manufacturing capability—from this perspective they are embodiments of progress.[39] Their use affirms

35 Andrea Peterson, "In an apparent first, Dallas police used a robot to deliver bomb that killed shooting suspect" *Washington Post* 8 July 2016, https://www.washingtonpost.com/news/the-switch/wp/2016/07/08/dallas-police-used-a-robot-to-deliver-bomb-that-killed-shooting-suspect/; Cyrus Farivar, "Dallas deployment of robot bomb to kill suspect is 'without precedent,'" http://arstechnica.com/tech-policy/2016/07/is-it-ok-to-send-a-police-robot-to-deliver-a-bomb-to-kill-an-active-shooter/.

36 Nasra Hassan, "An Arsenal of Believers: Talking to the 'Human Bombs," *The New Yorker,* 19 November 2001, 38.

37 Reuven Paz, "Programmed Terrorists? Analysis of the letter of instructions found in the September 11th attack," PRISM (Project for the Research of Islamist Movements) Article, available at http://www.e-prism.org/projectsandproducts.html.

38 Martin van Crevald, *Technology and War: From 2000 B.C. to the Present* Revised and Expanded Edition. (New York: Free Press, 1991), 232.

39 Understanding technology as the embodiment of progress has characterized the interaction of Western states and the non-Western world since the colonialism of the 1800s. Michael Adas, *Machines as the*

the perceived superiority of the culture that produced them and is, therefore, a form of psychological as well as physical warfare.

Suicide bombers therefore represent much more than a desperate effort to "throw bodies" at the mechanized forces of their adversaries. Their use allows their groups to invert roles, empowering themselves by portraying the mechanized forces of their adversaries as efforts to substitute machines for human values such as courage, faith, and the willingness of the individual to sacrifice for the community. A senior Hizballah official writes that one purpose of the group's so-called "self-martyrdom" operations is "the exposure of the Israeli soldier as one who hides in the safety of his military machines, afraid of direct military conflict." When the journalist Barbara Victor asked a group of Palestinian children why they were not afraid of the Israelis, one replied: "Because Israeli soldiers are cowards. They have tanks and guns. They hide behind their big machines."[40]

Conclusion: Just Good Enough

"[We] would be nowhere without Radio Shack."

-Richard Clark Johnson, IRA bomb maker[41]

Richard Clark Johnson was an American electronics expert who tackled some of the most daunting technological issues, particularly remote detonation systems, for the Provisional IRA. The candor he demonstrates above, revealed in a snippet of a conversation recorded by authorities, reveals that he was very conscious of one of the key advantages that militant groups possessed—their ability to appropriate and re-use, in novel and unanticipated ways, the readily available consumer technologies produced by the very societies that they were attacking.

American forces in Iraq learned the extent to which commercially available electronics had benefited their adversaries in 2006 when they confiscated several specially modified suicide vests. In addition to the necessary explosives, these vests also included webcams intended to transmit video footage from the attack to the bombers' handlers in real time. The vests were also equipped with a remote detonation capability, giving the support team the ability to detonate the bomber when and where *they* saw fit, particularly if it seemed as though the bomber was having second thoughts.[42] Collectively, this hybrid

Measure of Men: Science, Technology, and Ideologies of Western Dominance (Ithaca: Cornell University Press, 1989) and Daniel R Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981), esp. 130.

40 Naim Qassem, *Hizbullah: The Story from Within* trans. Dalia Khalil (London: Saqi, 2005) 50; Barbara Victor, *Army of Roses: Inside the World of Palestinian Women Suicide Bombers* (New York: Rodale, 2003), 185.

41 Toby Harnden, *Bandit Country: The IRA and South Armagh* (London: Hodder and Stoughton, 1999), 356-74; quote from 367.

42 Spencer Ackerman and Adam Rawnsley, "Wheelbarrow Rockets, Remote-Control Suicide Vests and Captured Drones: Wikileaks Eposes Insurgent Tech," http://www.wired.com/dangerroom/2010/10/wheelbarrow-rockets-remote-control-suicide-vests-and-captured-drones-wikileaks-exposes-insurgent-tech/.

of innovations—explosives, consumer electronics, and a radicalized sub-culture that glorified self-sacrifice—provided militants, at minimal expense, similar capabilities to those provided by UAVs for their American adversaries.

The use of webcams to provide oversight of suicide bombing missions, the use of Humvees as precision guided munitions, and the use of passenger airliners as cruise missiles on 9/11 are all examples of the innovative means by which terrorist groups appropriate readily available technology for their own purposes. Overall, the effectiveness by which terrorist groups have repurposed existing technological systems suggests that the high-technology endeavors of the developed world may have actually eroded, rather than enhanced, the capabilities of states relative to non-state forces.[43] Historian Martin van Crevald observed this trend many years ago, writing: "…many modern weapons tend to act as parasols. Whereas their own electronically supported firepower is wasted in antiguerrilla operations, they allow guerilla warfare and terrorism to take place below the sophistication threshold that they themselves represent."[44]

Importantly, this high "sophistication threshold" comes at a much higher monetary cost that limits the number of weapons that can be deployed and reliably maintained. After an exhaustive statistical analysis of American military programs in the 1970s, Franklin C. Spinney found that ever increasing defense budgets were *not* leading to higher levels of military readiness but instead were contributing to a self-perpetuating cycle of ever-increasing complexity in weapon systems that outpaced improvements in operational effectiveness. The data, he found, suggested "a general relationship between increasing complexity and decreasing material readiness."[45] His insights have been borne out time and again over the last fifteen years as a global struggle to deal with the challenge of terrorism has come to cost trillions of dollars. These lessons challenge the assumption that when it comes to international security, newer, more technologically advanced, and (inevitably) more expensive weapon systems are inherently better.

In contrast, some of the most effective weapons deployed by states in recent years have been the result of a similar, relatively low-tech process of improvising and re-purposing existing technologies. For example, the UAVs that have come to dominate battlefield skies around the world resulted from the fusion of two existing technologies—remotely piloted vehicles and high bandwidth wireless communications. The combination resulted in a platform that provides reliable intelligence and surveillance—as well as a degree of military capability—at a fraction of the cost of manned aircraft. UAVs can linger for hours providing much needed situational awareness of an environment in a way that manned aircraft simply cannot. Because UAVs do this with relatively simple technology, they

43 Thomas X. Hammes**,** *The Sling and the Stone: On War in the 21st Century* (St. Paul, MN: Zenith Press, 2004), 204-9.

44 van Crevald, *Technology and War,* 304.

45 Franklin C. Spinney, *Defense Facts of Life: The Plans/Reality Mismatch,* edited with a commentary by James Clay Thompson (Boulder: Westview Press, 1985), 37.

comprise a technological approach that is effective without being "high" tech. Instead, UAVs can be understood as "good enough" tech.[46]

Technically sophisticated, expensive, and complex weapon platforms dominated the state level conflict of the Cold War era. The conflicts of today, many of which operate below the state level, necessitate a different approach toward technology. Terrorist and guerrilla groups have already made this shift to very devastating effect. Countries like the United States should learn to appreciate this approach and should endeavor to complement their "high-tech" approach with increasing doses of "good-enough-tech" in order to provide themselves with the broadest range of tools for managing conflicts around the world.

46 The problems that UAVs have raised, including violations of territorial sovereignty and civilian casualties resulting from UAV strikes, are a consequence of *how* they have been used by the United States—secretly, without consultation with allies or oversight into targeting decisions—rather than being inherent in the technology. For an overview of the impact of UAVs, see Chris Woods, *Sudden Justice: America's Secret Drone Wars* (New York/Oxford: Oxford University Press, 2015), esp. 6-7; Robert Capps, "The Good Enough Revolution: When Cheap and Simple is Just Fine," http://www.wired.com/2009/08/ff-goodenough/.

APPENDIX

OPEN SOURCE STATISTICS ON SUICIDE BOMBING

One of the most significant challenges facing researchers who are interested in terrorism as a global phenomenon is that there is no one continuously operational open source database from which to draw reliable, consistent data. This leaves the researcher with two possibilities. The first is to attempt to compile the data on his or her own, which would necessitate extensive resources. The other option, which I have followed, is to try to understand the differences in the available databases in order to merge their data in such a way that the result is consistent with the reality of terrorist violence.

The two databases that I have utilized for my own research on suicide bombing are the Global Terrorism Database, maintained by the START Center at the University of Maryland, and the Worldwide Incident Tracking Center, which was maintained by the American Countering Terrorism Center from 2004-2011. To arrive at an accurate picture of the global incidence of suicide bombing since 2000 I have utilized GTD data for the years 2000-2004 and then again for 2012-2014, and WITS data for 2005-2011. My reasoning is as follows. For 2000-2004, the GTD is currently the best existing database, although it has its flaws. Most significantly, data collection was outsourced and overall manpower devoted to the project was insufficient to collate and evaluate the full number of terrorist attacks throughout the world, and it tended to under-report attacks during this time period. WITS, during its time of operation, was more thorough and consistent in data collection; after a bit of a shaky start in 2004, it provided the best overall statistical record from 2005 until it was de-funded after 2011.

This left the GTD as the default database for statistical information on global terrorism from 2012 to the present day. Leaders at the START Center decided to use the opportunity to improve greatly data collection and coding for the GTD so that it would be both more comprehensive and more reliable. For example, the database currently surveys approximately 1.3 million articles every single day from 55,000 sources that seem likely to contain information about terrorism or other forms of political violence. Articles are sorted, filtered, duplicates discarded, and the remainder turned over to human coders for data entry and coding in the database. Thus START as it currently stands probably offers the best statistical picture with regard to global terrorism that we have had to date.

Even considering these factors there are additional challenges to consider. WITS filtered data through a definition of terrorism that excluded attacks on military targets. In the case of suicide bombing, the database tended to exclude attacks on combatant targets (an appreciable number) in order to focus more narrowly on what was considered to be "suicide terrorism." The total number of suicide bombings in WITS is therefore somewhat lower than the total number of suicide bombings that took place during the years in which WITS was operational. The GTD definition is broader, including attacks

against combatant targets, and is more consistent with my own definition of suicide bombing, which is based on the function of the bomber in the attack rather than the target of the attack. As a consequence of the GTD's decision to include suicide attacks against combatant targets and it is more thorough overall process of data collection, some—but not all—of the increase in attacks in the past four years in my table is a consequence of the shift from WITS to GTD after 2011. Nevertheless the overall pattern of suicide bombing since 2000—a steady, dramatic increase from 2000-2007, followed by a decline from 2008-2011, followed by a significant increase—is consistent.

Sources: Ariel Merari, personal communication, 9/11/2014; for GTD, Erin Miller, personal communications 12/1/2014 and 12/2/2014 and Michael Jensen, "Discussion Point: The Benefits and Drawbacks of Methodological Advancements in Data Collection and Coding: Insights from the Global Terrorism Database (GTD)," http://www.start.umd.edu/news/discussion-point-benefits-and-drawbacks-methodological-advancements-data-collection-and-coding, accessed 12/2/2014; for WITS, see John Wigle, "Introducing the Worldwide Incident Tracking System (WITS)," *Perspectives on Terrorism* 4 #1 (March 2010) 3-23.

BIBLIOGRAPHY

Adas, Michael. *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance.* Ithaca: Cornell University Press, 1989.

Arthur, W. Brian. *The Nature of Technology: What It Is and How It Evolves*. New York: Free Press, 2009.

Beniger, James R. *The Control Revolution: Technological and Economic Origins of the Information Society*. Cambridge: Harvard University Press, 1986.

Beyerchen, Alan. "Rational Means and Irrational Ends: Thoughts on the Technology of Racism in the Third Reich." *Central European History* 30 #3 (1997): 386-402.

Bloom, Mia M. and John Horgan. "Missing their Mark: The IRA's Proxy Bomb Campaign." *Social Research* 75 #2 (2008): 579-61.

Brooks, Harvey. "Technology, Evolution, and Purpose." *Daedalus* 109 #1 (1980): 65-81.

Campbell-Kelly, Martin, William Aspray, Nathan Ensmenger, and Jeffrey R. Yost. *Computer: A History of the Information Machine.* Third Edition. Boulder: Westview Press, 2014.

Cardwell, Donald. *Wheels, Clocks, and Rockets: A History of Technology*. New York: W.W. Norton and Company, 1995.

Castner, Brian. *The Long Walk: A Story of War and the Life that Follows.* New York: Doubleday, 2012.

Drucker, Peter F. *Technology, Management, and Society.* New York: Harper Colophon, 1977.

Friedman, George. *America's Secret War: Inside the Hidden Worldwide Struggle between America and its Enemies*. New York: Doubleday, 2004.

Gerovitch, Slava. "Human-Machine Issues in the Soviet Space Program." In *Critical Issues in the History of Spaceflight,* ed. Steven J. Dick and Roger D. Launius, 107-140. Washington, D.C.: NASA Office of External Relations, 2006.

Grier, David Alan. *When Computers Were Human*. Princeton: Princeton University press, 2005.

Hammes, Thomas X. *The Sling and the Stone: On War in the 21st Century*. St. Paul, MN: Zenith Press, 2004.

Harnden, Toby. *Bandit Country: The IRA and South Armagh*. London: Hodder and Stoughton, 1999.

Hassan, Nasra. "An Arsenal of Believers: Talking to the 'Human Bombs." *The New Yorker*, 19 November 2001.

Headrick, Daniel R. *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century*. New York: Oxford University Press, 1981.

Hoffman, Bruce and Gordon H. McCormick. "Terrorism, Signaling, and Suicide Attack." *Studies in Conflict and Terrorism.* 27 #4 (2004) 243-281.

Hoyt, Timothy D. "Technology and Security." In *Grave New World: Security Challenges in the 21st Century* ed. Michael E. Brown, 17-37. Washington: Georgetown University Press, 2003.

Hughes, Thomas P. *American Genesis: A Century of Innovation and Technological Enthusiasm.*New York: Viking, 1989.

Institute for Economics and Peace. *Global Terrorism Index 2014.* http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014_0.pdf

_____. *Global Terrorism Index 2015.* http://economicsandpeace.org/wp-content/uploads/2015/11/Global-Terrorism-Index-2015.pdf

Isaacson, Walter. *The Innovators: How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution* New York: Simon and Schuster, 2014.

Johnson, Stephen B. *Secret of Apollo: Systems Management in American and European Space Programs*. Baltimore: Johns Hopkins University Press, 2002.

Johnson, Steven. *Where Good Ideas Come From: A Natural History of Innovation*. New York: Riverhead Books, 2010.

Lewis, Bernard. *The Assassins: A Radical Sect in Islam*. New York: Oxford University Press, 1967.

Lewis, Jeffrey William. *The Business of Martyrdom: A History of Suicide Bombing* (Annapolis: Naval Institute Press, 2012).

Merari, Ariel. "The readiness to kill and die: Suicidal Terrorism in the Middle East." In *Origins of Terrorism: Psychologies, Theologies, Ideologies, States of Mind*, ed. Walter Reich, 192-207. Washington DC: Woodrow Wilson Center Press, 1990.

Mindell, David A. *Between Human and Machine: Feedback, Control, and Computing Before Cybernetics*. Baltimore: Johns Hopkins University Press, 2002.

Mokyr, Joel. *The Gifts of Athena: Historical Origins of the Knowledge Economy*. Princeton: Princeton University Press, 2002.

Naftali, Timothy. *Blind Spot: The Secret History of American Counterterrorism*. New York: Basic Books, 2005.

Nance, Malcolm. *Defeating ISIS: Who They Are, How They Fight, What They Believe.* New York: Skyhorse Publishing, 2016.

Paz, Reuven. "Programmed Terrorists? Analysis of the letter of instructions found in the September 11th attack." PRISM (Project for the Research of Islamist Movements) available at http://www.e-prism.org/projectsandproducts.html

Qassem, Naim. *Hizbullah: The Story from Within*. Translated by Dalia Khalil. London: Saqi, 2005.

Rogers, Everett M. *Diffusion of Innovations*. Fifth Edition. New York: Free Press, 2003.

Schatzberg, Eric. "Technik comes to America: Changing Meanings of Technology before 1930." *Technology*

and Culture 47 # 3 (2006): 486-512.Singer, Peter W. *Wired for War: The Robotics Revolution and Conflict in the Twenty-first Century*. New York: Penguin Press, 2009.

Spinney, Franklin C. *Defense Facts of Life: The Plans/Reality Mismatch.* Edited with commentary by James Clay Thompson. Boulder: Westview Press, 1985.

Sterne, Jonathan. *MP3: The Meaning of a Format.* Durham and London: Duke University Press, 2012.

The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States. Authorized Edition. New York: W.W. Norton and Company, 2004.

van Crevald, Martin. *Technology and War: From 2000 B.C. to the Present*. Revised and Expanded Edition. New York: Free Press, 1991.

Victor, Barbara. *Army of Roses: Inside the World of Palestinian Women Suicide Bombers*. New York: Rodale, 2003.

Wigle, John. "Introducing the Worldwide Incident Tracking System (WITS)." *Perspectives on Terrorism.* 4 #1 (2010): 3-23.

Woods, Chris. *Sudden Justice: America's Secret Drone Wars.* New York/Oxford: Oxford University Press, 2015.