'Moving the techno-science gap in Security Force Assistance'

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Abstract
This paper looks at the impact of military technology diffusion on military assistance operations (MAO), in the United States known as Security Force Assistance or SFA. The discussion looks conceptually at the role of technological change and how it interacts with martial cultures in military assistant operations. I argue that growing trends in science and technology suggest potential conflicts between culture and technology. Relying on a culture-technology model drawn from anthropology, the paper contends that new technologies will present increasing challenges for the emerging MAO landscape. The paper will illustrate that the techno-science gap will continue to grow as innovations such as robotics, sensors, and networks continue to develop. Finally, the paper will look at ways to overcome this conflict between culture and technology.

Introduction
State powers have sought to influence events in other countries through indirect operations since time immemorial, from Roman trainers in the faraway realms of the Empire to Nazi German training of the nascent Turkish Republic. During and after the Cold War, military assistance operations (MAO) became a primary way to be involved in another state's national security challenges without being militarily active in front line positions. From British Army trainers in Israel to US Army trainers in Vietnam, MAO has been a mainstay of foreign policy for many nations who, through alliances or other national interests, seek to support the military capabilities of national governments over insurrectionists or unfriendly neighbours. At the same time, the state of military technological development, will increasingly differentiate militaries from each other with the increasing use of advanced networks, material and force employment concepts that it will be increasingly difficult to deliver via MAO.

Herein, I argue that there is an increasing tension within MAO, as some militaries begin to change the way they seek to go to war. MAO ordinarily relies on teaching skills and capabilities around purchased or loaned assets but can include skills as basic as marksmanship, as we see in indirect operations and Special Support and Reconnaissance (SSR) missions. But what happens as the very character of war itself begins to change, through doctrines and concepts that are themselves the result of changes in science and technology? From the beginning of the Revolution in Military Affairs (RMA) to the development of the third offset in 2016, the United States continues to change the way it would seek to go to war.[1] Although Soviet military theory impacted upon preceding ideas underlining the RMA, these changes in US military capabilities are also direct result of changes in science and associated technological development; the subsequent wars in Iraq and Afghanistan put them into practice.

In such circumstances, does the increasing 'capabilities' gap start to represent a 'techno-science' gap, redefining the way in which war is understood though the use of these

[1] On the Third Offset, see http://www.dodlive.mil/2016/03/30/3rd-offset-strategy-101-what-it-is-what-the-tech-focuses-are/ (accessed 23 November 2018)

scientific and technological developments? 'Techno-science' (or technoscience) refers to how human activity is shaped by science and technology, but also more critically, how science is shaped by technology and the social. If we understand war as a primary application of science and technology, and also subsequently how actors prepare for war, then the different techno-scientific conditions of actors will present challenges to the way in which one actor will seek to assist another.

This paper seeks to unpack this tension of what is referred to here as the 'techno-science' gap. We will first look at how MAO is a mechanism of foreign policy. We will then examine the impact of capabilities gaps on alliances and MAO operations. Next, we explore why technology is important in how one military might seek to assistant another, looking specifically at a conceptual framework for how technology conflicts with culture. Finally, we will look at the policy dilemmas that this tension delivers, and the implications for how foreign policy and environments may change in the future.

Role of culture and technology

Some advancements in technology not only reshape societies, but impact on the way that militaries may seek to go to war in particular ways. We can identify these as *space*, *time*, *decision-making* and *agency* (see Miller 2013). *Space* refers to the way that militaries project power across space. This encapsulates air, land and sea and is expanded to think about space beyond the material towards networked space; how things communicate and relate to one another beyond or escaping geographical space. Advanced communication systems, the role of satellites, GPS or alternative geo-location technologies, the rise of remote warfare and the ability for Special Forces to be anywhere at any time: these are mainstays of the modern military. By and large, however, they are out of reach from those that would seek US or other assistance through MAO.

Time refers to the gap between observation and action, traditionally seen in the OODA loop (observe, orientate, decide, act), a well-known and widely adopted mnemonic of the US Air Force (see Osinga 2007). The ability to respond to actions either manually (with human) or arithmetically (without human) is quickening all the time as the result of processing power, machine learning, and communications. Instead, modern militaries are seeking to detect, classify, identify, track, understand, pre-empt in ever faster times.

Similarly, *decision-making* refers to the increasing ability to either centralise or distribute command and control, using systems to rapidly manage decision-making in real time. Where traditionally distributed command and control meant reduced communication or awareness, information and communication technologies (ICT) allow for a command structure to remain whole even as it fragments. Experimentation with distributed command and control continues to develop in connection to how commanders are able to visualise the battle space.

In terms of *agency*, I mean the ability for technology to reshape what we mean by actors in the battle space. While decision-making is becoming more distributed and testing traditional hierarchical organisations, technology is also spreading agency beyond human agents towards machines and systems. As a result, doctrine continues to develop in ways which need to take into account distributed agency, feeding back into the way we think about space, time and decision-making. The result is a shift in focus from the platform to the network. Accordingly, the view of actors also shifts, from one of independent agents to an emphasis on their part in a continuously adapting ecosystem. Space, time, decision-

making, and agency give us a set of parameters that help determine how technology shapes military operations.

Yet, we also need to look to the wider literature regarding the relationship between culture and technology. There has been a plethora of research published on the relationship between culture and technology. If we take technology broadly to mean everything from culture itself (White 2007), to the advent of writing, or numeracy, or even war itself, then the literature is seemingly endless. If we narrow the term to what we have thus far implicitly meant by technology – to mean ICT – then the literature is still large but more manageable. The key question being asked in this literature is this: to what extent does culture impact on the way in which society uses technology? There are numerous examples of where ICT has been implicated in the failings of culture, such as in the Fukashima disaster in 2011. Likewise, culture has been implicated in ICT failings, such as Avianca flight 52 which crashed as a result of the senior pilot's misreading of the plane's altimeter even though the more junior co-pilot recognised the readings. In this case, strict hierarchy was blamed and apportioned to the Colombian national culture. As Leidner and Kayworth (2006, 358) state, 'these examples help illustrate that culture at the national, organisational, or subunit level exerts a subtle and yet powerful influence on people and organisations and that information flows and information technologies are closely intertwined with culture'. Culture represents collective basic assumptions, values and artefacts (see Schein 1985) which all have the ability to exert 'a powerful influence on information related behaviours including, at the most basic level, *what is considered to be legitimate information*' (2006, 358, emphasis added).

Technology is not culturally neutral. Rather, technology can represent a host of different cultural values that are borne of the underlying assumptions of the meaning and expected use of such technology. As a result, we should see that culture has an impact on the way that defence technologies would have on different militaries and their cultures. Interestingly, the literature on culture and technology often assumes that culture remains steadfast while technology is used in variable ways and itself evolves. However, there is reason to think that technology has the ability to impact on culture in much the same way as we talk about the advent of the car, or automatic appliances, the television or even advanced ICTs today.[2] Similarly, we should expect that defence technologies will have an impact on militaries, and will be used in a fashion that is culturally determined. In other words, cultural values and a cultural artefact like technology are mutually related, even if the latter is borrowed from a different cultural setting.

How might we think about culture and technology that allows us to operationalise it in relation to MAO? Taking Leidner and Kayworth's lead from their 'Tripartite view of IT-Cultural Conflict' (2006, 374), we can think about culture, or more specifically values, in three ways. This approach builds on the work that others have done in relation to MAO, SSR and other indirect operations, while focusing on the relationship between culture and technology that is often closed over in the literature (see Cottey and Forster 2004). Firstly, members of a group, whether nation, organisation or sub-unit, will have shared cultural values that express basic cultural assumptions. Secondly, there are those values that are embedded in technology, such as those functions that the technology has been created to deliver or the effects it has been set to make. Finally, there are those values that are embedded in specific technologies, such as PowerPoint or UAVs, that go beyond the

[2] For a review of the literature on culture and technology, see Leidner and Kayworth 2006, 360–373

broader cultural values in technological concepts, like communication or management. At this moment it is interesting to think about the transfer of technologies and what this means for these sets of values. Take RMA as an example. Parts of the Pentagon thought that RMA was not only the future of the US way of war, but that it was the *only* way of war and that its allies would therefore also need to incorporate the RMA if they wanted to stay in the business of warfighting. Thus, the imposed, borrowed, transferred or given technology takes on a different set of cultural values than one produced from the national culture.

If we take these three sets of cultural values juxtaposed, there are then three sets of conflicts, as illustrated by Leidner and Kayworth. The first is the *system conflict*, whereby the values embedded in specific technologies are in contradiction with the values of the group members. War has important behaviours, rituals and mores that reflect the values of group members. At what point would system conflict arise from the way in which specific technology is to be used and the effect it has, or more likely, when a specific technology is used for an effect it was not originally meant to deliver? While Leidner and Kayworth look at the national, organisational, and sub-unit levels, we can see that there is an international or more specifically bilateral level during MAO at which system conflicts might arise. This notion is important for our study, but also fits with their first proposition: 'the greater the cultural distance between the group responsible for championing the [technology] and the group adopting [it], the greater the system conflict experienced by the group adopting the [technology]' (2006, 375). As a result, another proposition holds true: 'the greater the system conflict experienced by a group, the greater the modification of use to support the group's values' (2006, 376). System conflicts pose considerable contradictions to the goals of future MAO.

Secondly, there is another form of cultural contradiction between group member values and the value embedded in broader technology. This is referred to as the *contribution conflict* because it pertains to the relevance or irrelevance of any technology to deliver a meaningful effect in relation to the group members' cultural values. An example is provided by a hypothetical management system introduced to hold easily accessible information, but perceived as top down monitoring instead. Herein lies a contribution conflict. Leidner and Kayworth propose (2006, 377) that if the embedded values of the broader technological concepts are closer to those of powerful members, there will be less contribution conflict. This reflects what we often see in technological adoption between militaries, especially during peacetime where shared operational experiences are less likely. Furthermore, the greater the contribution conflict, the less likely that the technology will be used; even if, for instance, there is an operational need for such technology.

Finally, there can be a *vision conflict* where there are contradictions between the values of the broader technology and a specific technology set out to fulfil these functions. The conflict arises when a group has to reconcile between the values of the broad technological objective and its elaboration into a specific piece of kit. Such a vision conflict could arise between the objectives of remote warfare and the embedded value of UAVs, whereby government forces may see the value of drones as ISR (intelligence, surveillance, reconnaissance) but not as a vehicle for armed strikes. Here, Leidner and Kayworth propose that 'the higher the vision conflict a group has with respect to a [technological] system, the lower the adoption rate of the system by the group' (2006, 379). This model, as inferred from Leidner and Kayworth, sets out a way to think about MAO as a technological exchange, and the contradictions that may arise from either or both sides in that exchange.

This theory of culture and technology conflict does have two ways in which to ameliorate the chances of conflict. In the first, what Leidner and Kayworth (2006, 380) refer to as 'managers' have the ability to promote shared technological values. How this shared value promotion is done would be the goal of further research, but existing cases suggest it is difficult. We might at this point think again about how the US military sought to influence its NATO allies through the promotion of technological values embedded in concepts such as Network Centric Warfare (see Guha 2012). Even where we have seen a more positive reception to specific technological applications of NCW adopted by or transferred to NATO allies, the concept itself still remains contested (see Wiesner 2013). We could even go so far to say that NCW has been more difficult to communicate across different member-groups because it is a technology-centred battle concept, which appears to contradict existing core group values. For instance, Erik Dahl (2002) talks about how NCW challenges the foundational operational art underlying traditional battle experience. The embedded values of the technological concept of NCW and the diffusion of its specific technologies provides an example of how culture and technology have produced value conflict across and between national militaries.

The final resolving proposition is that 'the emergence and resolution of the three types of conflict will, over time, result in cultural changes' (Leidner and Kayworth 2006, 380). The emergence of value conflicts suggests that the way that technology interacts with cultural values will impact on the way that the technology will be used or exploited, while resolution suggests that there is a resultant cultural shift wherein group member assumptions and their associative values themselves begin to change. ICT is one type of technology that has seen this pattern of emergence, resolution and subsequent cultural shift. Yet, cultural assumptions and values become more evident when there are conflicts, which suggests that this process of emergence, resolution and change is dynamic and overlapping rather than sequential, as Leidner and Kayworth initially proposed.

In summary, borrowing from Leidner and Kayworth, I propose here that we conceptualise the relationship between endogenous culture and exogenous technology in the conflict model presented above, allowing us to take forward system, contradiction, and vision conflicts as a way to talk about technology and MAO. In essence, I am trying to highlight where there are cultural translation issues, and how we might seek to ameliorate them. Such an endeavour is important, as the US – and with it, the UK, France and others – become more technologically sophisticated, beyond the natural scope of those they seek to assist through MAO. This tripartite system of culture-technology conflict gives us a conceptual framework to do just that. We may also bear in mind that the historical relationship of some assisting states like the US and UK with receiving states may in itself provide a buffer against culture and technology not recognised in Leidner and Kayworth. In other words, we should see less conflict where there is a shared view of the martial space. We look at this tension in context in the next section.

Models of Security Force Assistance

The training and advising of foreign militaries is as old as military alliances are old. Naturally, alliances have a common interest in the security of members. Broadly speaking, MAO has been referred to in many ways, such as defence assistance, military assistance, foreign direct assistance, foreign internal defence missions, and indirect operations. We can define MAO as 'the unified action to generate, employ, and sustain local, host-nation or regional security forces in support of a legitimate authority' (Security Force Assistance 2009,

1). What we understand today as MAO had its birth in the Marshall Plan, which allowed the United States to use reconstruction and development initiatives to shore up allied Western European militaries for a new martial standoff with the Soviet Union. The training, advising and equipment received by West European militaries laid the groundwork for how the United States sought to use MAO as a mechanism of containment during the Cold War. This eventually would be used in Greece, South Korea, Latin America, South East Asia and more. Since the end of the Cold War, the United States, UK, and other countries have sought to use MAO to implement security sector reform, on the one hand, and to prosecute the 'War on Terror' on the other, by enabling local militaries to face the internal security dynamics that threaten their states. We can see this in the US support of the Philippines, initially aimed at communist guerrillas and eventually focusing on the Muslim insurgency in the south of the country. Support for the Georgian military was also focused on international terrorism, particularly in the Pankisi Gorge (see Bennet 2013).

For the last 16 years, attention has been heavily focused on US and allied MAO in Afghanistan and Iraq. In his *Foreign Affairs* article, 'Helping Others Defend Themselves: The Future of US Security Assistance', then US Secretary of Defence Robert Gates called on the US military to be able to deal with threats that would arise from failed or failing states, 'in many ways, the main security challenge of our time' (Gates 2010, 2). For Secretary Gates, this meant 'building partner capacity: helping other countries defend themselves or, if necessary, fight alongside US forces by providing them with equipment, training, or other forms of security assistance' (2010, 2). Written at a time when the US was still at war in both Iraq and Afghanistan, the tenor of the article is about making it possible for allies and locals to take a more active role in engaging immediate local threats that could become (or already are a symptom of) threats to international security. Gates argues that there are two main functions of MAO. These are a) the advisory function and b) the combined approach application. The advisory function is seen in the way in which trainers and senior military advisors set out to reinforce local militaries through operational and tactical concepts and doctrine, as well as information sharing. The combined approach application sets out to bring together a range of different departments and agencies to support MAO. Gates refers to this as 'Bridging the Potomac' (between Foggy Bottom and the Pentagon who sit on the two sides of the river), where the Departments of Defence and of State have a joint responsibility to treat the conditions of the threat facing the local partner (2010, 4). In this case, Gates refers to support for 'the Lebanese army, the Pakistani special forces, and the navies and maritime security forces of Indonesia, Malaysia, and the Philippines' (2010, 4).

MAO programmes have been traditionally carried out by those with cultural and area knowledge, such as Special Forces or other elite troops like the US Army Green Berets and US Marine Corps. In the US response to Abu Sayyaf in the Philippines, for instance, the US dispatched a mobile training team to create a company-sized counter-terror unit to work with the Armed Force of the Philippines (AFP) (Bennet 2013, 52). US Army Green Berets have been a long-time contributor to MAO programmes in the Philippines, since the initial response to the then communist rebellion 1950s. In UK and French cases, both have relied on conventional and special and elite forces to train local militaries, such as the long history of the SAS in Israel or the Commandement des Opérations Spéciales (COS) in Francophone Africa. The size of such MAO operations have been ordinarily the size of companies, but can be larger depending on the degree of training and the intensity of direct operations. US assistance to Colombia varied throughout the 1980s, and then grew from Special Forces

training to larger scale assistance that would come to be known as Plan Colombia (2013, 96–98).

While MAO can be seen as a North-South issue whereby wealthy states support poorer states, alliance politics has worked very similarly. Developing a discussion present since the end of the Second World War, the 1990s saw a growing rhetoric of the capabilities gap between the US and the rest (see Coonen 2006; Yost 2007; Crowcroft and Hartley 2012; Farrell and Rynning 2010; Terriff, Osinga, and Farrell 2010). This gap came at a time where all NATO members were downsizing, but the difference in scale from the US meant that many European militaries became unable to perform stand-alone operations. Furthermore, the US began to change in ways that would make its military more technologically driven than its NATO allies. Technology here referred to platforms as well as what constituted doctrines like AirLand battle and AirSea battle. This is to say that technology has been often equated as the ability to deliver firepower, across time and with degrees of concentration, but this is only a very specific application in relation to how we might think of technology as applied to military operations. Nevertheless, the capability gap threatened NATO politically at a time when it was active in the Former Yugoslavia. The issue then (as it is now) was whether the European NATO allies were doing enough for their own security and that of the North Atlantic area. In the end, European allies continued to contribute to peace operations in the Former Yugoslavia while the US continued to transform.

As a result of this transformation, seen most clearly in the RMA, US military command saw the capability gap as a threat to future American operations. The US expected to rely on allies in future operations, but the doctrinal and technological differences between the two forces would mean that the US would be less operationally effective, and an ally might not be depended upon to hold a front. As Farrell, Rynning and Terriff (2013) show, the US went on a mission to bring the benefits of this technological revolution to its allies. NATO established the Allied Transformation Command in Norfolk, Virginia and have had a European senior officer in command since its inception. This era of transformation oversaw the introduction of professional militaries across Europe, as well as major technological shifts in ICT. The wars in Afghanistan and Iraq became a way for this transformation to be experimented with and implemented by the US and its allies. Yet, we can see that the culture-technology conflicts discussed earlier were ever present here, and even existed within the US military command before it reached European shores.

The capability gap that existed (and still exists) between the US and its European allies is important operationally because it says something about the way that the alliance is able to plan for and operationalise defence. The gap then becomes as much about how NATO seeks to posture itself, and the burden that the US takes in supporting it while at the same time seeking to have it match the US military's own operational preferences. Again, advanced communication systems are one of the areas where the US and its European allies have been mismatched, as in exercises, where command and control is not at the same level across the operation. The NATO capability gap is not the same as in MAO, though European militaries have themselves been subject to MAO at the end of the Second World War (and for some for Warsaw Pact members of NATO, after the Cold War). But it should be said that if this capability gap exists and impacts on NATO alliance planning and operations then it suggests that the barriers to cooperation can exist in militaries where they are less resourced and developed than those of European NATO allies. Finally, the capability gap should not be considered solely a technology gap, since often there has been as much discussion about the size of deployable forces as there has been about platforms or

technological assets – though discussion of the capability gaps has often been synchronous with the rise and fall of the RMA. While we do not have scope to go into details here, we can identify system, contradictory and vision conflicts as they have arisen and in some cases been overcome as new technologies and ways of exploiting them.

Alternatively, MAO as SSR has been a frequent development since the end of the Cold War, particularly brought to the fore by the operations in the Former Yugoslavia. Britain's role in MAO has by and large been through the SSR lens, although the Britain has relied on more direct MAO in the past, particularly in the Middle-East (namely by training the Omani and Jordanian militaries). Returning to MAO as SSR, Britain has been active in Africa in just this way. A good example of this is the UK assistance mission in Sierra Leone. The British-led International Military Advisory and Training Team (IMATT) was one of the primary actors developing discipline and skills in the Sierra Leonean military. As Ashlee Godwin and Cathy Haenlein state (and is echoed in Gates' 'bringing the Potomac' challenge), the foundation of the international effort to develop the Sierra Leonean military was based on the driving concept of the development-security nexus (2013). While Sierra Leone sits outside the international security concept laid out in Gates' article in that Sierra Leone, did not immediately pose national security threats to the UK (or Liberia to the US for that matter) outside the flood of arms to West Africa that the war induced (which can be tied to the rise of Boko Haram in Northern Nigeria and other conflicts in the region). The IMATT mission closed in 2013, when it was deemed, at least publicly, that the local armed forces were a capable force. In its place, the IMATT was replaced with the International Security Advisory Team (ISAT). The result was a transition away from defence reform to security-sector reform. The MAO model in Sierra Leone was focused on discipline and basic skills, such as reading and writing, which matched the needs of a country that had suffered extensively during the war. The underlying logic of the IMATT, and the lower-key ISAT that followed it, was that capacity-building is a foundational element of MAO. This is important because in many cases, as in Sierra Leone, the biggest threat to a state can be in fact the military itself. While it was important for IMATT and then ISAT to make the Republic of Sierra Leone Armed Forces (RSLAF) a more effective fighting force, professionalising their role in the post-conflict peace was more important.

MAO as defence effectiveness has been seen in a number of different cases, but we might pull out the US military's efforts in the Philippines, Colombia and Georgia, as Richard Bennet has so expertly done (2013). In all three cases, these states faced challenges to their own territorial control. In the Philippines and Colombia, there has been a long running insurgency cum civil war. Defence effectiveness was an important part of trying to bring these conflicts to an end, as it seems to have done in the case of the FARC in Colombia. In Georgia, the dilemma was the congregation of Chechen insurgents in the Pankisi Gorge, which had been using the valley to make running attacks on Russian forces across the border. The challenges faced by US MAO teams were somewhat different in each of the three cases. The Philippines Armed Forces needed better ISR to make gains against an elusive enemy. The Colombian forces had fought a long war with the FARC but needed the assets and training to make gains on a well-trained and well-resourced insurgency. In the Georgian case, the challenge was to bring a fledgling military that had lost territory in Abkhazia and South Ossetia to a point of effective control over its non-contested territories. Hence, MAO was about capacity building and skills training. In all three cases, the local militaries were able to make gains against their adversaries following help of US information sharing, asset lending and skills training. Yet, we might wish to note that further research

would need to be done to show anything more than capabilities increased, capacity increased, but that did not always translate to desired effects for US allies. Nevertheless, all three cases were about dealing with insurgency. The role of technology in counter-insurgency (COIN) from human terrain modelling to ISR has radically developed over recent years, stemming from the wars in Afghanistan and Iraq.

These cases are important for our study here because it highlights the asymmetries in starting points between the trainers and the trained. For any military, discipline and by extension command and control are fundamental. The challenge that US, UK and other forces face going forward is the extent to which technology begins to shape these most basic elements of the military. Put another way, how far down does military transformation go in MAO? As espoused by the RMA, or in the objectives of the US Third Offset? Advances in information and communication technology (ICT) are having an increasing impact on the very foundations of society and with it how more advanced forces operate. We have seen that technology impacts on societies at different rates, and perhaps most importantly, in different ways. What we will see in the next section is a discussion of the relationship between culture and technology , so that we might be able to evidence the existing and forthcoming dilemmas that MAO efforts will face in the future.

Policy dilemmas and implications

We have seen a prospective argument that the state of military technological development, particularly but not exclusively in the US, will be increasingly differentiated from other militaries by its reliance on advanced networks, material and force employment concepts that it will be increasingly difficult to deliver via MAO if the culture-technology conflicts are not addressed. Earlier, I show how these sets of conflicts have already happened in alliance politics. Here, I want to look at how technology is shaping the character of war. Furthermore, I want to show that technology is not something extra or added, but is intrinsic to thinking about the character of war.

Towards a research programme

The conflicts that emerge between culture and technology matter for us in this article in that they tell us something about how assumptions about war making are inherently technological. From this, we should assume that the ability to assist, train and even engage in indirect operations between technologically asymmetric militaries will need to overcome the conflicts as we have laid them out here. In particular, the system conflict will arise when technology has the ability to upset standing doctrine and concepts or if technology appears to upset traditional power and command structures in the military. For instance, the move towards UAVs may suggest to some that there is a change in balance of power between services. The contribution conflict appears where technology presents a different way of approaching an operational challenge, such as a change in the way a military may seek to prosecute a jungle warfare campaign. Where a system conflict says something about the adopting military itself, a contribution conflict refers to the conflict between how a technology may contradict existing approaches or utilities. The vision conflict can work in both directions of the MAO relationship. While the adopting military may take a general technological advance for granted, it may conflict with specific applications that may seemingly contradict the perceived advantage of the general technological advance. For instance, if a technological advance allows greater manoeuvrability while a specific application seems to imply a static deployment, then there

will be a vision conflict. At the same time, we could imagine that as new technological applications are introduced to adopting militaries, there may be local applications of such a technology that may contradict the general technological advance as envisaged by the MAO delivering military. We can think of novel ways of using a range of different technologies for local conditions.

To get a sense of the sorts of conflicts that might arise in future MAO programmes, let us look at the changing nature of science and technology as it is now and how it takes us forward. There are three shifts in military systems that are being technologically enabled. The first is the shift in focus from the platform to the network. While militaries are loathe to talk about NCW today, they are nonetheless dealing with the challenges that were laid out in the concept. With increased processor power, bandwidth capabilities, sensors and machine learning, militaries are being confronted with how they might fight wars, especially anti-access or area denial activities that will require a much more connected and 'joined up' way to deal with technological advancements in electronic warfare, ballistic and cruise missiles, ICT jamming, electric magnetic pulses, UAVS, UUVs and much more. Secondly, there is a shift from viewing actors as being independent agents to viewing them as being part of a continuously adapting ecosystem. As we increase sensors and improve and proliferate machine learning, militaries will be able to be much more resilient or 'antifragile' in their campaigns (see Taleb 2012). This shift has serious implications with the way we think about war, militaries and command and control. Finally, there is a shift in the importance of making strategic choices to adapt or even survive in evolving ecosystems. The question becomes who makes these decisions or how are they realised? Again, we reflect on how we might imagine command and control to change in relation to distributed or even arithmetic decision-making across a wide range of spatial dimensions (especially useful for engaging anti-access systems).

Overall, we have a research programme that demands further attention. The techno-science gap as we have discussed here has the potential to impact on how well militaries are able to assist others to respond to their own and shared security threats. The technology-culture conflicts are seen throughout society and are a natural outcome of the diffusion of technology. Nevertheless, while ubiquitous, there are ways in which these conflicts can be overcome. Further research should be carried out with military trainers to gauge the challenges that MAO faces in improving defence effectiveness and security sector reform. Furthermore, I would like to see further research in how receiving states seek to overcome the techno-science gap during MAO. The impact of information technologies, machine learning, and robotics will continue to shape militaries and how they prepare for war.

Conclusion

Why might we assume that the martial technologies will become an ever-greater conflict between culture and technology going forward? The pace of change has increased with the rate of scientific and technological convergence that has followed the ICT, genetic and arguably the neurological revolutions that continue to evolve today. Convergence refers to the way in which separate science and technological fields begin to come together to create new fields of research and development. Examples of converging technologies are processors and mechanics, biology and engineering, cognition and coding, and informatics and networks. These changes have a great potential to impact on how countries like the US, but also China, Russia, UK, France, Israel and others think about warfighting and become a central part of the cultural norms and assumptions that they hold and then seek to share in

MAO indirect operations. These militaries will be increasingly able to gain advantage on time and space as a factor of war fighting. They will be required to increase their joint operations. They will increasingly be reliant on complex weapons systems that allow for range, guidance, changes in environment and targeting. Finally, these militaries will be confronted with a more complex martial environment that suggests that the OODA loop will become incorporated into a more sophisticated loop that includes detect, classify, identification, track, understand, and pre-empt. The OODA loop is a good place to rest as we think about the changes in modern and emerging warfare. For many operations, the OODA loop is still a valuable way of thinking about warfare. The tighter the loop, the better. However, the OODA loop also has many assumptions about the ability to observe, the challenges to orient, the distributed decision-making and assets to act. In all, this characterisation of scientific and technological change suggests that we are seeing an emerging future that make MAO operations more difficult as the doctrine, concepts, assets and martial environment continue to differ.

MAO operations are an important part of the foreign policy toolkit, as an alternative to committing to war. If traditional interventionists states like the US, UK, France and others wish to continue to deploy MAO operations as a way of precluding larger scale instability and conflict, there are emerging challenges that come with the scientific and technological innovations we are witnessing. This paper has shown how conceptualising culture and technology relationships is a way of thinking about future MAO operations, with the identification of system, contribution and vision conflicts. Here, I also talked about the way in which we can already see how technological and doctrinal differences between even the US and its NATO allies suggests that the prospect for conflict over martial culture and technologies is not only in our future, but already exists. However, the key for our discussion here is that where traditional MAO operations have been about command, training and intelligence, even these indirect operations have the potential to be impacted by scientific and technological developments. This argument suggests that the prospect MAO as a form of conflict prevention as opposed to military intervention is made more difficult and complex through these conflicts between culture and technology. At the same time we should not assume that these tensions could not also be an important way to control a principle state's relationship with the receiving state. In other words, while the focus here has been on overcoming such technology-culture conflicts, there may be reasons why MAO states may wish to enhance them.

Finally, while this article has primarily looked at asymmetric, allied military assistance, we should be able to observe a similar circumstance amongst near-peer, adversaries as they seek to adopt and adapt from each other in the lead up to or execution of war. While others have looked at how adversaries learn from each other in war, the approach in this paper points us towards looking at how the culture-technology conflicts might influence how states seek to respond to their adversary. Nevertheless, the focus here has been on asymmetric relations in order to illustrate the growing distance between military capabilities of the principal state training and the agent state learning, especially as information technology continues to escalate the development of martial technologies. This tension between culture and technology is not only relevant to MAO, but can be broadly interpreted where technology diffusion meets new cultures. However, they matter to militaries in as far as governments seek to use MAO as a form of conflict prevention if not indirect warfare.

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