Introduction

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The study of international security has always been a very controversial field. Contestations over issues as important as war and peace, liberation and subjugation, invasion and non-intervention are to be expected. But over the last twenty five years, not only have there been normative struggles over these key issues – illustrated most dramatically recently by the arguments over the war in Iraq – but there have also been arguments over what counts as 'security' itself. Security for whom, and from what, has been at the forefront of academic texts in international relations in the English speaking world, and also throughout continental Europe.

From these various arguments, one can detect different schools of thought on international security, bounded by the answers the group itself has agreed upon concerning those core questions of what comprises security, for whom, and from what. Realists of various hues focus on state threats, and on power and freedom from threat. Neo-liberals, while also focussing on states, emphasise the cooperative possibilities in the international system. Constructivists focus on norms, very often at the inter-state level, and on issues such as security cultures. Many perspectives on security derive their titles from particular geographies. The Copenhagen school looks at the way issues become securitised. The Welsh school emphasises the demand of examining security issues for their emancipatory possibility. The Paris school stress the totally constructed nature of social life from a Foucaudian perspective. The Toronto Group has examined the propensity of environmental scarcity to lead to conflict. And peace studies experts stress the normative importance of choices about the use of violence.

Yet these complex dimensions to the way in which security is conceived of is, perhaps, less than half of the story of understanding the intellectual nature of modern security studies. And here already we have an important change of terminology – from

international security, with its apparent emphasis on the state level, to security studies, with the possibility of considering security beyond the state at group levels, whether this be violence between ethnic and other groups, or between genders. Security studies – and the different schools of thought outlined in the preceding paragraph – has developed and grown within the (sub) discipline of international relations; all of the schools in security studies outlined relate in some form or other to broader sets of thinking in international relations theory. But is security studies the preserve of the study of international relations?

Of course that is not so. In sociology, economics, geography, urban studies and planning, area studies, history and other disciplines in the social sciences and the humanities, scholars have given some consideration to the use or threat of use of organised violence for particular ends. And those examinations may or may not relate to the conceptualisations and language used by the various schools of security studies that have developed in international relations.

In this intellectual world, where a 'thousand flowers (or schools) are blooming' one of the means of drawing together different strands is to focus on particular themes. Thus, when thinking about violence in Africa for example, expertise from international relations can be brought together with that in economics, geography, gender studies, language and cultural perspectives. Another theme that can be analysed from a variety of different perspectives is that of the role of technology in security; and that is the purpose of this volume.

Within the study of international relations, technology has always been a theme in the examination of security. During the Cold War, technology was a vital component of thinking about the threat of war. The development of nuclear weaponry and missile technology were translated into fears of missile gaps and into strategic thought contained within the concepts of nuclear rollback, mutually assured destruction, escalation dominance, arms control, and strategic defence. Age old debates about the relationship between the offence and defence were transformed by new technological possibilities. Of course, this is not to argue that international security was driven by technology alone: what was important was the way in which particular sciences were constructed and understood. *Strategy* became the code word for political debate about technology and security, even while at the same time it constructed *experts* who were often accorded special status to decide upon these contentious political and ethical issues.

It would be tempting to claim that, with the collapse of the Soviet Union and the Cold War superstructure, issues of technology and security became less relevant. With the nuclear threat gone, security could be more 'social' than military in its meaning. Certainly international organisations such as NATO started to commit themselves to a 'broader' notion of security, one that would include societal, political, economic and environmental threats and challenges alongside military ones. But a dichotomy of this sort would be a misleading. On the one hand, it suggests that security was less 'social' in the Cold War than in the contemporary world. Yet violence in the Congo or over Biafra, for example, rather suggests that this is not so; indeed, revolution in Latin America and

much of the developing world throughout the 1960s and 1970s would add to that sense. Yes, in the English speaking world and in much of Europe, international security meant mostly the Cold War and its technology; but that does not mean much more than that is where the intellectual focus was driven by a whole host of factors, from government research funding to the impact of decolonisation on European intellectual endeavour. On the other hand, such a conceptualisation – that technological factors are less important after the Cold War – itself underplays the importance of technology in the study of international security and security studies in the contemporary world.

One area of this continued importance of technology relates to the military. The Cold War may be over; but in Asia, nuclear diplomacy – and the consequent construction of the role of technology – is a vital and high profile theme. Since the abolition of the Soviet state, India and Pakistan have developed nuclear weapons and are in the process of developing a complex nuclear relationship. America, and through the United Nations, other states, worry about Iran's nuclear developments, and what the construction of an Iranian bomb might mean for the international security of the region. North Korea has detonated some sort of a nuclear weapon, putting into question the nature of security policy in China, Russia, Japan, Taiwan and that broader region. Nukes still rule the game in the most heavily populated parts of the world.

Of course, this is not the totality of the military-technology issues in the contemporary world. Since the Persian Gulf War, indeed in some ways because of the dominant reading of the Persian Gulf War, states have focussed on the technological possibilities inherent in American military force. The ability to precision bomb targets with limited collateral damage has been constructed as the ideal in the use of force; no casualties to the user, only the guilty killed amongst the targeted. Bombing over the former Yugoslavia; cruise missiles flying across the world to targets in Afghanistan; the lightening military march to Baghdad in the 2003 war; all have contributed to this sense that with military technology comes previously undreamed of possibilities. Indeed, the US decision to invade Iraq in 2003 was in some ways a high point for this belief – that technology would solve nearly all security problems. Wrong doing could be swept away by military asymmetry, and new popular political structures would grow in its place. Maybe, in the mire of post–invasion Iraq, with suicide bombing and improvised explosive devices being at the same time both highly effective and at the opposite end of the technological spectrum from the US, the Iraq war will seem the zenith of this belief in military technology solving security problems and in the force of arms leading to normatively better worlds. Perhaps that is so, but it is still unlikely. Isomorphism rules – states militaries seeks to copy that of the United States, because with technological sophistication comes a sense of the apex of the profession. That is, even if a military does not see itself being involved in transformatory wars, it will still want to be taken seriously, and that implies owning expensive and advanced equipment, and the ideas that go along with it.

The so called 'war on terror' has more fully shown the limitations of the reliance on technology: in Afghanistan, American Special Forces have resorted to horses as well as stealth technology. The ability to manufacture and kill by anthrax in the United States in

the aftermath of '9/11' undermined still further the confidence of the superpower in its security, and still remains a crime that in public is unsolved. But these aspects are not about the failure or otherwise of technology; rather, they are about what is understood by technology, how it can be used in particular places at particular times and for particular reasons, and how it is often used in particular places and times for reasons others than those widely anticipated.

It is not only in the area of military security, though, that technology is an important theme in security. Could there be an argument that climate change is a security challenge – a threat to the future of humanity – without the complex science and technology that goes with it? The scientific community – in many countries, if not all – have been called upon to 'prove' the claim of climate change, and this has been only possible with complex observations of the atmosphere, and of regions in the Arctic and Antarctic, amongst others. Our whole notion of threat in this field is constructed through scientific experiment and debate.

Another area of the continued importance of technology in security relates to surveillance in social order and control. In the developed world, more and more people are watched both physically through closed circuit television, and also practically through computerised databases and increasingly, biometrics and identity cards. Are these infringements of civil liberties? And if so, is that important? The London bombers of 2005 built home made devices with which to kill; they were filmed many times on CCTV, and yet were not stopped ahead of time. Does this mean more viewing and more monitoring is required of all citizens?

Technology remains an important theme in the way in which both international security and security studies are understood and pursued. The technological possibilities forward today challenge all the schools of thought in the academic study of international relations. More importantly, they open possibilities for discussions and collaborations across the disciplinary divide(s) to address practical problems. This volume is a contribution to that wider debate.

Technology

While, broadly conceived, 'technology' enters into many of the aforementioned shifting security dynamics, specifying just how it helps constitute environments and perceptions of security is less than straightforward. While technology is readily sought as a means of guaranteeing safety and protection; the pace and breadth of scientific and technological developments are often said to challenge the prospects of achieving such ends.

These competing tendencies suggest the need for careful attention. One way to begin this is with the basic question 'What is technology?'. Despite (or rather perhaps because of) the ubiquity of the term, in popular, academic and policy discussions, 'technology' is not often well defined. A commonplace understanding though is that it consists of equipment based on applied science that is employed to fulfil some particular functions. As scientific understanding grows, so too does the ability to engineer instruments to manipulate the world. This way of thinking suggests a rather unidirectional and linear

relation between knowledge and hardware. The popular understanding of the development of the atomic bomb during World War II in the Manhattan Project is perhaps the most prominent example where emerging science of the time was turned into a novel device. Yet, history would suggest a rather complex relation between the knowledge and skills associated with engineering and science, even in the case of the bomb. Each has feed off of and given impetus to the other at different points in time. In addition, many analysts contend that technology should not only be thought of as 'hardware', but rather the term should cover the practical skills, organizational competencies, and training associated with the operation of devices.[1]

Consideration of the question 'what is technology?', however, can quickly turn stale when asked in the abstract. Consider it in relation to the now well-celebrated and disputed concept of the 'Revolution in Military Affairs' (RMA). The suggestion that technology can lead to significant changes in war is not a new one. The introduction of chariot, machine gun, tanks and airplanes have been linked to major alternations in the conduct of combat.[2] The Soviet Marshall Nikolai Ogarkov is often cited as a source of inspiration for much of the recent attention to the potential for radical shifts. Ogarkov's notion of the 'Military Technical Revolution' (MTR) was meant to signal how the integration of information and communication, sensor, and other technologies would afford capabilities with profound implications. In recent years, much discussion has taken place regarding whether militaries are in the midst of a transformative revolution or mere evolution in capabilities as well as who has or will gain from any change.[3]

Yet, the manner in which technology is conceived is essential in understanding the likelihood of a revolution, its character, how it can be realised as well as who can take advantage of it. Metz and Kievet's original formulation of the revolutionary potential at hand as 'RMA' rather than 'MTR' was meant to move away from a preoccupation with integrated technology to include its synergy with changes in organizations, systems, and operational methods.[4] In a recent twist to the story of RMA, however, the focus on perception, choice and leadership has mixed in an uneasy fashion with language of certainty, determinacy, and inevitability. So as Metz has written that:

> Today technology is an enabler of the revolution in military affairs, allowing changes that political and military leaders would like to make as they respond to political, economic, and social changes. But it can also be an independent variable, forcing uncomfortable changes and, sometimes, eroding stability and order. New technologies or new combinations of technology have the potential to alter not only tactics and operational methods, but military strategy itself.[5]

When treated in the manner suggested in the last two sentences, the technologies of cyber war, precision weapons, military robots, etc. can themselves force significant, if not revolutionary, changes. In such a formulation of independent variables there appears little scope for affecting the impact of change and few barriers that can be erected to halt its spread.[6] Attention to the difficulty of attaining the necessary skills or organizational competencies is marginalized. Herein the whole language of 'choices' or 'decision-making procedures' seems misplaced if not misleading. Technological developments –

presumably driven to achieve ever more efficiency and effectiveness in achieving agreed ends – are in some nontrivial sense going to take place. This way of thinking about technology in RMA contrasts sharply with other analyses; such as Freedman's examination of information technologies in war.[7] For him the character and relevance of such technologies depends on highly contingent political and strategic developments.

Even this brief consideration of the place of technology in military transformations evokes a sense of how questions about the character, origins and implications of technology are at once bound up with longstanding concerns in the social sciences regarding the rationality and goal directedness of action; the scope for human agency and determinacy; as well as the relation between individual choices and institutional outcomes. Considering how technology relates to the (itself problematic) notion of security then, is an undertaking whose demands should not be underestimated.

Technology and Security

The remainder of this chapter furthers the previous discussion by surveying some of specific topics in which the relation between security and technology has been investigated. As will be argued, in each technology occupies a rather problematic space, seen as both enabling and undermining conditions of security.

Mobilizing Technology for National Security

Much of the relevant academic and policy literature has focused on how science and technology (often treated as synonymous) could best be harnessed for national defence. Research and development (R&D) are meant to yield concrete outcomes that confer an advantage of one sort of another. Perhaps particularly in the US since World War II, as mentioned previously, the notion a 'technological fix' to security threats has been quite prominent and successful in justifying the expenditure of public funds. The search for such a 'fix' extends well beyond military matters to include political and economic security more generally.[8]

Yet, it has also been recognized that marshalling science and technology is not a straightforward process. Many advanced technologies – be they major platform weapons such as jet fighters or information and communication devices – are complex systems whose procurement and management is fraught with difficulties. Military requirements are often ill defined[9] and the decision making is situated within a host of strategic, institutional and budgetary uncertainties.[10] How to promote innovation and avoid bureaucratic forms of nepotism (e.g., as in concerns about the "Military Industrial Complex") have been perennial policy concerns.[11]

How expenditure on military-related R&D might be best organized so as to secure wider civilian benefits has been another area of longstanding concern. For instance, this can be seen in debates about the advisability of relying on unplanned and unpredictable 'spin-offs' versus trying to fund areas with apparent dual military and civilian potential.[12] Responses to such questions are often tied in with evaluations regarding the advisability

and appropriateness of the military steering the research agenda of universities and other public agencies.[13]

But harnessing technology in aid of security is not only recognized as a complex and uncertain undertaking, but one that can set up destabilizing dynamics. Mobilizing technology is not a one off achievement, but rather a continuous process of innovation, re-innovation and planned obsolescence. The pursuit of means of security goes hand in hand with worries about the insecurity that will later be afforded by those very same means when used by others. The continuing pursuit of technological advantage can bring second order problems too. For instance, with the sustained, substantial and increasing funding of military R&D in the US, for example, questions are not only being asked about whether European commercial and military firms are at a competitive disadvantage but whether European militaries are becoming incompatible with US armed forces.[14]

Traditional policy and academic concerns about how to harness technology for national security though have been given a fresh analytical twist in recent years with the wider turn to culture, ideas and identity in disciplines such as international relations.[15] As part of this turn, consideration has been given to the role of norms in regulating behaviour and constituting identity.[16] Norms have been said to factor into a variety of topics mentioned so far in this introduction. For instance, it has been contended that conventional power- or interest-based approaches cannot explain the pattern of weapons procurement in many developing countries. These states acquire high-tech weaponry not because of strategic calculations, but because of identity considerations about what it means to be a modern state.[17] Studies of the taboos against using nuclear weapons by Tannenwald[18] and the development of chemical weapons by Price[19] have elaborated how particular weapons became stigmatized to such an extent that few seriously contemplate their use -- whatever their benefits. The formation of these taboos – largely forwarded by Western highly industrialized countries – has been part of constituting what it now means to be a 'civilized' state. In a related fashion, elsewhere it has been maintained that the uptake of certain technologies – such as precise aerial bombing – requires they be 'congruent with preexisting cultures of their institutions'.[20] Such claims strongly challenge any suggestion that technology is simply an independent variable forcing change.

One common theme of these norms analyses is that norms and related cultural factors cannot be resigned to a residual role in political affairs, such as explaining lags in states pursuing their interests, irrational decision making or the choices made in highly ambiguous situations.[21] While norms might have been acknowledged in the past as a simplifying mechanism that enabled actors with pre-existing interests to maximize utility in a complex world, in recent analyses they are not simply intervening mechanisms. Rather actors' identities (and therefore interests) and norms are mutually constituted. This has important implications for the relation between norm and traditional international relations power and interest explanations.[22] In considering the emergence of the taboo against the use of nuclear weapons, Tannenwald does not portray norms and interests as exclusive categories. She argues norms 'enter into, and change, the cost-benefit calculations of interests (constraining), but they also help to constitute those interests, identities and practices in the first place. Interests and international norms may

coincide, but this coincidence does not render norms superfluous'.[23] Thus the relation between technology, identity, and security is an important one.

Arms Dynamics

The established policy and academic concern about mobilizing technology, however, is only one prominent area. The recognized destabilizing dynamic associated with the pursuit of technological superiority alluded to in the previous sub-section has been a fairly longstanding consideration itself. Much of this has focused on the drivers for the continuing search for new forms of weapons and other technologies. Models offered have varyingly centred on the 'action-reaction' dynamic of inter-state competition, the internal political, economic and social factors to a state that result in certain technologies being pursued, and well as the imperatives associated with technological possibilities.[24] As with the points made about technology in the RMA above, the reasons identified for the development of arms involve thorny issues about the place of human agency, rationality, and institutional structures in behaviour. Because of this, how the models for arms dynamics relate in practice is often not thoroughly specified. This dynamic is regarded as an important one because of the potential for an unplanned and socially undesirable arms racing between competitors.

Some analysts though have sought to provide a wide ranging (and critical) analysis of why certain technologies are developed or pursued. Here the attempt is made to move beyond a consideration of military procurement systems, technological capabilities, and inter-state rivals of immediate relevance to instead consider how basic social fears are nurtured, sustained, and exploited for political ends.[25] Lyon, for instance, has argued that fears about terrorism post-9/11 are being used to frame public health in security terms and to justify greater expenditure on surveillance technologies.[26]

In a more historical analysis, Jenkins examined perceptions of the threats in the United States from aerial bombers capable of delivering chemical weapons after World War I.[27] As contended, post-World War I, elite US statesman, industrialists, and scientists presented themselves as the avant-garde of humanity through their efforts to develop chemical weapons. The extent of funding of chemical weapons-related research and development during and after the war in turn led to developments in bomber aircraft, pesticides, and tear gas – all of which in turn facilitated the possible further development of chemical weapons. Instead of seeking political alliances with post-war Germany, the country was isolated and dealt with through security measures. The collective result of these actions was a self-fulfilling cycle of the production of fear where chemical weapons become increasingly regarded as an appropriate and necessary component of national defense.

In considering how technology becomes forwarded as a solution to a certain definition of the problem, Jenkins also examines alternative understandings of security and how these were or were not incorporated into prevailing policy discussions. For instance, after WWI those campaigning for arms restrictions generally took as their starting concern the question of how America's military and diplomatic power should be developed so that

the US could carry out the task of being the leaders of the civilized world. Those that departed from this line of reasoning (such as those calling for outright disarmament) were systematically ignored or labelled as dangerous subversives.

The Role of Scientific and Technical Expertise

The above consideration of how technology can best be harnessed to enhance security suggested attention should be given to the matter of *who* makes decisions. Here the place of scientific and technical experts is an important issue. It is widely recognized that since WWII in Western countries scientists and engineers have played a significant role in defining national security problems and advising about solutions. A concern with this has been whether scientists and engineers' professional and individual priorities have inappropriately influenced the framing of problems and responses. Rather than simply being knowledgeable experts that provide objective facts and advice, many analyses have contended these experts advocate particular and sometimes questionable options in line with their professional interests or assumptions.[28] So Eden argues that assessments of the damage of nuclear attacks in the US have focused on blast rather than fire damage and least in large part due to the particular concerns of the types of scientific advisers utilized by the military.

Just how much influence scientists and engineers exert is alternatively conceived and often poorly specified. Following on from previous points made in this chapter, however, this is hardly unexpected or unprecedented. The question of what influence scientists and engineers have in any particular area cannot be resolved without contending with difficult issues about agency and institutional decision making. In addition, Edgerton argues that in the case of the UK, the historical role of scientists and engineers in warfare has been ignored because the warfare footing of the British state has been downplayed.[29] This historical blindness makes it difficult to comment on the shifting importance and influence of certain professions. The question of what influence scientists and engineers *should* have in defining security priorities and responses in Western countries depends on similarly complicated assessments about the role of expertise in democratic decision making.

Limits and Security

One area in which scientists and engineers have played a significant role in recent decades is in the development and enforcement of arms controls. Yet, attempts to limit the means of war have a long history, dating back to the ancient world. Since then arms controls have been agreed or imposed for reasons as varied as to curb the threat posed by defeated powers at the conclusion of conflicts, to strengthening strategic stability in times of unsettled peace, to introduce humanitarian norms, and to restrict the proliferation of technology.[30]

As long as such controls have been used though, there has been debate about whether they ultimately further or undermine security.[31] The scope for deception about adherence has lead to concerns about a false sense of protection being engendered. Much doubt has

been expressed as well about the ultimate effects of certain states forgoing certain technological options. So the turn away from developing antiballistic-missile system decades ago by the US is credited with giving greater impetus to the development of multiple, independently targetable reentry vehicles (MIRV) for nuclear weapons as well as other forms of delivery such as Trident submarines.[32] In a comprehensive critique informed by realist preoccupations, Gray argued that attempts at arms control are fundamentally flawed and only feasible when otherwise irrelevant.[33]

Of course, when it comes to considering the merits of selective limits on technology, the question of 'security for who?' looms large. Another line of criticism regarding attempts to place limits on war has been that they reflect and reinforce the hierarchical power relations of the time. As such, certain forms of violence are put out of the reach of certain states (e.g., chemical weapons); while others are free to pursue their technological superiority elsewhere (e.g., conventional weapons, nuclear capabilities).[34] It is not just weapons themselves that are put out of the reach in some agreements, but any precursors and capabilities needed to produce them (e.g., as in the Australia Group export controls on materials and equipment). Such limitations then can reinforce disparities in civilian capacities. Another concern with reinforcing hierarchical relations is that attention to the rules of the conduct of war itself is said to distract from attention to whether wars should be fought in the first place, a move that favours certain (warfighting) nations.

Whatever the desirability of limitations on who has what sort of capabilities, their feasibility is another matter. To return to the RMA, the impending or arrived transformation in the conduct of war is said by some to severely limit the prospects for arms control.[35] One reason offered for this is that the development and proliferation of civilian commercial technologies that underlie such a transformation (e.g., telecommunications, computing, and sensors) are said to be beyond control through international agreements.[36] Also, it has been argued that because of the RMA, the destructive potential of conventional weapons will equal that posed by many unconventional weapons of mass destruction (WMD). This prospect is said both to undermine the rationale for agreements (such as the Biological and Toxin Weapons Convention and the Chemical Weapons Convention that are based on limiting classes of technology rather than those with certain magnitudes of effects) and to provide incentives for those states without the significant resources to seek unconventional forms of force capabilities.[37]

Vulnerability

An area of recently renewed attention to the relation between technology and security is the vulnerability to attack of critical technological infrastructures, particularly in those countries highly dependent on large scale integrated systems associated with electronic banking, transportation, food supply, and energy delivery. Although such large scale integrated technological systems provide many essential functions for modern societies, they are generally highly open and vulnerable. While the possibility of sabotage or disruption of critical infrastructure systems is hardly new to the twenty-first century, the extent and depth of reliance on technological systems (particularly those employing

information and communication technology) combined with the threat of terrorism is said to pose major issues for technologically sophisticated countries. The very systems which once ensured numerous forms of security now appear relatively obvious targets to jeopardized security.

Just what those key issues are though, varies between analysts. Winner, for instance, argues that Western societies face a crucial choice in light of potential threats: whether to attempt to 'harden up' existing vulnerable technological systems through further technological means such as sensors, barriers, or surveillance measures, etc. or to reconsider those policies that lead to a dependency on tightly coupled large scale systems in the first place.[38] The former, for instance, would lead to carrying on with large scale energy systems with reinforced nuclear plants and power grids while the latter would such a move away from the dominate forms of energy production and distribution to instead embrace smaller scale, locally produced forms of renewable energy. The choice about which path to pick is a fundamental one for Winner because it involves basic issues about how to foster trust in government and scientific and technical experts in modern society. For Metz, the prevalence of integrated infrastructure might well offer opportunities for countries such as the US to defeat adversaries without the inefficiencies and collateral damage associated with conventional weapons and in addition it might make the US highly susceptible to disruptive attack.[39]

The previously examined topics are just some of the most prominent ones where the interaction of technology and security is now a matter for intense discussion. In general there seems little room for doubt about the heightened attention to security post-9/11. As well, there seems little room for doubt that thoroughly addressing the issues being posed will require addressing longstanding concerns in the social sciences. Against these varied and complex issues and contexts, questions can be asked about the responses of academic analysts and, specifically, whether the varied disciplines that might contribute to understanding the relation between security and technology are prepared for the breadth of the task at hand. As has been argued, studies of security (here rather narrowly conceived of as national defence and warfare) have often been marginal to the mainstream of many academic disciplines, even those such as history with a long running attention to the military matters.[40] War, conflict, and violence are often seen as exceptional events that are not part of the normal functioning of society and thus not of central to understanding it.[41] The attention to security widely conceived today then provides an opportunity and a challenge to traditional academic disciplines.

The Chapters

This book advances the understanding of the inter-relation between security and technology. Its principal objective is to assess the contemporary security challenges posed by emerging scientific and technological developments while understanding how perceptions of security are themselves formed in relation to scientific and technological developments. In this, the place of technology in fostering and undermining security is examined, as is the way the definition of security transforms over time. Doing so requires addressing a complex mix of issues about the intentions of actions, their

consequences, the characteristics of technologies, organisational structures and international dynamics that are best approached through a range of disciplinary traditions. The contributions in this book stem from political science, security studies, international relations, history, sociology, and science and technology studies. Examining the place of technology in fostering and undermining security also requires making decisions about what should be questioned and what should be taken for granted as part of analysis. As will be apparent in the chapters that follow, each contributor has made choices about when and how to question what is meant by 'technology' and 'security'. These decisions were taken to address particular concerns against a particular disciplinary background. Attending to the diversity of such choices and their implications is important in understanding the utility and limits of analyses in this area.

The chapters in Part I share a focus on how fields of study regard the security-technology relation. All three pose significant challenges to certain prevalent presumptions and agendas. They differ, however, in the way their arguments are advanced. Andrew James begins with a historical overview of security-related science and technology (S&T) policy since World War II, mainly with reference to the US and UK. As part of this, attention is given both to *policy for science* (the strategies and procedures established to harness S&T for national defence) and *science for policy* (the incorporation of scientific and technical expertise into policy making processes). James details how perceptions of the international security environment and the appropriate policies for S&T have mutually formed over time. Further he considers how this process was part and parcel of an enduring (if not fully harmonious) relation between scientists, engineers, and the military planners during the Cold War. With the end of the Cold War, various attempts have been made to establish new rationales for S&T policy, most recently in combating international terrorism. James though does not just chart changing rationales, but ends with a warning about the failure of S&T policy analysts in Europe today to assess how determinations of the international security environment are influencing policy as well as how S&T policies are contributing to international (in)security. In response, he outlines areas for future research.

In Chapter 2, Rappert and Balmer unpack the notion of 'technology' through reviewing themes from the field of science and technology studies (STS). While hardly united in their thinking, in recent decades analysts associated with this emerging field have attempted to progressively open up the innovation and use of technology to social analysis. In relation to matters of security and the military, this has meant going beyond the long-established concerns of S&T policy. In particular this chapter assessing what STS suggests for understanding threats from weapons of mass destruction (WMD). As argued, central to this field is treating scientific knowledge and technical innovation as forms of practice rather than simply abstract knowledge or material products. This has significant implications for assessments of the ease producing and proliferating WMD, the effectiveness of control measures, the negative consequences of controls, and the way in which secrecy and openness should be seen to function.

Continuing with the questioning of the status of technologies, in Chapter 3 Boudeau examines a specific attempt to assess WMD threats. As she underscores, traditionally in

intelligence studies 'threat' is taken as a function of capabilities and intent; wherein these two are treated as separate factors that are independently determinable. Through examining US intelligence efforts to assess WMD threats from Iraq in the buildup to the 2003 invasion, she details how – in the practical efforts undertaken by intelligence analysts – capabilities and intent were co-defined. Just what a technology is and what 'it' does then are not simply determinable through noting their physical properties. Instead such properties are the upshot of interpretations.[42] Boudeau's analysis draws on insights from the field of ethnomethodology, whose central concern is the contingent methods individuals employ to make meaning of the world. She contends that recourse to a partition between capabilities and intentions in intelligence studies bears little connection with how intelligence analysts orient to threats in their work. The implications of this chapter extend far beyond the specific concern about WMD-related threat assessments to the general hindrance posed by the inclination of many analysts to conceptualise practical activities.

Part II then moves into the governance of security. In contrast to the case based approach in Chapter 3, Whitman considers the prospects for the global governance of converging technologies. This question is motivated by a concern that the long established national and international systems of governance might not be able to meet the challenges posed by today's global threats and the increasing intersection of major areas of technology – such as nano-, information, and bio-technology. The said growing convergence of such areas has been taken by some as implying that disarmament efforts are ill-fated if not futile.[43] Whitman seeks to identify the fault lines in existing regulatory systems that are likely to be visible in the future if they are not today. In doing so, his argument evokes a sense of large scale macro developments in a time of globalisation that are difficult to capture in narrowly focused analyses. While this chapter provides numerous traditional security-related examples, the argument forwarded clearly both demands and provides attention to other areas such as environmental hazards. Although Whitman offers a number of reasons for concern regarding our ability to predict or control future negative implications of technologies, recent efforts to develop and renew global governance mechanisms provide some reason for hope regarding the effectiveness of our political systems.

Moving from the governance of diverse converging technologies to one security area in particular, Farrell addresses the mix of rules, networks, norms, and organizations established to govern when, how and what kind of force is used in conflict. As contended, the web of such measures already provides significant constraint on warfighting and war preparation. Chapter 5 considers the barriers to achieving further international co-operation. The problems of multilateral agreements in this regard are many, not least the competition between states in pursuing superiority. While interstate competition has been examined already in some detail in international relations, Farrell identifies three other barriers: the uneven pace of military and legal change, the multiple and conflicting levels of pertinent norms and interests, and the uncertainty associated with the developmental direction of military technologies. The consideration of the last of these provides an opportunity to revisit some of the themes of Chapter 2 and their implications for the governance of technology.

In Chapter 6, Stone turns away from matters of choices in the co-ordination of and co-operation between states towards the strategic combat options of particular ones. Special reference is given to how Western nations, especially the US, deal with 'rogue states'. In contrast to much of current strategic thinking, Stone takes issue with the continuing pursuit of enhanced military means to render rogue states defenceless – what he refers to as the pursuit of technical fixes to problems of political order. As argued, no matter how accurate bombs and bullets, if the goal in war is to render certain states defenceless then civilians are likely to greatly suffer because of the damage to a country's basic infrastructure and instability engendered. A clear message is offered about the limitations of new and improved technologies to secure security without the wisdom to know how to use them. For Stone, the pursuit of ever more sophisticated technologies threatens to marginalise alternative options that may have the net effect of reducing security. Instead of handling rogue countries with ever more technical innovations, he counsels that the strategic notion of 'limited war' should be revised – in essence that decisive political control should be brought to bear on goals served by force.

The chapters in Part III share in the effort to examine certain aspects of the technology-security relation in detail. The possible deployment of space-based weapons is the focus for Hilborne's chapter. Particularly (but not exclusively) because of prominent voices in the US calling for the weaponisation of space, much concern has been expressed in recent years regarding whether any such move would initiate an expensive arms competition and undermine space as common heritage. Despite claims that just as the air, land, and sea have been weaponised then space must follow, Hilborne argues this outcome is neither inevitable nor imminently foreseeable. A major danger of recent attempts to play up the prospect of weaponisation though is that they may well undermine the fragile, but highly consequential, standard formed over many decades that space should not be weaponised. Somewhat counter-intuitively, it is argued that the indeterminacy and unspecificity of the existing array of international treaties and agreements has been their major strength. Should the largely non-formalized and non-institutionalised agreements be breached, they would be long in repairing. Hilborne does not just bemoan and dismiss interest in space weapons by major powers though. Instead, he recognizes the possibility for legitimate reasons for pursing this path and offers suggestions for multilateral action that reflect this acknowledgement.

In Chapter 8, Dando asks whether the prohibition against chemical (and biological) weapons can sustained given developments in science and the desire by states to pursue technological options. Specifically, his concern is how civilian research in neuroscience might combine with the interest in major state powers into so called mid-spectrum incapacitating agents to lead to a re-evaluation of the acceptability of chemical weapons. The promise of weapons that have only temporary effects has long been forwarded by certain states and individuals as a justification for leaving certain chemical and biological weapons options open.[44] The concern for Dando is that the pursuit of such options might lead to complete erosion of the prohibition against chemical weapons. He ends with a call to for greater involvement of civil society in disarmament debates to prevent this outcome.

Whereas Dando ends with such a plea, in Chapter 9 Durodié examines the conditions that structure the possibilities for public participation and political action in relation to matters of security. Here the focus is not so much with defining the severity of particular threats or recommending specific policy directions, but instead examining the contingent processes whereby threats become defined in specific ways and a limited number of responses become seen as viable. In focus in this analysis is a consideration of the inter-relation of the place of scientific and political elites in contemporary security debates and the networks of social bonds in the public. The chapter set out a broad vision of historical transformations that poses diverse questions. Durodié offers a highly critical analysis of how threats and risks are handled today; one that contends that current practices are significantly undermining social reliance. As with Stone in Chapter 6, he questions how narrow technological solutions are proffered for should be understood as wide ranging problems.

Through such contributions, this book seeks to stimulate further attention to the relation between security and technology. While it does not pretend to cover all germane issues in that relation, by focusing on a wide range of theoretical approaches and practical agendas it does seek to illustrate what work has already been undertaken into the relation, emerging areas of research, and avenues for future investigation. Technological aspects of security are crucial to understandings of how violence and threat are communicated in world politics and in local societies; but they are also crucial to the communication of reassurance and commitment.

How technologies are understood, in terms of possibilities and dangers, very much depends upon the social context and the nature of local political debates and cultures. Some polities are more likely to rely upon the reassuring possibilities of technological solutions than others. However, there are always a series of tensions in these contentious issues of the technological aspect of security: between threat and reassurance; freedom and restriction; control and proliferation. These dilemmas – at both national and international level – are themes underlying all of the analyses that follow.

Introduction

[1] B. Buzan, *An Introduction to Strategic Studies: Military Technology and International Relations* (Basingstoke: Macmillan, 1987) and G. Herrera, 'Technology and International Systems' *Millennium* 32(2003): 559-593.

[2] T. Farrell and T. Terriff, *The Sources of Military Change* (London: Lynne Rienner, 2002).

[3] For contrasting assessment, see M. O'Hanlon, *Technological Change and the Future of Warfare* (Washington, DC: Brookings Institute, 2000) and W. Nolte, 'Keeping Pace with the Revolution in Military Affairs' *Studies in Intelligence* 48(1) (2004) http://www.cia.gov/csi/studies/vol48no1/article01.html

[4] S. Metz and J. Kievet, *Strategy and the Revolution in Military Affairs* 27 July (Carlisle Barracks: Strategic Studies Institute, 1995).

[5] S. Metz, 'The Next Twist of the RMA' *Parameters* Autumn (2000): 40-53.

[6] L. Eliason and E. Goldman, 'Theoretical and Comparative Perspectives on Innovation and Diffusion' In E. Goldman and L. Eliason (eds.) *The Diffusion of Military Technology and Ideas* (Stanford: Stanford University Press, 2003).

[7] L. Freedman, *The Revolution in Strategic Affairs* Adelphi Paper 318 (London: Oxford University Press for the International Institute of Strategic Studies, 1998).

[8] M. Pianta, *New Technologies Across the Atlantic: US Leadership or European Autonomy?* (Hemel Hempstead: Harvester, 1988).

[9] D. Kelves, 'R&D and the Arms Race' In E. Mendelsohn, M. R. Smith and P. Weingart (eds.) *Science, Technology and the Military* (London: Kluwer, 1998): 465-480.

[10] T. Farrell, *Weapons Without a Cause: The Politics of Weapons Acquisition in the United States* (New York: St Martin's Press, 1997).

[11] As in M. Kaldor, *The Baroque Arsenal* (London: Abacus, 1982).

[12] J. Alic, L. Branscomb and H. Brooks *Beyond Spinoff: Military and Commercial Technologies in a Changing World* (Boston, MA: Harvard Business School Press, 1992).

[13] W. Smit, 'Science, Technology and the Military: Relations in Transition,' In S. Jasanoff, G.E. Markle, J.C. Petersen and T. Pinch (eds.) *Handbook of Science and Technology Studies* (London: Sage, 1995) and P. Mirowski, 'Cyborg Agonistes: Economics Meets Operations Research in Mid-Century' *Social Studies of Science* 29(5) (1999): 685-781.

[14] A.D. James, *US Defence R&D Spending* (Manchester: PREST, 2004).

[15] J. Checkel, 'The Constructivist Turn in International Relations Theory' *World Politics* 50(1) (1998): 324-348.

[16] R. Jepperson, A. Wendt and P. Katzenstien, 'Norms, Identity and National Security', In Peter Katzenstein (ed) *The Culture of National Security* (New York: Columbia University Press, 1996): 54.

[17] D. Eyre and M. Schuman, 'Status, Norms and the Proliferation of Chemical Weapons', In Peter Katzenstein (ed) *The Culture of National Security* (New York: Columbia University Press, 1996).

[18] N. Tannenwald, 'The Nuclear Taboo' *International Organization* 53(3) (1999): 433-468.

[19] R. Price, *The Chemical Weapons Taboo* (Ithaca, NY: Cornell University Press, 1997).

[20] T. Moy, *War Machines* (College Station: Texas A&M University Press, 2001): 7.

[21] As argued, for instance, in M. Desch, 'Culture Clash' *International Security* 23(1) (1998): 141-170.

[22] M. Neufeld, 'Interpretation and the "Science"' of International Relations' *Review of International Studies* 19 (1993): 39-61.

[23] Tannenwald, 'The Nuclear Taboo', op cit.: 463.

[24] See B. Buzan and E. Herring, *The Arms Dynamic in World Politics* (Lynne Rienner Publishers, 1998) as well as Farrell, *Weapons Without a Cause* op cit.

[25] See, e.g., Moy, *War Machines* op cit. and H. Gusterson, 'The McNamara Complex' *Anthropological Quarterly* 75 (1) (2001): 171-7.

[26] D. Lyon. 'Technology vs. "Terrorism"', *International Journal of Urban and Regional Research* 27(3) (2003): 666-678.

[27] D. Jenkins, *The Final Frontier: America, Science and Terror* (London: Verso, 2002).

[28] B. Harvey, 'Science, Technology and Military Policy' In I. Spiegel-Rösing & D. de Solla Price (eds) *Science, Technology, and Society* (London: Sage Publications, 1977) and P. Forman and J. Sachez-Ron (eds), *National Military Establishments and the Advancement of Science and Technology* (Dordrecht: Kluwer, 1996).

[29] D. Edgerton, 'British Scientific Intellectuals and the Relations of Science and War in Twentieth Century Britain' In P. Forman & J.M. Sanchez Ron (eds) *National Military Establishments and the Advancement of Science: Studies in Twentieth Century History* (Dordrecht: Kluwer, 1996).

[30] See S. Croft, *Strategies of Arms Control* (Manchester: Manchester University Press, 1996).

[31] B. Rappert, *Controlling the Weapons of War: Politics, Persuasion and the Prohibition of Humanity* (London: Routledge, 2006).

[32] D. Kelves, 'R&D and the Arms Race' In E. Mendelsohn, M. R. Smith and P. Weingart (eds.) *Science, Technology and the Military* (London: Kluwer, 1998): 465-480.

[33] C. Gray, *House of Cards: Why Arms Control Must Fail* (Ithaca, NY: Cornell University Press, 1992).

[34] T. Smith, 'The New Law of War' *International Studies Quarterly* 46 (2002): 355-374 and R. Falk, 'The Challenges of Biological Weaponry', In Susan Wright (ed) *Biological Warfare and Disarmament* (London: Rowman & Littlefield, 2001): 29.

[35] See a special issue in 2002 of *Disarmament Forum* issue 4. Available at http://www.unidir.org/bdd/fiche-periodique.php?ref_periodique=1020-7287-2001-4-en

[36] J. Arquilla, 'Patterns of Commercial Diffusion' In E. Goldman and L. Eliason (eds) *The Diffusion of Military Technology and Ideas* (Stanford: Stanford University Press, 2003).

[37] M. Clarke, 'The Implication of the Revolution in Military Affairs for Arms Control, Non-proliferation and Disarmament' *Disarmament Forum* 4 (2001): 5-10

[38] L. Winner, 'Trust and Terror: The Vulnerability of Complex Socio-Technical Systems' *Science as Culture* 13(2) (2004): 155-172.

[39] S. Metz, 'The Next Twist of the RMA' *Parameters* Autumn (2000): 40-53.

[40] D. Edgerton, *Warfare State* (Cambridge: Cambridge University Press, 2006).

[41] M. Howard, 'Where is the History of Warfare Going?' Presentation to the launch of Centre for the Study of War, State and Society Exeter 3 May 2006.

[42] See K. Grint and S. Woolgar, *The Machine at Work* (Cambridge: Cambridge University Press, 1997).

[43] E.g., M. Clarke, 'The Implication of the Revolution in Military Affairs for Arms Control, Non-proliferation and Disarmament' *Disarmament Forum* 4 (2001): 5-10

[44] B. Rappert, Non-Lethal Weapons as Legitimizing Forces?: Technology, Politics and the Management of Conflict (London: Frank Cass, 2003).