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Introduction: Transforming War, 1914–1918

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ABSTRACT

This introduction to five case studies of military adaptation between 1914 and 1918 reviews how warfare was transformed in the First World War. It examines the experience of the three major western front protagonists – France, Germany and Britain – positing that, having different military cultures, each army adapted differently but that for all the pace of change was rapid and the outcomes appropriate to meet the tactical and operational challenges of the modern industrialised battlefield. It links the historical study of military adaptation between 1914 and 1918 to more recent theoretical explanations of how armed forces innovate in response to changes in warfare. It suggests that these theories have only limited applicability to the circumstances of intensive combat that defined the First World War battlefield.

Those who wish to understand the nature of the twentieth century's wars must engage with the transformative processes inherent in warfare between fully industrialised societies.¹ Perhaps it is the enormity of the socio-cultural phenomenon that the Great War became, or its wide-ranging, prolonged and often iniquitous consequences, that undermine balanced judgment of this key military event. Either way, except among scholars of military history how the war was fought seems nowadays of limited interest compared with how it was experienced and remembered. While equally transformative of the societies that fought it, it was the nature and needs of the battlefield that determined 'home front' developments;

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¹For a general discussion of its place in wider military transformation down the centuries see the essays in *The Dynamics of Military Revolution, 1300–2050*, ed. Macgregor Knox and Williamson Murray (Cambridge: Cambridge University Press, 2001).

therefore the dynamic military adaptation occurring at 'the front' needs to be factored into understanding of the war's modernising effects.² Although the existence of a western front Revolution in Military Affairs (RMA) is now generally acknowledged in studies of the 'trench warfare' that epitomises the First World War,³ some scholars still position their analysis of the conflict's military developments within a dated meta-narrative of inefficiency and military ineffectiveness,⁴ informed by ingrained myths of command incompetence and futile sacrifice that have become a subject of study in themselves.⁵ Few scholars would now accept the idea of a slow-witted and poorly managed engagement with modern war. Examination of aspects of evolving military practice, and a comparative approach to the challenges and responses that all belligerents shared in the twentieth century's defining conflict, suggests that rapid, effective and long-lasting shifts in warfare sprang from the apparently stalemated trenches.

The First World War is a striking exemplar of the dictum attributed to Darwin that 'it is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change'. The articles collected in this special edition give examples of how the British, French and German armed forces on the Western Front were 'adaptable to change' in this sense. These suggest that in this all-or-nothing struggle for survival to which each army was adapting, transformation was inherent to military experience, and that its pace and assimilation were factors that would determine the outcome of the military conflict.

²Home front change is studied extensively, but not in explicit relation to events on the battlefield. See, for instance, Adrian Gregory, *The Last Great War: British Society and the First World War* (Cambridge: Cambridge University Press, 2008).

³See the discussion in Jonathan A. Bailey, 'The First World War and the Birth of Modern Warfare', in *The Dynamics of Military Revolution*, pp. 132-153.

⁴For a recent example see the chapter 'Complex Adaptation: the Western Front, 1914-1918', in Williamson Murray, *Military Adaptation in War: With Fear of Change* (Cambridge: Cambridge University Press, 2011), pp. 74-118. Of course a suggestion of dynamic and successful adaptation between 1914 and 1918 would have undermined the broader thesis Murray was positing. Nevertheless, his analysis ignores the extensive scholarship since the publication of his seminal co-edited volume, *Military Effectiveness, vol. 1: The First World War*, ed. Alan Millet and Williamson Murray (London: Allen & Unwin, 1988). Other works on military change gloss over the war, for example *The Evolution of Operation Art: From Napoleon to the Present*, ed. John A. Olsen and Martin van Creveld (Oxford: Oxford University Press, 2011).

⁵See for example Dan Todman, *The Great War: Myth and Memory* (London: Hambledon and London, 2005) and Gordon Corrigan, *Mud, Blood and Poppycock: Britain and the First World War* (London: Cassell, 2003).

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Most historians no longer need to be told that between 1914 and 1918 lions were not led by donkeys, since military commanders' professionalism, and the growing military effectiveness of their armies in response to the particular challenges of the industrialised battlefield, have been the subject of sustained enquiry for three decades. It has taken a long time. In 1960, Cyril Falls explained that he wrote his history of the First World War because 'I wanted to do all I could to demolish a myth as preposterous as it is widely believed. For the first time in the known history of war, we are told, the military art stood still in the greatest war up to date.'⁶ For some reason, static positional warfare had quickly come to exemplify all that was wrong with military science. By the time of the next war scholars could shorthand the British army's catastrophe of 1 July 1916 as 'typical trench warfare operations',⁷ although in fact such misfortune was far from typical that year or subsequently: and not even typical of 1 July 1916 if the French army's overwhelming success on that day and the achievements of the bloodied but successful British XIII Corps are acknowledged alongside the British army's upset on part of its front of attack.⁸ Certainly First World War battles were always going to be intensive and costly – in General Charles Mangin's oft-quoted words, 'whatever you do, you lose a lot of men'⁹ – although that was a consequence of the scale of warfare as much as the style. What had already been lost in simplistic post-war critiques was the complexity, variety and dynamism of the art of war between 1914 and 1918 – a period which saw a terminal break with Napoleonic paradigms of warfare and the emergence of proto-modern tactical and operational methods – because the theatre in which it developed remained in strategic stalemate.

Building on foundations laid in the early 1980s by Shelford Bidwell and Dominick Graham and John Terraine, a generation of archival research on the British army has made great progress where Falls failed.¹⁰ The 'preposterous myth' has been

⁶Cyril Falls, *The First World War* (London: Longmans, 1960), p. xvi.

⁷Harvey A. de Weerd, 'Churchill, Lloyd George, Clemenceau: the Emergence of the Civilian', in *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler*, ed. Edward M. Earle (Princeton: Princeton University press, 1941), pp. 287-305: 290, n. 14. No doubt the author had taken his cue from the anti-military memoirs of his British subjects.

⁸William Philpott, *Bloody Victory: The Sacrifice on the Somme and the Making of the Twentieth Century* (London: Little, Brown, 2009), pp. 175-8.

⁹Charles Mangin, *Lettres de guerre, 1914–1918* (Paris: Arthème Fayard, 1950), p. 112.

¹⁰Shelford Bidwell and Dominick Graham, *Fire-power: British Army Weapons and Theories of War, 1904–1945* (London: Allen & Unwin, 1982); John Terraine, *White Heat: The New Warfare, 1914–1918* (London: Sidgwick & Jackson, 1982).

demolished and 1914–18 is increasingly being acknowledged as a period of dramatic change rather than stagnation. It should be stressed, however, that despite this intensive revisionism one hundred years afterwards we still only partially understand the ‘military machines’ of the first industrialised mass war. Moreover, scholarship on the British and Dominion forces, reacting to the cultural misconception mentioned above, has made far greater progress than the study of allied or enemy armies.

The armies that took the field in August 1914 found that the ‘principles’ of war as defined and debated in pre-war years were only partially applicable to the actual circumstances of mass battles between armies equipped with modern communications, logistics systems and killing technologies. In actual fact, the war broke out at a moment when doctrinal debate in most armies was engaging with the potential changes that industrialisation and mass would bring to the battlefield and to strategy, although no definitive answers had yet been formulated.¹¹ Thus the war itself became a workshop and proving ground for rapidly developing military doctrine and modernising armed forces. Leaving aside the inherent killing power of modern military technologies, this process of change in itself was liable to lead to false starts, missed opportunities and even the ‘blunders’ dwelt on by subsequent generations, that would on occasion make ‘cannon fodder’ of the troops that fought. It would therefore be a difficult four years of warfare, during which military art and science were completely transformed, with armies forced constantly to adapt to new realities as they struggled to master the industrial battlefield.

It can be argued that warfare has probably never witnessed a more rapid and profound transformation than that which occurred between 1914 and 1918. Although fought statically in field entrenchments for most of its course and in most of its theatres,¹² it had a profound impact on military theory and operational practice thereafter which defined warfare until the turn of the twenty-first century. While cultural perceptions of military inflexibility and incompetence persist against the evidence, nonetheless scholarship over the last twenty-five years has done much to redress such misperceptions. We have come a long way towards understanding the changes in warfare and the armies which fought (particularly on the western front),

¹¹For relevant discussion see Douglas Porch, *The March to the Marne: The French Army, 1871–1914* (Cambridge: Cambridge University Press, 1981), Robert T. Foley, *German Strategy and the Path to Verdun: Erich von Falkenhayn and the Development of Attrition, 1870–1916* (Cambridge: Cambridge University Press, 2005), and Bidwell and Graham, *Fire-power*.

¹²Even the ‘trenches’ themselves went through a process of transformation, from the hastily excavated linear positions of 1914 to the deep, strongpoint-based defensive networks that the armies fought over in 1918, indicative of the rapidly evolving dynamic between offence and defence.

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although our grasp of the changes which took place remains incomplete, and the investigation of the transformative processes which produced them has not been systematic or sufficiently wide-ranging. The articles here touch on elements of that transformation, presenting snapshots in time and place that give insights into the processes and outcomes of this dynamic change.¹³

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In this introduction we wish to locate the First World War RMA within the wider parameters of contemporary debates on military adaptation and transformation, restoring the tactical, operational and doctrinal shifts of these years to the central place in modern warfare which they should occupy. While widely investigated, the fundamental changes in warfare between 1914 and 1918 remain only partly understood. This is a consequence of limited thematic and geographical focus to date. The tactics of the trenches have long been a subject of historical investigation, by authors such as Paddy Griffith and Martin Samuels.¹⁴ The emergent operational level of war has only been engaged with more recently, by Andy Simpson and David Zabecki primarily.¹⁵ The learning process too, as applied to the British army's traumatic but ultimately successful adaptation to modern warfare, has been a fruitful, if contested, field of enquiry.¹⁶ These defining studies focus on the British and

¹³The articles arise from the work of the First World War Operations Research Group based in the Department of War Studies, King's College London, of which the authors are members.

¹⁴Paddy Griffith, *Battle Tactics of the Western Front: The British Army's Art of Attack, 1916–18* (New Haven, Ct.: Yale University Press, 1994); Martin Samuels, *Command or Control? Command, Training and Tactics in the British and German Armies, 1888–1918* (London: Frank Cass, 1996).

¹⁵David Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War* (London: Routledge, 2006); Andy Simpson, *Directing Operations: British Corps Command on the Western Front* (Staplehurst: Spellmount, 2006).

¹⁶Initially and still colloquially referred to as the British army's 'learning curve', historians have developed a more rounded and nuanced view of the learning process in all armies since the publication of Gary Sheffield's ground-breaking study of the British army's development, *Forgotten Victory: The First World War, Myths and Realities* (London: Headline, 2001). One of its originators, Peter Simkins, has recently suggested, 'first used...among British military historians in the early 1990s, the phrase 'learning curve' was mainly employed as a kind of shorthand to signify that one rejected the 'lions led by donkeys' and 'butchers and bunglers' interpretations of the First World War. ...Given the growing consensus on the issue, we should perhaps at last recognise that, at least among serious students of the First World War, this particular battle has now been fought and won and that the term 'learning

German armies, which faced each other on the northern end of the western front. Scholarship on the French army, which throughout the war faced and fought the bulk of the German army, has lagged behind. Until recently Douglas Porch's 1990 study in *Military Effectiveness* was the most accessible, if limited, engagement with the subject. His judgement that on the Great War battlefield the French army put in a 'courageous but unintelligent performance' seems hurried and half-formed in the light of recent scholarship.¹⁷ Moreover, as Porch's own analysis reflects, the study of French experience had been skewed towards the disasters, trials and errors of their war – August 1914, Verdun and the 1917 mutinies – rather than addressing the process of military 'lessons learned' which enabled the French Army to take on and defeat the most powerful military machine of early twentieth-century Europe. Its tactical development has belatedly been considered by Michel Goya, Jonathan Krause and Tim Gale although the processes by which 'the first modern army' thought, learned and acted remain relatively unknown compared with those of its main ally and primary adversary.¹⁸ Other European armies, Russian, Italian and Austro-Hungarian principal among them, were going through their own transformative process during these years, and also deserve systematic study to provide a full picture of the transformative effect of the war.¹⁹

curve', when used in this connection, should therefore be laid gently to rest, its duty done.' Peter Simkins, *From the Somme to Victory: The British Army's Experience on the Western Front, 1916–1918* (Barnsley: Pen and Sword, 2014), pp. xiv-xv. See also William Philpott, 'Beyond the "Learning Curve": The British Army's Military Transformation in the First World War' (10 November 2009), RUSI online analysis (<https://rusi.org/commentary/beyond-learning-curve-british-armys-military-transformation-first-world-war> – accessed 28 February 2018). For recent examples see Robert T. Foley, 'A Case Study in Horizontal Military Innovation: The German Army, 1916–1918', *Journal of Strategic Studies*, 35/6 (2012), pp. 799-827 and 'Learning War's Lessons: The German Army and the Battle of the Somme, 1916', *Journal of Military History*, 75/2 (2011), pp. 471-504.

¹⁷Douglas Porch, 'The French Army in the First World War', in Millett and Murray, *Military Effectiveness*, vol. 1, pp. 190-228: 225.

¹⁸See Michel Goya *La Chair et l'acier: L'Invention de la guerre moderne, 1914–18* (Paris: Taillandier, 2004); Jonathan Krause, *Early Trench Tactics in the French Army: The Second Battle of Artois, May–June 1915* (Farnham: Ashgate, 2013); Tim Gale, *The French Army's Tank Force and Armoured Warfare in the Great War: The Artillerie Spéciale* (Farnham: Ashgate, 2013).

¹⁹The Italian army is considered in John Gooch, *The Italian Army and the First World War* (Cambridge: Cambridge University Press, 2014). Eastern front campaigns are now being more thoroughly investigated although the armies that fought them await their historians. See for example, Timothy C. Dowling, *The Brusilov Offensive* (Bloomington: Indiana University Press, 2008); J. R. Schindler, *Fall of the Double Eagle:*

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Transformation – of material, method and military culture – took place at both the tactical and operational levels of war. What scholarship has definitively demonstrated is that the pace of military change was rapid. The opposing armies co-existed in a dynamic equilibrium of tactical and operational innovation and counter-measure that ironically sustained rather than ended the strategic stalemate. By the end, however, the opposing armies were very different in their organisation, method and understanding of war. It had been transformed into the ‘modern style’ of warfare through the integrated processes of technological adaptation, institutional learning and conceptual rethinking.

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Military transformation is more than a historical phenomenon. Case studies of military innovation have multiplied over the last thirty or forty years, attracting interest from two rather different traditions: social science and history. A brief review of recent literature, taking these two in turn, will provide useful context for what follows and offers an opportunity to point out some of the strengths and weaknesses of what has been written to date. The last forty years has seen an attempt by social scientists, notable among whom are Barry Posen, Stephen Rosen and James Bradin,²⁰ to improve present-day decision-making by scouring the past for examples of military innovation. Summarised very broadly, the rapid development of information technology in the 1980s, interpreted in the Soviet Union as constituting a ‘military technical revolution’ and sometimes touted in the West as constituting a

The Battle for Galicia and the Demise of Austria-Hungary (Lincoln, NE: Potomac Books, 2015); Prit Buttar, *Collision of Empires: The War on the Eastern Front in 1914* (Oxford: Osprey Publishing, 2014), *Germany Ascendant: The Eastern Front, 1915* (Oxford: Osprey Publishing, 2015) and *Russia’s Last Gasp: The Eastern Front 1916–17* (Oxford: Osprey Publishing, 2016).

²⁰Barry Posen, *The Sources of Military Doctrine: France, Britain and Germany between the World Wars* (Ithaca: Cornell University Press, 1984); Stephen P. Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca: Cornell University Press, 1991); James W. Bradin, *From Hot Air to Hellfire: The History of Army Attack Aviation* (Novato: Presidio, 1994). See also Thomas C. Hone and Mark D. Mandeles, ‘Interwar Innovation in 3 Navies: US Navy, Royal Navy, Imperial Japanese Navy’, *Naval War College Review*, 40/2 (1987), pp. 63-83 and Thomas C. Hone, Norman Friedman, and Mark D. Mandeles, *American and British Carrier Development, 1919–1941* (Annapolis: Naval Institute Press, 1999). Earlier examples of similar studies are Harvey Sapolsky, *The Polaris System Development: Bureaucratic and Programmatic Success in Government* (Cambridge, MA: Harvard University Press, 1972) and Edmund Beard, *Developing the ICBM: A Study in Bureaucratic Politics* (New York: Columbia University Press, 1976).

'Revolution in Military Affairs', threw into sharp relief the importance of innovation.²¹ In particular, it highlighted the need to predict future requirements, to procure appropriate equipment and to configure force structures to meet novel challenges. The end of the Cold War and the emergence of new threats maintained the pressure. The unexpectedly prolonged conflicts in Afghanistan and Iraq in the twenty-first century further challenged militaries to reflect on what they were for, how they should evolve, and how they were expected to achieve their goals in a rapidly changing world and with a new paradigm of asymmetric warfare. The risk always exists that the urgent operational requirements of the present distort the past, driving analysts to rummage through the lumber room of old wars in the search for apparent precedents that will help soldiers fight the new. The First World War, this volume suggests, does indeed have lessons to teach modern militaries, but only if the decisions of the past are seen in their proper context.

Adam Grissom's 2006 essay 'The Future of Military Innovation Studies' provides an excellent survey of the field.²² Grissom identifies six basic models of how military innovation is driven: technological determinism; neo-realism; civil-military dynamics; inter-service relations; intra-service competition; and cultural responses.²³ He argues that the first two of these have been discredited and are not worthy of detailed consideration; neither offers a necessary or sufficient explanation of how and why innovation occurs. They may, at best, establish 'permissive underlying conditions'.²⁴ The other four models differ about the precise drivers of innovation. The 'civil-military' school, for example, best exemplified by the work of Barry Posen, argues that innovation is primarily the result of civilian intervention in military affairs, supported by 'maverick' officers in the armed forces. Thus, according to Posen, it was civilians in interwar Germany and Britain who prompted innovation, in mechanized combined-arms tactics and the integrated defence system of RAF Fighter Command respectively, while in France politicians allowed their army to stagnate in

²¹See Alan R. Millett and Williamson Murray, 'Military Effectiveness Twenty Years After' in *Military Effectiveness Vol. 3: The Second World War*, ed. Alan R. Millett and Williamson Murray (Cambridge: Cambridge University Press, second edition, 2010), p. xiv. Millett and Murray's three-volume study *Military Effectiveness*, originally published in 1988, was itself initially commissioned by the Office of Net Assessment, Office of the Secretary of Defense, US Department of Defense.

²²Adam Grissom, 'The Future of Military Innovation Studies', *Journal for Strategic Studies*, 29/5 (2006), pp. 904-936.

²³ *Ibid.*, especially pp. 908-19. Foley offers a succinct summary of this article in 'Horizontal Military Innovation', pp. 2-4.

²⁴Grissom, 'Future of Military Innovation Studies', p. 908.

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the tactics of 1918.²⁵ The applicability of this model to wartime transformation is moot. Between 1914 and 1918 all states struggled to find the correct balance between civilian and military control of the war effort, and how much civil control there should be of military innovation remained an open question to which answers were still evolving. The respective, and contested, roles of First Lord of the Admiralty Winston Churchill and the War Office in the genesis of the tank in Britain furnishes a comparative example.

For those, such as Harvey Sapolsky and James Bradin, who see inter-service rivalry as more important in bringing about change, the ‘invisible hand’ of competition for scarce resources between the services causes the latter to appropriate new missions and generates innovation. Classic examples are *Polaris*, born of rivalry between the USAF and USN, and the US Army’s embrace of helicopters to reduce reliance on USAF close air support.²⁶ Certainly in Britain’s war military and maritime strategies and service needs competed, but this was less the case in continental France and Germany. (Alongside the military transformation a naval transformation occurred, in response to submarine warfare). This however would also seem to be a model more applicable to the peacetime world of budgetary constraints, than to wartime. Indeed this suggests a weakness of many theoretical approaches to transformation, in that they assess the innovation drivers of peacetime armies, leaving aside the primary wartime driver, the need to defeat the enemy (and not to be defeated oneself).

If also primarily focused on the peacetime military, Stephen Rosen’s third explanation has more currency in wartime. He sees intra-service competition for preferment as more important. Rosen suggests that senior officers conceive of a new way of war and begin a debate, characterized as an ‘ideological struggle’. The success of their innovation depends on their ability to attract mid-level officer converts and to promote the careers of these disciples. As these disciples rise within the service, power shifts and the innovation does (or does not) become entrenched.²⁷ Simon House’s study of air warfare in this journal suggests that positive developments arise out of the promulgation and battlefield testing of rival theories or innovative technologies. This seems to be the way by which Ferdinand Foch, Philippe Pétain and other pre-war French military intellectuals proposed, tested and established

²⁵Posen, *Sources of Military Doctrine*, pp. 222-236. See Grissom, ‘Future of Military Innovation Studies’, pp. 909-910, for examples of other ‘civil-military’ studies.

²⁶Sapolsky *Polaris System Development*; Bradin, *Hot Air to Hellfire*, Grissom, ‘Future of Military Innovation Studies’, pp. 911-913 gives further examples.

²⁷Rosen, *Winning the Next War*, pp. 20-23. See also, Stephen P. Rosen, ‘New Ways of War: Understanding Military Innovation’, *International Security* 13/1 (1988), pp. 134-68. Again, see Grissom, ‘Future of Military Innovation Studies’, pp. 914-16 for further examples.

doctrinal adaptations as they rose in wartime to the top of the army which as staff college lecturers they had educated in peacetime.²⁸ The dynamic between ‘top down’ and ‘bottom up’ learning, explored in Tony Cowan’s article, would seem also to engage with this model, although his analysis suggests intra-service debate in the interests of battlefield effectiveness rather than professional rivalry is the driver in wartime.

The final approach, the ‘cultural model’, is best displayed in the work of Theo Farrell. Here, innovation is not just ‘driven’ but also ‘shaped’. ‘Drivers’ are typically external and ‘give militaries reason to innovate’. The most important are international threats and peer emulation, but he also includes ‘new operational challenges’ which presumably cover, amongst other things, the impact of new technology. These were certainly all present during the First World War: the enemy in front, allies to the side, and the fortified, firepower-dominated battlefield between. ‘But’, Farrell points out, ‘the process and nature of the innovation that follows are shaped by a number of factors internal to the state in question’. Leaving on one side whether ‘the state’ is the appropriate level of analysis, the three ‘national shapers’ are: resource constraints; domestic politics; and military culture. He defines military culture as: ‘those identities, norms and values that have been internalized by a military organization and frame the way the organization views the world, and its role and functions in it. Military culture is embodied in (and reproduced through) military training, regulations, routines and practice.’²⁹ Only innovations compatible with the dominant military culture can succeed. Innovation can thus come about in one of three ways. First, senior leaders can change the culture to bring about planned change. Secondly, external shocks – defeat being the most obvious – can reshape the culture. This certainly happened in the French army, beaten on the frontiers in August 1914 and needing to adapt to a war of attrition on national soil, if less so in the German and British armies whose military cultures seemed more entrenched.³⁰ Thirdly, a military might choose to emulate that of another nation, perhaps to enhance inter-operability or simply to imitate success. The dynamic of learning from

²⁸This is implicit in Claude Franc, *Le Haut-commandement français sur le front occidental, 1914–1918* (Paris, SOTECA, Éditions 14–18, 2012). Franc identifies the pre-war intellectuals who rose to high command on pp. 393–4.

²⁹Theo Farrell, ‘The Dynamics of British Military Transformation’, *International Affairs*, 84/4 (2008), pp. 777–807 (pp. 779–83).

³⁰An influential if controversial thesis of cultural conservatism in the highest echelons of the British army was promulgated in Tim Travers, *The Killing Ground: The British Army, the Western Front and the Emergence of Modern Warfare, 1900–1918* (London: Unwin Hyman, 1987). For the reasons for French disaster in August 1914, both cultural and practical, see Simon J. House, *Lost Opportunity: The Battle of the Ardennes, 22 August 1914* (Solihull: Helion & Co., 2017).

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ally and enemy, while certainly on-going, remains unexplored and misunderstood for this conflict. Tony Cowan's article, however, indicates that the German army certainly adapted its defensive practices in the face of increasing Anglo-French battlefield effectiveness (which is not the same as learning from the enemy), although gaining no more than short-term advantage as allied offensive methods developed in their turn. When the Allies tried to emulate these German defensive methods in 1918, however, the results were at best mixed.³¹ These observations aside, such factors would certainly seem to be relevant between 1914 and 1918, and this model offers much of value when examining innovation and change during this war.

The problem with military culture, of course, is that it is notoriously difficult to nail down. It is empirically unquantifiable; it is not unitary; it constantly shifts shape; and its effects are often tacit and extremely complex. When it comes to innovation, military culture must face the fundamental paradox that, on the one hand, innovation seems to succeed best where open debate and dissent is encouraged while, on the other, hierarchy and obedience to orders must be maintained. This contradictory internal dynamic was certainly operating as Germany adapted her defensive tactics, Cowan's study demonstrates, and did not facilitate the process. How a given military culture strikes that balance is crucial for the success or failure of innovation.

It is reasonable to present broader impressions on how and why the three armies approached the process of transformation differently, founded in military cultures that meant that each army engaged with adaptation to the industrialised battlefield slightly differently. This might also suggest why outcomes, if similar, differed in their details. All three armies too were profoundly reshaped by the experience.

The British army's culture and adaptation is the most studied, within the parameter of the long-running 'learning curve' debate. If a paradigm might be posited, it is of an army undertaking a practical exercise in response to rapid expansion and unfamiliar challenges. British and Commonwealth historians of the western front have built up a considerable body of literature charting the changes in warfare that occurred, and especially the British response to them, primarily in terms of technology, tactics, operations and command.³² These studies take an empirical approach rather than

³¹Allied defensive adaptation has yet to be explored in the same way that offensive warfare has been.

³²As well as works already cited, other important contributions include: Robin Prior and Trevor Wilson, *Command on the Western Front: The Military Career of Sir Henry Rawlinson 1914–18* (Oxford: Blackwell, 1992); Jonathan Bailey, *The First World War and the Birth of the Modern Style of Warfare* (Camberley: Strategic and Combat Studies Institute, 1996); *British Fighting Methods in the Great War*, ed. Paddy Griffith (London: Frank Cass, 1996); Ian M. Brown, *British Logistics on the Western Front, 1914–1919*

employing any sort of theoretical framework, and collectively have argued that the British Army was far from being the reactionary institution of myth, led by ‘butchers and bunglers’, which never got to grips with the realities of modern industrial warfare. Instead, it progressively climbed a ‘learning curve’, or underwent a ‘learning process’, which took it from disaster on the first day of the Battle of the Somme to leading the Allied armies to victory over Germany during the ‘Hundred Days’ campaign of August to November 1918.³³ Within this broader development, a number of sub-themes are identified, such as whether, and if so why, Dominion forces adapted better than metropolitan units,³⁴ how technology impacted upon innovation and whether learning was driven by doctrinal development or improved command methods.

The French army’s culture was rather different. French soldiers approached military matters from a cerebral perspective, more so perhaps than their British and German counterparts. Pre-1914, theoretic debates flourished in military circles and service journals over the nature of modern war and how the army should respond; when war broke out the army was in the grip of unresolved doctrinal debates between the advocates of ‘firepower’ and ‘shock’ and struggling to elaborate the newly emerging operational level of war.³⁵ This left the French army at a distinct disadvantage when war broke out, reflected in its poor performance in the first encounter with the enemy.³⁶ Harsh experience produced positive outcomes, and the French high command responded appropriately to the unexpected challenges of positional warfare with a firepower-based tactical doctrine and a scientific operational system that employed a modernising and increasingly technological army to ever increasing

(Westport: Praeger, 1998); Albert Palazzo, *Seeking Victory on the Western Front: The British Army and Chemical Warfare in World War I* (Lincoln, NE: University of Nebraska Press, 2000); Nikolas Gardner, *The Beginning of the Learning Curve: British Officers and the Advent of Trench Warfare, September–October 1914* (Salford: ESRI Working Papers, 2003) and *Trial by Fire: Command and the British Expeditionary Force in 1914* (Westport: Praeger, 2003); *Command and Control on the Western Front: The British Army’s Experience 1914–18*, ed. Gary Sheffield and Dan Todman (Staplehurst: Spellmount, 2004); Simon Robbins, *British Generalship on the Western Front 1914–18: Defeat into Victory* (London: Frank Cass, 2005).

³³See for example Sheffield, *Forgotten Victory* and Simkins, *From the Somme to Victory*.

³⁴See for example, Bill Rawling, *Surviving Trench Warfare: Technology and the Canadian Corps, 1914–1918* (Toronto: Toronto University Press, 2nd edn, 2014); Christopher Pugsley, *The Anzac Experience: New Zealand, Australia and Empire in the Great War* (Auckland, NZ: Reed Publishing, 2004).

³⁵See Porch, *March to the Marne*.

³⁶House, *Lost Opportunity*.

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effect, by late 1916 overtaking the German army in its development.³⁷ The French army's approach to transformation can be characterised as an intellectual or philosophical exercise, a re-conceptualisation of warfare in response to the experiences of battle by pre-war theorists such as Foch, Pétain and Marie-Émile Fayolle. Jonathan Krause's article elaborates one element of this re-education of an army, showing that a re-conception of artillery tactics underpinned the increasingly effective battlefield performance of the French army from 1915. Simon House's complementary look at how the French military met the iconic technological challenge of the war, with the development of their air force, fills a surprising gap in the historiography.³⁸

The German army's approach to adaptation, in contrast, might be seen as more bureaucratic than intellectual. Uniformity was a, if not the, primary concern. Consequently the army placed considerable weight on the introduction of systems which would disseminate and enforce compliance with common doctrine. The officers of the General Staff, who were the keepers of the doctrinal flame, were arrogant enough to believe they always knew the right answer. In the event of failure, instead of re-evaluating their premises and checking the logic of their conclusions, there was often a tendency to tighten up command structures, often through greater micro-management, to ensure better adherence to instructions. Thus while their adversaries were becoming more thoughtful and flexible in their approach to battlefield challenges, the German army became more sclerotic and authoritarian as the fortunes of war turned against it. (This mirrored developments in German domestic politics, underlining the importance of the cultural model).³⁹ Therefore, while the German army undoubtedly was capable of important innovations, for example in methods of defence-in depth, in storm-troop tactics and in artillery practices, the allies could generally develop effective counter measures more quickly than the German army could respond to allied surprises. By the last

³⁷A process elaborated in William Philpott, *Bloody Victory*. See also Michel Goya, *Flesh and Steel: The Transformation of the French Army and the Invention of Modern Warfare* (Barnsley, Pen and Sword, 2018).

³⁸ Much of the literature on the war in the air is Anglo-centric. See the articles by Peter Gray, Christopher Luck, Peter Dye, David Jordan, Simon Coningham and Alistair McCluskey in Gary Sheffield and Peter Gray (eds), *Changing War: The British Army, the Hundred Days Campaign and the Birth of the Royal Air Force* (London: Bloomsbury, 2013); John Buckley, *Air Power in the Age of Total War* (London: UCL Press, 1999); John H. Morrow Jr, *The Great War in the Air: Military Aviation from 1909 to 1921* (Tuscaloosa, AL: University of Alabama Press, 1993).

³⁹See Jonathan Boff, *Haig's Enemy: Crown Prince Rupprecht and Germany's War on the Western Front, 1914–1918* (Oxford: Oxford University Press, 2018).

months of the war Germany had lost the military innovation race and was being left ever further behind.

When it comes to organizational culture, almost all the existing innovation literature shares a hidden assumption. Armed forces are primarily seen in organizational terms as scientific Weberian bureaucracies, operating optimally and rationally, at least by their own lights, '*sine ira et studio*'.⁴⁰ This is potentially problematic on two levels. First, do organizations make decisions entirely rationally? Are there not severe cognitive limits to rationality? The actors within organizations are not emotionless instruments, as classical theory suggests, but humans with their own wants, needs and limitations.

The classical assumption that it is possible to know all possible outcomes and consequences of any given decision is particularly doubtful in wartime, where the fog of uncertainty cloaks everything.⁴¹ As Peter Paret has argued, war 'engages emotion as well as reason... The employment of violence can be rational. And yet violence and its effects are always emotional and subject to the irrational' and war can change 'from a tool of policy to a force that imposes – or seeks to impose – its own emotional demands.'⁴² Secondly, bureaucracies are seen as primarily conservative organizations. Militaries, especially, are seen as naturally 'resistant to major change. It is simply not in their nature. Organizations run on routines and standard operating procedures, and depend on stability for functional integrity. Moreover, military organizations, as socially conservative and closed communities (not unlike religious orders), are especially disinclined to innovate.'⁴³ This is partly the consequence of bureaucracies being power structures with a perceived tendency to perpetuate the status quo.

The contrasting impressions of how the three armies approached the process of transformation might lead one to question whether the objective Weberian bureaucratic machine is the correct model for the militaries of the First World War. Certainly, the more work that is done on the ethos of the British army before and

⁴⁰Max Weber, *The Theory of Social and Economic Organization*, trans. A. R. Henderson, and Talcott Parsons, rev. and ed. Talcott Parsons (London: William Hodge, 1947), pp. 309-312. The authors are grateful to Dr Aimée Fox for raising this point.

⁴¹James G. March, and Herbert A. Simon, *Organizations* (Cambridge MA: Blackwell, 2nd ed., 1993), pp. 157-192. Thanks to Professor Jonathan Bendor for discussing this question.

⁴²Peter Paret, *The Cognitive Challenge of War: Prussia 1806* (Princeton: Princeton University Press, 2009), pp. 3-4.

⁴³Farrell, 'British Military Transformation', p. 777.

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during the war, the less appropriate it seems.⁴⁴ Christian Stachelbeck's work hints that, even in Weber's homeland, the army was a less rational institution than is sometimes assumed.⁴⁵ The French army certainly had its factions and dysfunctions. Partly this was a consequence of the politics of the Third Republic, veering as they did back and forth between republican anti-militarism and patriotic citizen service, especially in the pre-Great War era of Dreyfus, the *affaire des fiches* and the nationalist revival, as Eugen Weber has suggested.⁴⁶ It was also the outcome of an unresolved dispute between the advocates of 'firepower' and 'élan' as the army tried to determine the nature of future warfare and how traditional *furia francese* might yet triumph on a technological battlefield. Indeed these continued to hamstring the army once war was declared. Perhaps, if we saw these armies instead as evolving organisms, working subjectively as best they could in remarkably trying conditions, we might be more understanding of the obstacles in the way of, for example, developing and inculcating appropriate doctrine, better grasp the processes involved, and get closer to what it meant to seek mastery of the industrial battlefield.

Many historians have over-simplified the nature of innovation itself, too. Consciously or otherwise, they cling to the influential Unfreeze–Change–Refreeze model of innovation originally proposed by Kurt Lewin in 1947.⁴⁷ The organization is first seen as being in an equilibrium position. As a result of some stimulus, this equilibrium is disturbed, the organization identifies the need to change, innovates, and moves to a new steady state, until it receives the next stimulus. This greatly underestimates the dynamism of the process, which is ongoing and unending. In the 1970s Donald Schön and Chris Argyris developed the concept, later fleshed out and popularized by Peter Senge, of the 'learning organization' capable of handling non-stop change.⁴⁸ The

⁴⁴See, for example, Palazzo's work on 'ethos' in *Seeking Victory on the Western Front: or David French, Military Identities: The Regimental System, the British Army, and the British People, c. 1870–2000* (Oxford: Oxford University Press, 2005).

⁴⁵Christian Stachelbeck, *Militärische Effektivität im Ersten Weltkrieg: Die 11. Bayerische Infanteriedivision 1915 bis 1918* (Paderborn: Ferdinand Schöningh, 2010).

⁴⁶Eugen Weber, *The Nationalist Revival in France, 1905–1914* (Berkeley, CA: University of California Press, 1959).

⁴⁷Kurt Lewin, 'Frontiers in Group Dynamics: Concept, Method and Reality in Social Science; Social Equilibria and Social Change', *Human Relations* 1/1 (1947), pp. 5-41 (pp. 34-5).

⁴⁸Chris Argyris and Donald A. Schön, *Organizational Learning: A Theory of Action Perspective* (Reading, MA.: Addison Wesley, 1978); Peter M. Senge, *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Doubleday, 1990). A short summary of the key ideas can be found in Diane Worrell, 'The Learning Organization: Management Theory for the Information Age or New Age Fad?', *Journal of Academic Librarianship* 21/5 (1995), pp. 351-7 (pp. 351-4).

Pentagon Quadrennial Defence Review of 2001 picked this idea up, pointing out that military transformation is ‘a continuous process and “not an end point”’.⁴⁹ One of the questions that remains to be answered is the extent to which First World War armies were ‘learning organizations’ *avant la lettre*, ‘skilled at creating, acquiring and transferring knowledge, and at modifying [their] behavior to reflect new knowledge and insights’?⁵⁰ When we actually look at what was transformed, and how rapidly, it suggests that such a model was appropriate. In only three campaign cycles modern warfare was conceptualized, adopted and applied: in 1915 basic ‘all-arms’ tactical concepts were tested; by 1916 materially-based ‘scientific’ operational methods were conceived;⁵¹ and in 1917 these were inculcated into the armies which were trained and equipped to fight modern combined-arms battles. In 1918’s last campaign these armies and their commanders applied these methods to fight the war to a decision.

Another common factor uniting most of the work done to date, Grissom argued, is that it concentrates only on innovation driven from the top down. He suggested we need more case studies which pay attention to change which works from the bottom up.⁵² In practice the dichotomy between the two is often a false one. Much innovation is actually born of a dynamic relationship between top and bottom, with demand-led and supply-led change interacting. Elsewhere, Robert Foley has recently introduced a paradigm of what he calls ‘horizontal innovation’, where lessons learned in the front line of the German army in 1916–18 were passed sideways around the institution, or went up and then sideways, rather than straight up or down.⁵³

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The range of work on military innovation and transformation in recent years notwithstanding, much remains to be done. Much of the literature specifically

⁴⁹US Department of Defense, *Quadrennial Defense Review Report*, 30 September 2001, p. 32. The British army has adopted the same jargon: General Sir David Richards speaks of ‘transformation in contact’ in ‘Twenty-first Century Armed Forces: Agile, Useable, Relevant’, presentation to the RUSI Land Warfare Conference, 23–25 June 2009, referenced in Robert T. Foley, Helen McCartney, and Stuart Griffin, “‘Transforming in contact’: learning the lessons of modern war”, *International Affairs* 87/2 (2011), pp. 253-70 (p. 253, n. 1).

⁵⁰David A. Garvin, ‘Building a Learning Organization’, *Harvard Business Review*, 71/4 (1993), pp. 78-91 (p. 80).

⁵¹The term is Ferdinand Foch’s. See ‘De nos dernières attaques’, 6 December 1915, reproduced in Maréchal Foch, *Oeuvres complètes* (Paris: Economica, 3 vols, 2008), ii, pp. 439-47.

⁵²Grissom, ‘Future of Military Innovation Studies’, p. 930.

⁵³Foley, ‘Horizontal Military Innovation’.

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focused on innovation is programmatic, designed to solve the problems of peace or limited war, and so most of it concentrates on peacetime change.⁵⁴ It therefore does not engage with a series of interesting questions which arise during unlimited conflicts. Is innovation easier, or harder, during total war? Does the existential threat to national survival clarify the changes required and make it easier to build consensus for innovation? Are resource constraints less of a concern? How do the changed civil–military dynamics of wartime impact upon innovation? Do ‘rat-catchers’, to use Andrew Gordon’s phrase, tend to replace ‘regulators’ in command in wartime and thus introduce the ‘maverick’ element Barry Posen considers helpful for innovation?⁵⁵ To what extent do inter- and intra-service rivalries help or hinder change? Does the influx of civilians into the armed forces inevitably bring with it a willingness to innovate which alters military culture? On the other hand, do civilians find their creative tendencies stifled by this military culture? (Paul Harris’s recent study of the expanded British General Staff indicates that civilians only penetrate so far into the military culture even in a rapidly expanded mass army: ‘the staff, unlike the wider army, remained an enclave of regular soldiers’).⁵⁶ More obviously still, how does the intervention of the enemy affect change?

Most of the innovation literature discussed so far has been written by social scientists interested primarily in the phenomenon of innovation itself and mining history for case studies which shed light on that. Contrastingly, historical revisionism, while soundly based in archival research and offering a useful corrective to previous lazy stereotypes, is not free of shortcomings of its own. First, the concepts and methods of learning and adaptation remain amorphous. The precise mechanisms by which change came about have yet to be fully drawn. Aimée Fox has recently shown in detail how the British army absorbed and implemented lessons learned, but little comparable work exists on the other armies.⁵⁷ Second, it is sometimes too focused on the formal and theoretical, neatly tracing developments in published doctrine, without always analysing how closely praxis cohered to theory and the extent to which learning went on informally: one of the many important points to emerge

⁵⁴One exception is Stephen Rosen, who looked at tanks in 1914–1918, the U-boat war and American strategic bombing in the Second World War. The recent collection, *A Military Transformed? Adaptation and Innovation in the British Military, 1792–1945*, ed. Michael LoCicero, Ross Mahoney and Stuart Mitchell (Solihull: Helion & Co Ltd, 2014), adopts a broader timescale and multi-service perspective.

⁵⁵Andrew Gordon, *The Rules of the Game: Jutland and British Naval Command* (London: John Murray, 2005), p. 597.

⁵⁶Paul Harris, *The Men Who Planned the War: A Study of the Staff of the British Army on the Western Front, 1914–1918* (Farnham: Ashgate, 2016), p. 192.

⁵⁷Aimée Fox, *Learning to Fight: Military Innovation and Change in the British Army, 1914–1918* (Cambridge: Cambridge University Press, 2017).

from Fox's work is the importance of the latter. Third, the dynamism of the challenge of mastering the industrial battlefield is often understated. The problem is portrayed as the search for a single key to unlock stalemate, where a better analogy might be a wrestling match with a protean monster which continually changes shape to frustrate its attacker. Fourth, it remains Anglo-centric. Only recently has the measure/counter-measure dynamic between the British and their enemy been considered, and there remains much scope for studying other armies and comparative analysis.⁵⁸

The articles collected here do not pretend to address all the problems with the existing literature, both social scientific and historical; but they will, perhaps, enable us to view the First World War transformation more broadly. Each army had to confront the transformation of war which took place (primarily) on the Western Front, and each learned, adapted and innovated during those four years. British, French and German armies all passed through the cycle of innovation and counter-innovation and contributed to the remodelling of warfare between 1914 and 1918. One hundred years later we can safely claim that warfare was profoundly changed then, that armies were the instrument of change and commanders its facilitators: how, why and with what consequences are fitting themes for consideration during the war's centenaries and beyond.

⁵⁸Jonathan Boff, *Winning and Losing on the Western Front: The British Third Army and the Defeat of Germany in 1918* (Cambridge: Cambridge University Press, 2012) assesses the denouement of this dynamic process rather than its development.