THE DIGITAL REVOLUTION:

CAMOUFLAGE UNIFORMS IN THE TWENTY-FIRST CENTURY

Introduction

The Revolution in Military Affairs with its digitalized communications, surveillance and guidance technologies has been the subject of intense academic scrutiny since mid-1990s.[1] There is little doubt that the introduction of these new technologies has altered the way in which western troops have fought over the last decade, even if, as Colin Gray[2] has observed, the nature of war – if not the character - remains fundamentally unchanged. Scholars are undoubtedly right to focus on the development and introduction of new equipment by which enemies are targeted and, ultimately, destroyed but, while new means of observing the battlefield and applying firepower on it have been developed, another much quieter and practically unnoticed transformation has been taking place. In the last ten years, there has been a dramatic change in the uniforms worn by combat soldiers, especially in the West. Western forces have increasingly replaced the disruptive patterns which have characterized military uniforms since the 1970s with digital camouflage designs. In 1997, Canada was the first to develop one of these distinctive new uniforms; a digitalized pattern called Canadian Pattern, 'CADPAT', involving a predominantly

[1] Colin Gray *Strategy for Chaos: revolution in military affairs and the evidence of history.* (London: Frank Cass, 2002); Colin Gray *The American Revolution in Military Affairs: an interim assessment*. (Strategic and Combat Studies Institute, 1997); Lawrence Freedman 'The Revolution in Strategic Affairs'. *Adelphi Paper*. 318. (Oxford: Brasseys, 1998); John Arquilla and David Ronfeldt *In Athena's Camp*. (Santa Monica, CA: RAND, 1997); Andrew Latham, A 'Warfare Transformed: a Braudelian Perspective on the 'Revolution in Military Affairs', *European Journal of International Relations* 8(2) 2002: 231-266; William Owens, 'Creating a US Military Revolution' in Theo Farrell and Terry Terriff (eds.) *The Sources of Military Change*. (London: Lynne Rienner, 2002).

[2] Colin Gray *Another Bloody Century* (London: Phoenix, 2006).

green design for woodland and a mainly brown design for arid environments.[3] The uniform was introduced into service in 2002. In 2004, based on CADPAT, the US Marines developed their own digitalized Marine Pattern (MARPAT) which was similarly produced in two separate versions, one for temperate and one for desert zones. In 2006, the US Army followed the Marines and Canadian Forces to introduce its own digitalized camouflage uniform the Universal Camouflage Pattern (UCP) or the Army Combat Uniform (ACU) for all theatres. Accordingly, they developed a grey-blue digital design which was intended to be able to blend into temperate, arid and urban environments. Other nations have similarly introduced digital or digital-like camouflage. Italy, Denmark, New Zealand, Afghanistan, China, Estonia, South Korea and Jordan have all introduced a new digital or quasi-digital uniform in the early 2000s. In the last three years, the British Army has also introduced a new camouflage pattern, Multi-Terrain Pattern[4], which although not digitalized has drawn on the principles of digital design, claiming to be one of the most advanced forms of camouflage capable of disguising troops in all environments.

A digital revolution in the military uniforms seems to be underway paralleling the revolution in military technology. It has been widely acknowledged that the uniforms which soldiers wear to battle are deeply significant not only in terms of the military performance which they facilitate – or impede - but also as a way of symbolizing the collective identities of soldiers and the military's relationship to civil society. For instance, in his work on military uniforms, Thomas Abler has recorded the way in which uniforms in the eighteenth and nineteenth century

[3] Hardy Blechman and Alex Newman *Disruptive Pattern Material* (London: DPM Ltd, 2004), 685; Peter Forbes, *Dazzled and Deceived: mimicry and camouflage*. (London: Yale University Press, 2009), 254.

[4] The UK's Multi-Terrain Pattern (MTP) is based on Crye Precision's Multicam pattern and, tested in 2009, was introduced into service in 2010. Multi-Terrain Pattern is slightly darker and the addition of dark brown splashes was intended to improve its performance in temperate areas in which the light tan tones of Multicam were only a little more effective than desert camouflage (see footnote 68). The British Army developed MTP which Crye Precision agreed to licence to the Army as one of their patented patterns.

developed the traditional dresses of marginal ethnic groups – 'hinterland warriors' - typically employed for dangerous, unconventional tasks like skirmishing or ambushing to signify particular roles; 'the military culture of imperial armies often values the combat officer over the parade-ground soldier, and acquisition of items of exotic clothing provide evidence of participation of the metropolitan soldier in distant campaigns…hinterland warriors were often employed in roles that differentiated them, at least initially, from troops in the regular army'.[5] Light cavalry or hussars, tasked with scouting, harrying and raiding, were a prime example of the hinterland warrior and the dress of hussars with its dolman and pelisse were derived from the Hungarians who formed the largest part of the French hussars in the Ancien Regime. Lancers across Europe widely adopted the czaptka (hat) and kurkta (jacket) of the Cossacks and Poles. In each case, more or less useless pieces of military attire served an important symbolic role, linking the light cavalry and lancers to an ethnic warrior group which specialized in irregular tasks. These strange jackets and hats communicated a sense of war-like savagery which was central to the reputation and status of these mounted troops. Today's apparently utilitarian digital uniforms seem quite different to the exotic attire of Abler's warriors. Yet, perhaps by considering contemporary uniforms alongside the often bizarre attire of the past, it might be possible to uncover the heavily symbolic character of these new and ostensibly functional military costumes. It may, in short, be possible to de-familiarise the present in order to show how these new uniforms serve not so much a functional military purpose but, rather, are a way of redefining and, indeed, reasserting the institutional identity of the armed forces.

[5] Thomas Abler, *Hinterland Warriors and Military Dress: European empires and exotic uniforms.* (Oxford: Berg, 1999), 4, 14.

If this is the case, then the radical change in uniform designs currently observable across the west would seem to offer a fruitful and indeed important object of study for international relations. These uniforms may not be mere military esoterica of interest only to the anthropologist but, on the contrary, they may provide a compelling insight into the status, culture and role of western armed forces and the changing character of civil-military relations at the beginning of the twenty-first century. Indeed, if Abler's argument is accepted, the exploration of uniforms may question rationalist neo-realist presumptions about the armed forces as instruments of state power which has been common in international relations literature.[6] These forces may not be understood merely as the instruments of rational policy but rather as partly autonomous institutions with their own distinctive cultures, politics and interests which have a material bearing on the character and possible application of military force. Indeed, the seminal work of Samuel Huntington, Morris Janowitz and S.E. Finer in the 1950s and 1960s sought to explore precisely the question of how the distinctive professional culture of the officer corps might influence civil-military relations.[7] In this way, although the analysis of military uniforms may seem a long way from traditional debates in international relations, in fact, the question of military culture has been an increasing area of interest for the international relations literature. For instance, in his recent work on Private Military and Security companies, Paul Higate has rightly noted the important work which has been conducted on the institutional aspects of these organizations but he has usefully sought to highlight cultural dimensions, raising the question of the corporate identity of PMSCs and their members.[8] In order to contribute to these debates

[6] E.g. Kenneth Waltz *Man, the State and War* (New York: Columbia University Press, 1959).
[7] Samuel Huntington *The Soldier and State* (Cambridge, Mass: Belknap Press, 1957); Morris Janowitz *The Professional Soldier* (New York: Free Press, 1960); S.E. Finer *The Man on Horseback: the role of the military in politics* (London: Pall Mall, 1967).

[8] Paul Higate 'Cowboys and Professionals: the politics of identity work on the private military and security company' Millennium 40(2): 321-341.

about military culture and identity and its contemporary transformation, this article addresses the question of why, in the last decade or so, have western forces recently found their existing uniforms inadequate? Why have professional forces in the west today seemed to prefer digital patterns? While simple technical arguments claiming the obvious objective superiority of digital designs are certainly not irrelevant, they do not seem to explain the enthusiasm with which militaries have adopted these uniforms, despite the sometimes significant costs involved. Indeed, in some cases, digital designs have been adopted despite their manifest inferiority over the disruptive patterns which they replaced, suggesting that non-scientific cultural factors may have been at work in the digital revolution. This article aims to provide some explanation for the current fashion for digital camouflage as the preferred uniform type in the armed forces today.

The Modern Uniform

Before analyzing the specific of development digital patterns in Canada and the United States, it is useful to situate the current transformation in a longer historical context which highlights the distinctiveness of contemporary developments with particular clarity; genuine paradigm shifts in military uniforms occur only very rarely which is precisely what makes the current transformation so noteworthy. Indeed, the current digital revolution constitutes only the fourth uniform revolution in the entire modern era going back some four hundred years. Although medieval armies had employed flags, banners, heraldic insignia and colored sashes[9] to identify

[9] During the Thirty Years War, combatants used sashes to distinguish themselves from each other: the Danes blue and orange sashes, the Swedes blue and the Dutch orange and white; John Mollo, *Military Fashion: a comparative*

themselves, the modern military uniform first appeared in the sixteenth century and specifically from about 1660, after the Thirty Years War.[10] It was adopted at precisely the moment when states began to generate their own standing armies and the uniform was intended to symbolize state power and the 'disciplined evolutions' which the state's armies sought to execute.[11] The uniform was, therefore, intimately associated with the early modern military revolution and its proponents including Gustavus Adolphus, Maurice of Nassau, Oliver Cromwell[12], Michel le Tellier and, his son, the Marquis of Louvois, the Great Elector Frederick William, Frederick the Great and the Duke of Marlborough.[13] One of the prime purposes of these uniforms was to distinguish combatants from each other and it is noticeable that European belligerents each choose bright colors which were easily distinguishable from their enemies (and which colors often had some national heraldic significance). Thus, by the mid- to late seventeenth century, British fought in red, the French in white (though later Revolutionary troops would adopt blue), the Germans in dark blue and the Russians and Austrians also in white.[14] Uniforms were intended to generate not only a sense of cohesiveness and pride among soldiers but also to accentuate the physical size and posture of soldiers, as a means of intimidating the enemy; headgear was often less designed to protect the soldier than making him appear taller and more

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history of the uniforms of the great armies of the 17th Century to the First World War. (London: Barrie and Jenkins, 1972), 22.

[10] Mollo, *Military Fashion*, 30; Karel Toman *A Book of Military Uniforms and Weapons* (London: Paul Hyman and Allan Wingate, 1964), 110.

[11] Hew Strachan *British Military Uniforms, 1768-1796: the dress of the British Army from official sources.* (London: Arms and Armour, 1975), 1.

[12] Cromwell is credited with introducing the red coat into his New Model Army (Mollo *Military Fashion*, 25).
[13] Geoffry Parker, *The Military Revolution*. (Cambridge: Cambridge University Press, 1999); Michael Roberts 'The Military Revolution, 1560-1660*:* in Michael Roberts, *Essays in Swedish History* (London: Arnold, 1967), 56-81; Michael Howard *War in European History*. (Oxford: Oxford University Press, 2000); Jeremy Black, *A Military Revolution?* (London: Macmillan, 1991); Christopher Duffy *The Military Experience in the Age of Reason* (London, Routledge and Kegan Paul, 1987), 14-15, 105-6.

[14] Mollo *Military Fashion*, 32,36; Toman *A Book of Military Uniforms and Weapons*, 111.

formidable.[15] The uniform actively sought to display the soldier on the battlefield. Military uniforms were then intimately associated, from their origins, with state power and, indeed, nationalism.

From 1660 to 1850, the coloured uniform predominated in Europe and was evident on battle fields from Poltava to Balaclava. With the appearance of industrial weaponry especially towards the end of the nineteenth century, this attire became increasingly inappropriate, however. Accordingly, western powers began to develop new kinds of uniform in order to conceal and camouflage their soldiers rather than to announce them to their enemies. Bright and elaborate dress began to be replaced by dull, more functional designs. Lieutenant Harry Lumsden had introduced 'khaki' (Urdu for dirty) uniforms to the Corps of Guides which he raised for the north-west frontier in 1846 and following the Indian Mutiny in 1857, khaki began to be adopted across India by British regiments. By 1885, khaki was the official uniform for India and, having also been used during the Boer War (1899-1902), it was adopted as Service Dress by the British Army in 1902.[16] Other powers followed Britain's example. The German army adopted 'feldgrau' in 1910 and while the French army still dressed in dark blue with red trousers (with khaki for overseas), it provided a light blue overalls to cover red kepis and trousers. In 1915, a horizon blue uniform was introduced. Throughout the major conflicts of the twentieth century from the First World War to Vietnam, mass citizen armies were all dressed in dull uniforms to conceal them on the battlefield. With the exception of elite troops, who were sometimes issues special camouflage tunics such as the British airborne 'Denison smock', the French and US lizard and

[15] James Laver, *British Military Uniforms*. (London: Penguin, 1948), 25.

[16] Thomas Abler, Hinterland *Warriors and Military Dress: European empires and exotic uniforms.* (Oxford: Berg, 1999), 114-25.

tigers stripes in Algeria and Vietnam and the German leaf, splinter or pea patterns favoured by the SS[17], these uniforms consisted of monochrome browns, greens or greys reflecting the mainly rural environment in which the soldiers operated.

After the Second World War and especially since the 1970s, the mass citizen armies which fought the wars of the twentieth century have disappeared to be replaced almost universally across the west by small, professional all-volunteer forces.[18] Armies have returned to the eighteenth century in terms of size. It is noticeable that at the same time, the old field uniform was replaced in the 1970s and 1980s by more advanced camouflage designs which only elite troops had ever worn previously. Thus, the British Army issued a 'Disruptive Pattern Material' (DPM) uniforms in the 1970s, the United States their woodland pattern in the 1980s, the German Army moved to 'flecktarn' in the late 1980s and the French introduced its disruptive camouflage designs at a similar time. Disruptive patterns became the globally dominant military style throughout this period, adopted by almost all militaries on all continents. Typically, these uniforms consisted of four colours - some combination of green, light and dark brown and black - and armies issued one pattern for forested terrain and an alternative one for the desert. The monochrome uniform was the norm from 1900 to 1970. For more or less thirty years from 1970 to 2000, the disruptive pattern became the dominant paradigm in military uniforms. The recent emergence of digital camouflage marks a fourth era in western military dress when disruptive

[17] Chris McNab. *20th Century Military Uniforms*. Rochester, Kent: Grange Books 2002), 10-11.

[18] Karl Haltiner, 'The Decline of the Mass Army' in Caforio, G. (ed.). *Handbook of the Sociology of the Military*. (London: Kluwer/Plenum, 2003); Karl Haltiner 'The Definite End of the Mass Army in Western Europe?' *Armed Forces & Society* 25(1) 1998, 7-36; Christine Kelleher, 'Mass Armies in the 1970s: the debate in Western Europe', *Armed Forces & Society* 5(1) 1978, 3-30; Michel Martin 'Conscription and the Decline of the Mass Army in France, 1960-75' *Armed Forces & Society* 3(3) 1977, 355-406; Jacques Van Doorn, J. 'The Decline of the Mass Army in the West', *Armed Forces & Society* 1(2) 1975, 147-57.

pattern material is in the process of being replaced, as DPM itself superseded the old field uniforms of the early to mid-twentieth century. The question is how is it possible to explain this fourth period of military dress in the early twenty-first century?

Digital Camouflage

The military requirement for concealment has probably been evident since the origins of human warfare and is closely related to its usage in hunting. Indeed, there are some examples of quasi-camouflage uniforms before the twentieth century. Roger's Rangers in the Seven Years' War and Wellington's rifle regiments who had the role of skirmishing in front of the line infantry were dressed in a dark field green some of whose purpose was concealment. However, the concept of camouflage in a modern sense is a relatively recent invention; it can be traced back to the First World War where the special conditions on the Western Front encouraged the combatants to innovate the art of concealment. The French, employing a number of prominent artists, were at the forefront of these developments and the word and concept of camouflage was institutionalized by them. Camouflage has been widely assumed to be derived from the French work, 'camouflet', which meant a practical joke or a small mine. This etymology may be correct but in fact, the French police of the late nineteenth century employed the term in its modern meaning; they used to 'camoufler' (i.e. disguise) themselves in order to apprehend criminals.[19]

[19] Gabriel Tarde, G. *Penal Philosophy*. (London: William Heinemann, 1912).

The principles of camouflage first identified French and the other belligerents on the western front were derived from two principle sources; natural history or ecology and art – often simultaneously. Thus, Abbott Thayer, the American artist and naturalist, was one of the most important figures in the emerging field of camouflage[20] and his work on animal coloration was seminal.[21] There, he identified the two principal means by which animals concealed themselves in nature; blending and dispersal. Animals blended into the background through adopting the same colour as it. Thayer took the point to absurd extremes claiming that the basic purpose even of the roseate spoonbill's shocking pink of was concealment; at dusk and dawn, the pink blended in with the crepulescent sky.[22] Yet, in general, his point was clearly valid. It was clear that animals were adapted to blend with their environments and Thayer, with some brilliance, demonstrated some of the more refined ways in which this effect was achieved. Most importantly, Thayer identified for the first time one of the critical adaptations which aided this blending process: counter-shading. The very pale undersides of both land and sea animals had widely troubled biologists who were at a loss to attribute a selective advantage to this colouring. Indeed, the white underbelly seemed to make any creatures more visible. Thayer brilliantly showed that in fact, when exposed to a bright light from above (which was typical for most animals operating in daylight), the darker upper body of the animals was illuminated, the underside cast into shadow. In this context, the dark tones of the upper side of the animal and its lighter underbelly were equalized by daylight so that the body appeared the same colour; the

[20] Gilbert Thayer and Abbott Thayer *Concealing-Coloration in the Animal Kingdom: an exposition of the laws of disguise through colour and pattern; being a summary of Abbott H Thayer's discoveries. (*New York: Macmillan, 1909); Hugh Cott, *Adaptive Coloration in Animals*. (London: Methuen, 1957).
[21] Roy Behrens, 'The Theories of Abbott H Thayer: father of camouflage' *Leonardo* 21(3) 1988, 291-96; Alexander Nemerov 'Vanishing Americans: Abbott Thayer, Theodore Roosevelt and the attraction of camouflage' *American Art* 11(2) 1997, 56.

[22] Thayer and Thayer *Concealing-Coloration*, 157.

body lost its highly identifiable roundness and became flat against a background whose colour it now matched. Counter-shading was a brilliant piece of Darwinian adaptation which significantly increased the ability of animals to blend into their backgrounds.

Simultaneously many animals also developed spots, stripes or patches which disrupted the outline of their physical form and impeded their identification. Thayer famously gave the example of the male ruffled grouse whose mottled colourings broke up the outline of its body, obscuring its shape. Tigers, leopards and zebras were other animals which employed disruptive coloring to conceal themselves. Thayer tried to contribute to the US War effort in World War I, offering a variety of suggestions about how to conceal military targets on land and sea from the enemy by disrupting their outlines. Among these suggestions was his proposal for disrupted camouflage patterns uniforms for soldiers. Thayer was a very important figure in the development of camouflage but, in the First World War, he was not the only intellectual source of camouflage, especially in terms of the principle of disruption. The French in particular applied Cubism, impressionism and pointillism to the art of disruption; de Scevola produced canvas sheets with disruptive patterns which were to be raised over artillery batteries or he organized the painting of the guns themselves in ways which would disguise them from black and white photographic reconnaissance.[23] Although Picasso was never personally involved in the war-effort, on seeing multi-coloured artillery pieces being towed through the streets of Paris, famously declared 'it is we [cubists] that created that'.[24] Indeed de Scevola himself stated that 'to

[23] Guy Hartcup *Camouflage: the history of concealment and deception in war*. (Barnsley: Pen and Sword 2008), 17; Homer Saint-Gaudens, 'Camouflage and Art' *Art Bulletin* 2(1) Spring 1919, 23-30; Lida McCabe, 'Camouflage – War's Handmaiden' *The Art World* 3(4) January 1918, 313-18.

[24] Roy Behrens. *False Colours: art, design and modern camouflage, 2002*. (Iowa: Bobolink, 2002), 69; Roy. Behrens *Art and Camouflage: concealment and deception in nature, art and war*. (Cedar Falls, Iowa: North American Review, 1981).

deform the object totally – I've used cubists methods'.[25] However, although he was not the unique founder, Thayer's basic principles of camouflage, blending and disruption, were universally accepted by all camoufleurs in the First World War and indeed from that time on. In order to conceal an object, the camoufleur has to ensure that it blends into the background and that its signature outline is broken up to impede recognition.

These two principles of blending and disruption remained essential to the generation of disruptive pattern material in the mid- to late twentieth century and, despite all the advances in vision science, they remain fundamental to this day. Digital camouflage utilizes principles of blending and disruption no less than the designs which de Scevola and his contemporaries developed a hundred years ago. Digital camouflage is claimed only to be superior at these two functions than the disruptive patterns which they are increasingly replacing. The development of digital camouflage has involved a number of prominent individuals and agencies but two the most important figures in this field in the US have been Lieutenant Colonel Timothy O'Neill, who has researched on camouflage within the US Army since the 1970s and holds a PhD in visual psychology, and Guy Cramer, the chief executive of one of the major camouflage manufacturers in North America, Hyperstealth Biotechnology, who have collaborated together to generate some of the most innovative digital designs for both military and civilian hunting markets. O'Neill was involved in the initial design of 'Dual-Tex' digital camouflage in the 1970s (developed for vehicles) and his work has remained important in the field. His research on digital camouflage provides a good illustration of the principles which inform these new designs and which explain the superior of contemporary pixilated patterns.

[25] Danielle Delouche 'Cubisme et Camouflage' in *Review: Guerres Mondiales et Conflits Contemporains* No. 171 Juillet 1993, 131.

According to O'Neill and Cramer, disruptive pattern materials have proved relatively effective as a form of personal camouflage but they are not necessarily optimal because they have not always addressed the question of how the human eye acquires targets nor examined the background environment in which soldiers operate systematically. They are not based on an scientific analysis of the environment or an understanding of the neurophysiology of human vision.[26] O'Neill's digital patterns seek to overcome this problem. Specifically, they involve a 'colormetric' analysis of likely backgrounds in which soldiers will operate to identify the most commonly occurring colours and the proportionate appearance of these colours. From this analysis, a pattern is developed best corresponds to the specific 'micro-environment' in which soldiers are trained to hide. In addition to this scientific research, digital camouflage involves two further innovations. Disruptive patterns tend to involve patterns of large, stable shapes each of a single colour. Unlike these coarse four-colour disruptive patterns, the micropattern consists of a more complex design which jumble colours together randomly to blur the design. In this way, digital camouflage is specifically designed to confuse the human eye by sending out a 'high spatial frequency component usually missing in traditional patterns'[27]; colours appear more densely than in traditional designs. In this way, digital patterns create a 'dithering' effect; its busier design confuses the eye. To accentuate this process, digital patterns specifically aim to avoid 'isoluminent' colours of the same brightness; such patterns resolve almost instantly into a monochrome. The best micropatterns, in fact, aim to create a design which appears to give the flat surface depth by the juxtaposition of colours of different brightness in a manner which is the opposite of Thayer's counter-shading. Because brighter colours stand out against contrasting dull

[26] Timothy O'Neill 'Quatar Innovative Camouflage: design guidelines'. (Unpublished report 2012a), p.11; Timothy O'Neill 'Camouflage and Vision Science' (Unpublished report, 2012b)

[27] O'Neill 'Quatar Innovative Camouflage', 27.

tones in the pattern, it gives an illusory three-dimensionality it does not possess disrupting the surface along the horizontal axis.

Digital camouflage employs a further technique. Hitherto, military patterns have concentrated on the boundary features of the target to disrupt it. They have focused on the edges of the target. O'Neill used the latest advances in visual psychology not so much to break-up the outline of the target but to disrupt its internal structure; 'Instead of focusing on boundaries, Dual Tex macropattern is designed to interrupt the internal symmetries of the shape'.[28] Specifically, digital camouflage creates a pattern which interferes with and distorts the internal structure of the human body in order to make it more difficult for the human visual system to detect; 'a macropattern is developed that interrupts the symmetry axes of the shape, degrading the recognition signature'.[29] Digital camouflage, as a whole, fuses the micro and macro-patterns, overlaying the disruptive macro-pattern with a blending micro-pattern. O'Neill concludes: 'The result was a macropattern that disrupted the shape of the target, making it harder to recognize, and a micropattern that matched the texture of the background, making it hard to detect'.[30] Digital camouflage is 'a combination of shape-concealing macropattern and background matching micropattern'.[31]

There is some evidence that digital camouflage has been more effective than the disruptive designs which it has replaced. For instance, in recent tests in the United States at the Natick Soldier Centre, which specializes in camouflage testing, digital designs have consistently

[28] O'Neill 'Quatar Innovative Camouflage', 14.
[29] O'Neill 'Quatar Innovative Camouflage, 15
[30] O'Neill 'Quatar Innovative Camouflage, 11.
[31] O'Neill 'Quatar Innovative Camouflage, 17.

been ranked very highly in a variety of environments. Thus, in the 2010 Natick Cropland/Woodland tests[32], the patterns were ranked:

1. Woodland Digital (pixelated)
2. Place U.S. Navy AOR-2 (pixelated)
3. 3.USMC Woodland MARPAT Digital (pixelated).

In the Desert Terrain tests:

1. DCU Digital (pixelated)
2. 2nd Place U.S. Navy AOR-2 (pixelated)
3. Desert Brush
4. USMC Desert MARPAT (pixelated).

In the Rocky Desert test:

1. Multicam
2. followed by USMC Woodland MARPAT Digital (pixelated)
3. Woodland Digital (pixelated)

In Mountainous terrain:

[32] These tests typically involve two stages. In the first, the patterns are tested in a simulation in which an observer wearing modified glasses with two micro-video cameras to track their eyes observes a 120-degree screen featuring 'onto which three ceiling-mounted, high-definition projectors beam, he said, "calibrated digital images" containing – somewhere – a small picture of a rifle-toting soldier wearing the latest camo pattern under exploration. "The observer sits in the sweet spot. A picture comes on of a tree line, or something like that, and the person searches the tree line to find a target," said O'Neill. The eye-tracking technology allows Army testers to follow the observers' screen scanning in real time and to record how long it takes them to find the hidden soldier or "bad guy.": http://usnews.nbcnews.com/_news/2012/07/17/12744591-uncloaked-how-army-is-testing-new-camo-to-replace-flawed-design?lite

1. Multicam and U.S. Navy AOR-Universal (pixelated)
2. Woodland Scorpion
3. U.S. Navy AOR-2 (pixelated)

The dominance of digital camouflage is clear; it won three out of four of the trials and was runner-up and/or third in all four trials. Multicam has performed well in certain environments, although it should be noted that while Multicam is not pixelated, it is a camouflage design which employs the complex micro-pattern of the digital systems, with seven (rather than the three colours usually used by digital designs) to create a dithering effect. There is a highly developed scientific theory of camouflage behind the development of digital designs, then, and, on this evidence, digital camouflage represents an objective improvement on disruptive pattern camouflage predominant between 1970 and 2000. It represents a purely technological advance, on the basis of scientific research. Indeed, many observers of camouflage has made precisely this point. For instance, James Laver has argued that that military uniforms have been designed on the basis of three principles: seduction, hierarchy and utility.[33] While the seduction and hierarchy principles were primary in the first era of the modern uniform, the utility principle has become increasingly important. Indeed for Laver, the uniform of the twentieth century was wholly functional: 'The invention of long-range fire-arms and the raising of immense armies have enormously increased the utility principle until today we may say that the long tug of war is over, at least so far as fighting troops are concerned...In modern warfare the utility principle has triumphed completely and the dress of commandos and tank crews is no more a 'uniform' in the proper sense of the term than are the dungarees of the factory hand'.[34] Given the research and

[33] James Laver, *British Military Uniforms*. (London: Penguin, 1948), 23.

[34] Laver, *British Military Uniforms*, 24,26.

testing which has been invested in digital uniforms, they seem to represent of an accentuation of the processes which Laver has observed. They represent the total triumph of the utility principle; indeed, they might be described as utilitarian so effective do they appear to be at concealing soldiers. The armed forces have rationally invested in digital camouflage in order to reduce casualties and enhance the performance of their troops and they have been right to do so.

The Problem of Camouflage

Although it would be unwise to deny the effectiveness of digital camouflage especially in tests, some scepticism about the easy confidence of the armed forces in their new uniforms might be justified. Indeed, previous studies of the military equipment and military technology would suggest that claims of objective technical advance must be treated with some caution. The armed forces and the industrial companies which produce their equipment have every interest in claiming that new technologies are self-evidently superior to that which they replace. Yet, in almost every case, sociologists have been able to demonstrate that these claims are simply rhetorical, concealing cultural presumptions or explicit institutional interests. Sociologists have sought to demonstrate how arbitrary often interested, social and cultural factors have informed and legitimated the process of apparently pristine technological development. Thus, Mary

Kaldor[35] has illustrated the way in which in the 1970s, western militaries developed 'baroque arsenals' of highly advanced weapons which had little realistic utility but were a means of sustaining the military industrial complex. Don Mackenzie[36] has shown how the development of accurate nuclear weapons in the 1970s was substantially a product of inter-service rivalry in the US and especially an attempt by the air force to retain its privileged status threatened by the Navy' ownership of intercontinental ballistic Polaris missiles. Only this rivalry could explain the apparent absurdity of requiring accuracy from a weapon of mass destruction, which could destroy an entire city. It might be thought that the introduction of a relatively similar piece of military technology like the rifle whose function is simple and therefore whose effectiveness is reasonably easy to assess would be above such distortions. Yet, James Fallows' famous study of the introduction of the M-16 rifle in the 1960s showed how US army culture and the institutional interests of the ordnance corps, which prioritized accuracy, bullet velocity and caliber, converted a highly effective infantry rifle, the AR-15, into an unreliable weapon in Vietnam: 'American troops in Vietnam were equipped with a rifle their superiors knew would fail when put to the test'.[37]

These studies have all shown how extraneous social, cultural and political factors have influenced and, indeed, in some cases undermined technological development. There is, in effect, no such thing as pristine technological progress where the self-evidently best military equipment is always chosen. Typically, institutional politics within the military or between the military and

[35] Mary Kaldor *The Baroque Arsenal*. (London: Deutsch, 1982).

[36] Don Mackenzie, *Inventing Accuracy: a historical sociology of nuclear missile guidance*. (Cambridge, MA: MIT Press, 1993).

[37] James Fallows 'The American Army and the M-16 Rifle' in Don Mackenzie, D and Judith Wacjman, (eds.) *The Social Shaping of Technology*. (Buckingham: Open University, 1999), 382.

civilian society recommend the adoption of particular kinds of technology, even though it is very difficult to determine in most cases whether it is objectively the best; in some cases, the technology does not represent any improvement at all. Although not as apparently technical as a nuclear missile or a rifle, digital camouflage might usefully be seen as a form of technology. It is a piece of equipment designed to improve the performance of the soldier. Moreover, a similar involvement of cultural and institutional factors may be evident with the development of camouflage. It may be possible to submit digital camouflage to the kind of critical investigation which Kaldor, Mackenzie and Fallows conducted in the past, identifying cultural and institutional factors which have been central to the digital revolution. Indeed, there seems to be considerable evidence that its adoption cannot be explained solely in terms of technical performance.

One of the central and most immediate problems for any camouflage design – which questions its utility notwithstanding the science behind it - is the multiple use to which soldiers put it. The tests which are conducted on camouflage trial the patterns against different backgrounds but even the most advanced test falls some way short of the very diverse environments in which soldiers find themselves when actually deployed on operations. While a particular design might match the generic woodland or arid environment in test conditions, at any particular moment, even the very best camouflage pattern might be contrasted with the background in which the soldier is working. Out on patrol in Afghanistan, soldiers in desert uniforms are often located among dense vegetation or rocks; alternatively, soldiers in woodland uniforms could be operating in urban environments. Different light conditions make camouflage more or less effective; in broad daylight patterns might become significantly less effective than in the shade. At night, they are almost irrelevant, beyond being of a dark tone. There are further

problems. One of the basis on which digital camouflage is claimed to be superior to previous designs is its dithering effect which confuses the eye by the juxtaposition of contrasting colours in a complex micropattern. There is no doubt that the micropattern works at close ranges when the eye can still discern the pattern very clearly and so be confused by it. However, the dithering effect lessens as the range increases and, quite quickly (from about 200-300 metres), the pattern resolves into monochrome green or brown. Of course, soldiers may well be operating at very close ranges in which case the camouflage may be advantageous but there will also be numerous occasions when troops are seeking to conceal themselves beyond ranges of 300 metres when the digital pattern is no better than disruptive patterns or indeed plain khaki. In practice, of course, it is frequently the case that uniforms become so ingrained with dirt, mud or sweat or so bleached by the sun that, in fact, quite quickly the digital patterns become invisible. Alternatively, the equipment which soldiers have to wear over their uniforms such as radios, webbing, ruck-sacks, body armour, helmets, goggles or weapons often conceals the digital pattern and, therefore, quite negates the purpose of the camouflage.

Furthermore, soldiers continue to wear various badges and insignia which also undermine the function of their uniforms. The flesh of the hands and face remain a problem. In training exercises soldiers are trained to paint their faces but they have rarely concealed their faces and hands with camouflage paint in Iraq and Afghanistan since they have to interact with the population. Painted faces would undermine any attempt to befriend and protect local populations as it is explicitly designed to dehumanise and distort the face. Although operationally necessary, the result is that no matter how good their clothing, soldiers' faces in Iraq and Afghanistan have remained very obvious; the nature of the mission has undermined the purpose of the camouflage. Indeed, most infantry soldiers do not rely on their camouflage uniforms to hide at all. If they are

genuinely seeking to conceal themselves, they hide under dense foliage, behind walls, in buildings or in trenches or shell-scrapes so their bodies cannot be seen at all. Any individual military uniform is thus at best simply a general match between operating conditions and camouflage design and no matter how good that design is, it could, in fact, even for the majority of the time be inappropriate, suboptimal or irrelevant for the environment in which the soldier is operating. The generation of digital designs may now be highly scientific, where patterns are produced by a detailed knowledge of human visual psychology and a close study of the micro-backgrounds in which the camouflage is intended to be used. Yet, in practice, the benefits of this research may be at best oblique, occasional and sometimes nugatory because of the diverse environments in and ranges at which soldiers operate. On objective technical grounds of utility, it is not clear why the armed forces have been so attracted to costly digital camouflage. Yet, the fact is that armies have actively embraced digital camouflage and, indeed, it is all but inconceivable that professional troops in the twenty-first century could be uniformed in simple monochrome - or even disruptive patterned - battle dress again which were regarded as wholly adequate in the twentieth century.

Even if it is accepted that given the special demands of producing camouflage patterns for battle dress, digital uniforms generally perform better, the attraction of pixelation, which is becoming the favoured and fashionable design for forces around the world, is scientifically unfounded. O'Neill and Cramer have both noted that since many of the designs are produced with computer programmes, it has been easier to use pixels. Yet, pixels themselves – the most distinctive feature of the digital design – have no intrinsic merit as camouflage: 'It is also essential to understand that the choice of rectangular pixels to represent the infinite number of optel shapes is arbitrary and based on the ease of digitally decomposing images into squares'. He

continues; ‘The purpose of the pixels is to add the high spatial frequency component usually missing in traditional patterns; the squares have no particular virtue squares’. O’Neill continues: ‘“Digital” camouflage is actually a misnomer, based on the superficial resemblance of these patterns to quantized or coarse digital images. In fact, the patterns of squares (or whatever shape we use) is employed to model the *texture* of typical backgrounds using a mathematical function. We could use hexagons or shapeless blobs as well, except that it is easier to render complex patterns by computer using squares. It is easy to misunderstand the purpose and mechanisms of this kind of design, which is why so many measures that try to use the approach without insight fall short’.[38] He emphasized the point in a private communication: ‘Choosing a design because it *doesn't* have pixels is the same logic that got us into this mess in the first place (viz., choosing a pattern because it *has* pixels). The only -- I repeat, *only* -- qualification that matters is how well it works in ecologically valid testing’.[39] The pixel possesses no special concealing properties. In the light of the realities of military operations, the irrelevance of pixels in themselves to camouflage and the priority of colour, the growing prominence of digital camouflage across western militaries and its attractiveness to them seems to be substantially underdetermined.

Indeed, the case of the US army’s Universal Camouflage Pattern (UCP), usefully demonstrates a quite irrational preference for pixilated designs whatever the actual properties of digital patterns. In 2006, the US Army invested $5 billion dollars in the adoption of its grey-blue digital pattern which was quickly shown to be ineffective in almost all terrains. As O’Neill has frequently observed the problem with a universal camouflage is that ‘the design is equally useless across the globe’. Designed to be universal, it is, ironically, ubiquitously useless.

[38] http://www.hyperstealth.com/digital-design/index.htm
[39] Timothy O’Neill, email communication, 7 July 2012.

> The problem with UCP was an imbecilic choice of colors. I am informed that the colors were supposed to be something like vegetation green, desert tan, and urban gray. There are three problems here. 1. It's hard to find an urban forested desert. Effective camouflage requires a practical definition of where soldiers will hide in a specific area, not broad -- global -- generalizations. (I call this the "tactical microenvironment.") This is why universal patterns are doomed to failure. 2. The colors chosen are extremely unsaturated - they are really just three shades of rather neutral gray, whatever the names of the colors might be. 3. The contrast between pattern elements is too low (we call this "isoluminance"). The eye does not discriminate patterns well by color alone; our visual system keys on contrast to discern shape. Because the UCP is isoluminant, the pattern disappears and the target revolves within a short distance into a formless uniform gray blob.[40]

UCP failed because it was simply the colours were wrong and insufficiently differentiated. Indeed, O'Neill points to the absurdity of the colour selection with some humor when he wryily observes that UCP was designed for an environment – 'an urbanized forested desert' – which is not currently known to exist. UCP is certainly extraordinary and care is needed to extrapolate from its failure to make wider observations about other digital designs, most of which have performed well. However, UCP demonstrates a critical point about digital designs. The pixel offers no special camouflaging properties. Any shape could disrupt an object just as well. Nevertheless, despite UCP's evident inadequacies, which were glaring to any experienced camoufleur, it was adopted by the US Army. No one is doubting the principles of vision science.

[40] O'Neill, email communication, 7 July 2012.

However, the actual practical effects of digital camouflage and especially its pixilated designs do not alone seem to justify the growing preference for digital uniforms among professional militaries; any pattern which abided by the principles of camouflage would work as well. There seems to be some suggestion that digital camouflage may be like Fallow's M-16 or Kaldor's baroque arsenal, then; its introduction has less to do with function than its proponents claim.

Explaining the Digital Revolution

Camouflage designs seem to have been self-evidently developed simply by matching colours and patterns to the natural environment. Yet, if the objective environment was the only consideration in developing camouflage patterns, then it might be expected that in any period, there would be a great diversity of camouflage styles. In any particular decade a multiplicity of designs might exist to reflect the very different regions in which different armies are operating and the independent internal processes which generated such patterns. Yet, such diversity is precisely what is not found in the development of camouflage. On the contrary, very stable and obvious camouflage paradigms are identifiable in the last hundred years. From 1900 to 1970, monochrome designs were favoured. From 1970 to 2000, disruptive patterns became dominant across all NATO, Warsaw Pact and aligned or non-aligned Third World nations. Within a general international military paradigm of disruptive patterning, each nation adopted its own distinctive design, with its own unique combination of colours. Yet, objectively, while individually different, they were all manifestly very similar, clearly referencing each other very closely. Twentieth century disruptive pattern designs might be understood as a Saussurian system of differences. In his seminal work, *Course in General Linguistics*, Ferdinand Saussure

claimed that languages were all constituted out of a system of oppositions; arbitrary sounds became word signifiers not by any intrinsic property they possessed (except for the special case of onomatopoeic words) but simply by being different from each other.[41] Camouflage patterns might be usefully interpreted as a system of symbolic rather than linguistic differences. The patterns have gained their meaning because each design, as part of a recognizable system, was differentiated by certain arbitrary features which defined its otherness. In this way, disruptive camouflage uniforms might be seen as the equivalent to the North West Coast Masks which Levi-Strauss analysed under the influence of Saussure's structuralism.[42] Instead of seeing each mask as a separate cultural artifact relating to specific local social functions, he saw them as an interlocking cultural system, each mask deriving its meaning – and use - from its opposition to other masks. Thus, the Swaihwe and Dzonokwa masks were not separate entities but constituted a single system sustained by mutual oppositions. Where the Swaihwe's eyes and tongue protruded, the Dzonokwa masks were sunken. In this way, according to Levi-Strauss, the beneficient implications of the Swaihwe mask in direct opposition to the malignance of the Dzonokwa mask was signified. The meaning of each mask arose in a series of (arbitrary) oppositions between them.

Military camouflages in the twentieth century seemed to have operated in the same way to generate a self-referential system of signs, denoting a world military system of national units.[43] Indeed, it is possible to identify genealogies within this system.[44] Thus, there were

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[41] Ferdinand Saussure *Course in General Linguistics* (New York: Columbia University Press, 1960).
[42] Claude Levi-Strauss *The Way of the Masks* (London: Cape, 1983).

[43] J Borsarello. *Camouflage Uniforms of European NATO Armies: 1945 to the present*. (Atylan, PA: Schiffer Military History, 1999); Martin Brayley, *Camouflage Uniforms: international combat dress 1940-2010*. (London: Crowood, 2009)

[44] Blechman and Newman *Disruptive Pattern Material*, 262.

regional styles, reflecting political and military alliances, dependencies and interactions. For instance, in this period the Norway and Sweden adopted a distinctive angular disruptive pattern which was taken directly from the Wehrmacht's *zeltbahn* (camouflaged poncho) in the Second World War, which each country adapted slightly to its own national taste. The US and UK woodland design were closely compatible with each other, while the French and Belgium were also very similar. Disruptive camouflage patterns might be seen not as individual patterns, then, developed by a vertical consideration of their function (their relationship to the environment), but generated in a horizontal network of symbols which reflecting social, political and military hierarchies. Crucially, digital camouflage breaks this signifying system; introducing a new suite of signs.

A major impetus for digital camouflage seems to arise from a requirement to rupture the existing disruptive camouflage paradigm. Digital designs have been preferred simply because there are arbitrarily different in a Saussarian or Levi-Straussian way. Yet, such a reading would seem to ignore the obviously dense connotations which digital designs and above all the pixels have. To assert that the pixel is merely different does not seem to be adequate to explaining its special attractions in the current era. It is explicitly seen as deeply attractive to the military. It is worth considering why. The 1990s Revolution in Military Affairs was widely conceived of consisting of three elements; new surveillance (ISTAR) technology, precision guided munitions and digital technology. All three have been extremely important but the development of new surveillance techniques has been particularly important both operationally for the military and in terms of the representation of warfare itself. Visualization – and above all the ability to identify targets at range, at day and night- has been one of the most striking innovations in western warfare since the end of the Cold War. Through the use of satellites and drones, western forces

are able to target opponents at a level of resolution and invisibly which was previously unachievable; individual insurgents can be tracked at night moving through the cities of Iraq or villages of Afghanistan. Accurate observation has facilitated the increasingly ubiquitous – if not always legal - use of lethal force. Predator drones flying over Pakistan are one example of this where insurgents are plotted and targeted for elimination from 14,000 feet.[45] Significantly, most of this surveillance technology is digitalized, utilizing new photographic imaging methods, based on the pixilation of data.

A number of commentators have noted the implications of digitalization for the soldier: 'Throughout the modern period military bodies have been disciplinary bodies. Now they aspire to be digital ones'.[46] Because it is comprised of pixels, new camouflage patterns have been able to signify the rise of digital technologies. The pixel becomes what the art historian, Ernst Gombrich[47] would call a 'schema'; an artistic sign whose representational meaning is automatically accepted. In this case, digital camouflage is taken to represent the digitalization of the military. However, digital designs seem to be further advantaged as signifiers because of their use in popular culture. It is noticeable that digital camouflage is increasingly used in cinema and video games to communicate a sense of the hyper-modern, cybernetic soldier. Indeed,

[45] A number of scholars have noted the increasing this digitalization of warfare has changed cultural representations of warfare and the prosecution of war itself Ryan Bishop and John Phillips 'Sighted Weapons and Modernist Opacity: aesthetics, poetics, prosthetics' *Boundary 2* 29(2) 2002, 157-179. Indeed, in 1991, Jean Baudrillard was able to announce that the 'Gulf war did not happen' because combat had been reduced to a series of hyperreal screen images which were more convincing and realistic that the war they purported to represent Jean Baudrillard, *The Gulf War did not take place*. Indiana: Indiana University Press, 1995). Paul Virilio has subsequently criticized Baudrillard's concept of hyperreal war (Paul Virilio and Sylvie Lotzinger, *Pure War* Semiotexte, 1997) but in recognizing that the armed forces' enhanced capacity to see things was an epochal change, Baudrillard was perceptive (despite his typical hyperbole).

[46] Michael Dillon, 'Intelligence incarnate: martial corporeality in the digital age' *Body and Society* 9(4) 2003, 144.

[47] Ernst Gombrich *The image and the eye: further studies in the psychology of pictorial representation. (*Oxford: Phaidon, 1982); *Art and Illusion: a study in the psychology of pictorial representation*. (London: Phaidon, 1977); 'Illusion and Art' in Gregory R and Gombrich E (eds) *Illusion in Nature and Art*. London: Duckworth, 1973).

Hyperstealth Biotechnology have actively highlighted this connection with filmic representations. Along with many other patterns, Hyperstealth recently developed a new urban digital camouflage for Canada's Special Forces; Canadian Urban Environment Pattern (CUEPAT). Although the uniform has not been officially sanctioned, it is nevertheless already appearing in a very popular US sci-fi television series, Primeval. Actors playing special forces soldiers in this programme will be attired in CUEPAT uniforms. CUEPAT was selected by the director precisely because it was consistent with the futuristic content of the programme. This identification of digital patterns with the future is not unique. It is noticeable that in the James Cameron's futuristic three-dimensional film, *Avatar*, the largest grossing picture of all time, the US Marines, who operate as cybernetic hypermasculine human-technical systems (as opposed to the natural indigenous peoples) are depicted in digital camouflage. The popular usage of digital camouflage charges up the pixel with a series of associations which eventually attach themselves to real soldiers and their actual military uniforms. As Jon Armitage has noted: 'the social allure of the humanoid cyborg warrior, of new levels of militarized machinic incorporation and even human-machine weapon systems, shows no sign of abating'.[48] Because of its multiple connotations, digital camouflage is able to symbolize military transformation particularly efficiently.

Ironically, the symbolic effectiveness of digital camouflage in connoting a techno-military revolution seems to be achieved not in spite of its scientific origins but substantially because of them. It is noticeable that both O'Neill and Cramer stress that digital camouflage is a grounded in science and specifically of visual psychology rather than art and ecology. As

[48] Jon Armitage, 'Militarized bodies: an introduction' *Body and Society* 9(4) 2003, 2.

O'Neill notes, 'Naturalistic methods are richly informative, but carry some shortcomings that need to be understood'.[49] Camouflage in the twentieth century, based on the often impressive intuition of painters or naturalists, did not systematically analyse the micro-environments in which soldiers would operate or consider how the human visual system actually worked. By contrast, O'Neill's digital camouflage patterns are explicitly informed by a scientific understanding of visual psychology. Indeed, the scientific basis of new designs is stressed by their designers including Cramer and O'Neill; the evidence is not denied but the rhetorical purpose of appealing to scientific research has to be recognised. In this process, the technicalities of vision science become crucial and a central to the explanation of and justification for the new patterns. In order to generate the optimal colouring and design, 'the spatial components (optels) [the tone and frequency in which colours occur]' are 'detected by image analysis of typical backgrounds'. 'A fractal [random broken] series' is then generated from this information the elements of which are deduced. decomposed at points matching the salient Fourier components will do well'.[50] The Fourier component, a mathematical algorithm, is used at this point from which it is possible to calculate the most frequently occurring colours in any sequence. It is used to generate a micropattern which blends the target into the background by 'a careful survey of the target environment for spatial and colorimetric properties'. In many cases, artists, using naturalistic methods, have been able to judge colour matches equally well or better than computerized testing. Consequently, while often practically as effective as the scientific methods used in generating digital designs, twentieth century patterns do not have the symbolic resonance with which research endows digital patterns. Digital camouflage is able to communicate a sense of contemporaneity precisely because its designers rhetorically stress that it is 'scientific'. In this

[49] O'Neill 'Quatar Innovative Camouflage', 3.
[50] O'Neill 'Quatar Innovative Camouflage', 17.

way, digital patterns are able to rupture the existing disruptive paradigm, not only because they are so different from twentieth century designs but because they are replete with connotations of the Revolution in Military Affairs and the wider digital revolution.

Digital Patterns and Status

Digital camouflage seems to have some very significant symbolic advantages over twentieth century designs but it is necessary to consider the introduction of digital patterns more closely to understand the motivation of armies for adopting these designs. Why have armies found the symbolic meaning of the digital pattern so irresistible? One of the crucial factors at work in the introduction of digital uniforms seems to have been a process of domestic and international status competition between different armies. Clearly, since the Canadian armed forces were the first to introduce a digital pattern with CADPAT in 1997, it may provide some insight into the rationale behind the military's attraction to pixilated camouflage. As might be expected, the Canadian army's introduction of CADPAT was explained in predictably utilitarian terms; it was simply superior to previous patterns. However, as the uniform started to be issued, discussions of its appropriateness were revealing; they seemed to suggest that while the uniform may well have been an advance on previous disruptive patterns, other factors were equally at work in recommending it to the Canadian Army. It is noticeable that when Canadian Forces first deployed to Afghanistan in February 2002 on manifestly dangerous and war-fighting mission which differed drastically from Canadian's peace-keeping commitment throughout the post-war period, CADPAT, as a new uniform, became the focus of considerable debate. Arid CADPAT (brown and grey for desert environments) had not yet been developed and the first soldiers

deploying to Afghanistan were attired in the green temperate CADPAT pattern which was regarded as inappropriate in Afghanistan. There were concerns that Canadian soldiers were potentially at greater risk than they needed to be because they might be more easily detected by Taliban and Al Qaeda fighters. Lieutenant General M.K.Jeffery, from the National Defence Headquarters, who was responsible for the decision to send Canadian troops in temperate CADPAT rather than to buy US desert pattern uniforms, countered these criticisms in public statements. He explicitly emphasized that a substantial reason for camouflage uniforms was not, in fact, their practicality but rather their symbolic function: 'I acknowledge that concealment is a vital part of a soldier's protection while on operation. But there are many factors determining camouflage effectiveness, the colour of the uniform being only one of them. Uniforms and equipment, regardless of colour, have limits in terms of their ability to blend into varied terrain'.[51] The general concluded: 'As we send troops into a major operation, it is right that we should all reflect on their preparedness. I am confident that Canada is deploying a professional, well-trained force to Afghanistan. They are equipped with some of the best clothing and equipment in the world. They are prepared to do the job and will do Canada proud'.[52] As Jeffery's statement affirms, CADPAT is an effective camouflage in the correct environment but its first operational usage demonstrated that its adoption was not based purely on practical, military considerations. On the contrary, the new digital uniform was central to the self-identity of the Canadian Army and its projection of that identity. Institutional and status factors were acknowledged by the Canadian army itself as playing an important role. Above all, by breaking with the disruptive past, CADPAT communicated both to Canadian citizens and to other

[51] Mike Jeffery 'Uniform Colour is an acceptable risk' *The Ottawa Citizen* 2002, 13

[52] Jeffery, 'Uniform Colour is an acceptable risk', 13.

militaries that Canada was a modern professional force no longer restricted to peace-keeping operations. Such a demonstration was in fact very important to the Canadian Forces in the late 1990s and early 2000s.

The Canadian Armed Forces were the first western forces to professionalize. In 1945, immediately after the Second World War, they de-mobilized their citizen army which had fought in the European Theatre. However, although the Canadian army was a professional force in name, it was not particularly professional in the sense of capability or performance. From 1945 to 1990, the Canadian army specialized in UN peace-keeping missions and, although it trained for combat, it was primarily a constabulary force. This lack of professionalism became evident in the 1990s and especially in 1994, when a Canadian airborne battalion was deployed to Somalia on a stabilization mission. The deployment was deeply problematic and included the torture and murder of a local by the paratroopers which engendered a political crisis in Canada. Indeed, in his work, *Lament for an Army*, John English[53], a military historian and ex-Canadian Army officer, described this incident not as an aberration but as the logical consequence of an army which has been poorly trained, equipped and led for decades; Somalia demonstrated the lack of professionalism in the Canadian military. As a result of the scandal, the Canadian Airborne Regiment was disbanded and the Canadian Armed Forces as a whole was subjected to intense scrutiny whose aim was not simply to bring the force under civilian control but to make it a more modern, better trained and professional force. As General Jeffery's statement implied, the development of CADPAT seems to have been part of this wider process of transformation and professionalization. Although, no senior commander has publicly stated it, the Canadian Army

[53] John English, *Lament for an Army*. (Toronto: Canadian Institute of International Affairs, 1998),

seemed to want to create a uniform which dissociated the force from its post-War and now quite tarnished peace-keeping reputation and especially the Somali scandal. The question was how to generate a camouflage design which would not only work in the field but would serve the symbolic purpose of distinguishing a reformed military. In adopting digital camouflage, the Canadian Army cleverly broke out of the established symbolic system. It is here that the digital design seemed to have been hugely advantaged over any other comparable pattern. A disruptive pattern which employed blobs and colours could easily have been developed which would have been equally effective; this is essentially what Multicam is. However, digital camouflage had the important additional symbolic effect of genuinely breaching the established disruptive paradigm and of creating a new system of military signs. Digital camouflage was new.

Further suggesting that its symbolic distinctiveness may be as important as its functionality, it has been noticeable how strictly the Canadian Army has sought to restrict the dissemination of this uniform. Thus, it is illegal in Canada for civilians to wear CADPAT camouflage at all and individuals who have breached this law have been threatened with prosecution.[54] For instance, in July 2004, the army threatened to arrest Scott Collacutt for trying to sell damaged and used CADPAT uniforms he had procured to a movie supply company.[55] Subsequently, in March 2006, a large quantity of CADPAT uniforms appeared on the internet for sale; they had apparently been stolen by soldiers or civilians in the supply chain. The Canadian army and the Ministry of Defence sought to recall the uniforms and to ban their sale.[56] Significantly, although the question of security was raised in public announcements, the problem

[54] Hamilton Spectator 'Army Probes Internet Sale of Uniforms'. 15 March 2006, 10.

[55] John Farrell, 'Army wants uniforms back' *The Leader-Post* 26 October 2004, 6.

[56] Hamilton Spectator 'Army Probes Internet Sale of Uniforms', 10.

here did not seem primarily to be a security issue. Rather, the dissemination of CADPAT to civilian consumers undermined the symbolic function of the new uniform. If civilians wore it, as they do practically every kind of disruptive pattern, CADPAT would no longer could not therefore signify the new and distinctive professionalism which the Canadian Army was trying to project.

Indeed, the cost of CADPAT suggests that the symbolic significance of CADPAT has always been very important to the Canadian Army. It was noted above that the development of digital camouflage is something of a conundrum; it is not obviously worth the investment. The Canadian 'Clothe the Soldier Programme' which eventually involved the introduction of CADPAT, cost $287 million, with each uniform costing $100 in comparison with the $80 dollar solid olive green uniform which it replaced[57]; a not insignificant twenty per cent increase in uniform costs especially at a time of budgetary contraction. These increases in costs may be relatively small in comparison with defence budgets but they are costs which could have been avoided completely by maintaining existing and certainly adequate uniforms, especially since, as noted above, it is highly uncertain that advanced camouflage makes an objectively significant difference to combat performance. Nevertheless, digital camouflage has a very useful symbolic function. The new uniform signifies a higher level of investment in each individual soldier by the Canadian state. In contrast to the mass armies of the twentieth century, where soldiers wore the same basic, mass produced uniform and were ultimately expendable, expensive new uniforms imply that professional troops in the twenty-first century are individually valuable. They are not simply soldiers but highly trained experts for whom the advantages of technical camouflage

[57] P Small and J Rankin 'Desert Garb does Canada Proud' *Toronto Star* 7 February 2002: 13.

uniform, even if they are very small, are worthwhile: despite their cost. In this way, CADPAT becomes a self-referential system signifying the new status of Canadian soldiers; simply because they are wearing it, they are presumed to be highly professional. They become the cyborg warriors they aspire to be.

A similar status motivation seems to have been evident with the adoption of MARPAT which was developed from CADPAT. As with O'Neill and Cramer have elaborated in the discussions of the principles of digital camouflage more widely, there were coherent operational reasons for the development of MARPAT and great care was taken in its selection. The colours were developed by the sniper school at Quantico Virginia; marines were then asked to assess various patterns including a version of Vietnam Tiger stripe. From this process, MARPAT was eventually selected as the most famous design. As the Natick tests demonstrate, both temperate and arid MARPAT patterns have been effective. However, the introduction of MARPAT seems have had a symbolic dimension, in a manner not dissimilar to CADPAT. Interestingly, the MARPAT design uniquely includes the globe and anchor insignia of the US Marine Corps embroidered into the digital pattern on the left breast pocket of the uniform; the insignia appears every seven meters on pre-cut material. The pattern is intended as a deliberate statement of corporate identity even as the pattern is meant to provide the best form of concealment. Indeed, serving marines have quite explicitly recognized this function. Thus, announcing the introduction of MARPAT, one marine officer paradoxically claimed that, 'We want to be instantly recognized as a force to be reckoned with. We want them to see us coming a mile away in our new uniforms'. Clearly, the officer was speaking metaphorically but he usefully highlighted the status dimension which has been central to the introduction of MARPAT. Other marines have affirmed the point. Sergeant Roston Boodram, a marine who helped test the new uniforms in the field,

observed: 'A marine needs to look sharp 24/7'.[58] He believed that the MARPAT which he had tested fulfilled this important corporate aesthetic requirement. Whatever its functional properties, digital camouflaged was 'sharp': it communicated a distinctive sense of individual and collective status and self-identity which he as a Marine NCO recognised as compatible with the ethos of the Marine Corps.

In fact, the US Marines have always been conscious of their distinctiveness from the US Army about whose intentions towards them they have expressed consternation bordering on paranoia at some points. At the beginning of his history of the US Marine Corps, Lieutenant General Victor 'Brute' Krulak, one of the most famous Commandant Generals of the Corps, cited a perhaps apocryphal conversation between Lieutenant General Holland Smith and the Secretary of the Navy James Forrestal as they watched the assault on Iwo Jima on 23 February 1945. Forrestal suggested that this action would mean there would be 'a Marine Corps for the next five hundred years' to which Smith replied: 'When the war is over and money is short they will be after the Marines again, and a dozen Iwo Jimas would make no difference'.[59] Krulak's history should be read as a response to this challenge. It is an explicit celebration of the Marine Corps and its successes in order to justify its existence and protect its future. Indeed, Krulak himself observed that 'the continuous struggle for a viable existence fixed clearly one of distinguishing characteristics of the Corps – a sensitive paranoia, sometimes justified, sometimes not'.[60] The US Marines constantly fear they will be disbanded or absorbed by the army or the navy and Krulak repeats that; 'Threat, in one way or another, has been a major influence on the

[58] John Leland, 'The World: giddy yet covert' *New York Times* 20 January Section 2002, 4: 3.

[59] Charles Krulak *First to the Fight*. (Pocket Books, 1991), 17.

[60] Krulak *First to the Fight*, 18.

growth of the Corps from the start. Rooted in the attitudes or aspirations of the Army, the Navy or various chief executives, its nature has varied – threat to the Corps' repute, to its right to fight, to its very survival'.[61] Since the 1990s, as the Marines have been employed on increasing number of land-based operations with no amphibious dimension, this fear of absorption has become more pronounced once again. In Afghanistan and Iraq after 2001, the US Marines fought exclusively as infantry soldiers far away from the sea. Accordingly, precisely as their distinctive amphibious role has been less evident, the Marines have had to continue to assert their corporate identity and, indeed, superiority. The emergence of MARPAT seems to have been part of this continuing struggle for survival and self-assertion. This requirement for a new uniform seems to have been particularly pointed because from the 1980s, the US Marines had been issued the same uniform as the US Army; the woodland pattern for temperate climates, the US 'chocolate chip' desert camouflage during the Gulf War and its replacement desert pattern for the invasion of Iraq. MARPAT may, indeed, be an effective uniform but its purpose is only partly functional. It is very substantially designed to distinguish the Marines from the US Army and to generate a sense of corporate pride and unity at a time of new challenges and threats.

The Marines' adoption of MARPAT was an important symbolic moment for it began to mark the rise of a new camouflage paradigm in which new signifiers would be required by all forces, if they were to distinguish themselves from their peers and rivals. It is this symbolic logic which seems to have impelled the US Army's selection of UCP in 2006. Unlike the Canadian Army (20,000 soldiers) or the US Marines (200,000 marines), the US Army remains a very large organization. It consists of approximately 500,000 troops. Accordingly, given the expense of

[61] Krulak *First to the Fight*, 250.

equipment and the fact that in the new strategic environment of the 2000s, the Army might be called upon to fight anywhere and, indeed, they were operating in quite different environments in urban, desert and mountainous terrain in Iraq and Afghanistan, senior commanders expressed a preference for the possibility of a single military uniform issued to all soldiers. At the same time, with the intense pressures of a failing campaign in Iraq in which numerous casualties were being taken every week, the Army contracted the research and development phase drastically. Any means of reducing casualties and increasing combat performance were clearly regarded as essential. Consequently, under this pressure, Cheryl Stewardson, a textile technologist at the Army research center in Natick, Massachussetts, where most of the armed forces camouflage patterns are produced, noted: 'It got into political hands before the soldiers ever got the uniforms'. The problem was that Program Executive Office Soldier, the organisation which administers equipment, had suddenly ordered Natick's camouflage team to pick a pattern long before trials were finished. According to James Fairneny, an electrical engineer on Natick's camouflage team, 'They jumped the gun'. Researchers were ordered simply to take their 'winning' colours and pixelate them: 'basically put it in the Marine Corps pattern'. The consensus among the researchers was that the Army regarded their own uniform as outmoded in the light of the US Marine's adoption of MARPAT. The US Army were still attired in the disruptive patterns of the old paradigm. UCP offered a rapid solution to this symbolic problem and, indeed, precisely because the colours on the uniform were so unusual and so different from either CADPAT or MARPAT, UCP was a highly potent signifier. Although it may be ineffective in the field, it is an aesthetically distinctive uniform. From a symbolic perspective, it was therefore highly successful. Stewardson stated: "It was trendy...If it's good enough for the Marines, why shouldn't the Army have that same cool new look?" Others involved in the process

have affirmed the point. Graves observed: 'That's what this really comes down to: 'We can't allow the Marine Corps to look more cool than the Army.'[62] O'Neill confirms that status competition with the US Marines played a significant role in UCP's development: 'Never decide Pattern A just looks cooler than Pattern B. The Marine Corps call that a 'CDI factor' – chicks dig it'.[63] Laver's seduction principle seemed to be very strongly, albeit sometimes unwittingly, at work in the introduction of UCP. Moreover, not only did the UCP create a distinctive place for the US Army in the emergent digital paradigm, but the universal pattern did solve the problem of mismatched gear, so that the uniform generated a unified sense of Army identity: 'Brand identity trumped camouflage utility'.[64] Status seems to have triumphed over function.

The evidence the researchers from Natick provide is compelling but it may be useful to refine their own interpretations somewhat. For instance, it is unlikely that either Brigadier Jim Moran, commander of PEO, or other commanders who eventually selected the uniform deliberately sacrificed function for status. Clearly, they wanted to produce a successful pattern which would prove effective in the field. A rather more subtle process seems to have been at work among these commanders than the researchers' statements may allow for. Specifically, the Army seemed to have allowed itself to become confused about the principles of camouflage and to assume that any design with pixels (because it was part of a new camouflage system of signifiers) would automatically be better than disruptive designs. Given that both CADPAT and MARPAT were successful designs, they seemed to have assumed that it was the pixels themselves which were important. The symbolic logic which demanded distinction within the

[62] http://www.thedaily.com/page/2012/06/24/062412-news-camouflage-fiasco-1-5/
[63] http://usnews.nbcnews.com/_news/2012/07/17/12744591-uncloaked-how-army-is-testing-new-camo-to-replace-flawed-design?lite
[64] http://www.thedaily.com/page/2012/06/24/062412-news-camouflage-fiasco-1-5/

emergent digital paradigm produced a uniform which could not actually function as a camouflage. The prime concern seems to have been to address a morale crisis with the US Army as it faced defeat in Iraq and to re-assert the status of the Army against the Marines. The army was also going through a crisis in Iraq where by 2006 a catastrophic strategic defeat looked very likely. The decision to introduce a new uniform seems to have been impelled by these difficulties and generated an unusual haste in the research and procurement process. It was noticeable that at the same time as UCP was being hurriedly procured, General David Petraeus was initiating a profound revision of the army's doctrine and indeed entire self-conception with the writing of the now famous Counter-insurgency Field Manual 3-24. UCP seemed to be a symbolic dimension of this transformation, physically demonstrating with the soldiers' uniform that the army was metamorphosing into a quite new force conceptually, doctrinally and, perhaps, even morally. The pixel was the symbolic means of achieving this change and, like a fetish, it was assumed that since digital camouflage resolved the status problem it would therefore necessarily also improve the combat effectiveness of the troops; it would make US soldiers less visible and, therefore, less vulnerable to insurgents. The status problem was unwittingly conflated with and given precedence over a technical one.

North American militaries seem to have been beguiled by digital camouflage because its powerful technological symbolism conveniently addressed the status crises (and competitions) which each of these forces faced in the first decade of the twentieth century.[65] The prominence of

[65] The US Army and Marine Corps currently in the process of developing a new camouflage pattern to replace existing digital patterns. In the case of UCP, affirming the status dimension of its introduction, the US Army has accepted its failure and, indeed, in Afghanistan, US soldiers now operate in Crye Multicam, procured as a temporary operational requirement. Because of this organic dissemination (and its associations with the Special Forces), it is possible that the replacement for UCP and for MARPAT will be a universal Multicam design, rather than digital pattern. The outcome is, as yet, unknown. However, it is clear that neither the US Army or Marines will return to a conventional disruptive pattern design.

reputational considerations may seem surprising in the selection of an artefact as mundane as a uniform but there seem to be a number of parallel examples of this process. Indeed, Christine Demchak's work[66] on the revolution in military affairs is particularly apposite here precisely because she is interested in exploring the rationale behind the global dissemination of network centric technology, to which the development of digital camouflage seems to be symbolically related. Demchak draws on DiMaggio and Powell's concept of 'mimetic isomorphism'.[67] Against rationalist theorist of institutional development, DiMaggio and Powell famously claimed that actors will imitate and follow the leading institution; they will imitate the structures and practices of the dominant organization as a means of asserting their status in competition with their rivals. Applying this concept of mimetic isomorphism to the military, Demchak has argued that the adoption of network centric approaches often has little to do with the objective strategic requirement of the militaries which procure it. Demchak notes that militaries have adopted network-centric technology even though it is extremely expensive and may not match the specific security threats which they face; indeed, in many cases, it manifestly does not. In the light of this irrationality, Demchak plausibly suggests that the prime motive in explaining the dissemination of digital technology is status. The armed forces and their governments want to assert their international status through imitating the leaders in the field – the United States - irrespective of their own needs. In fact, in terms of the dissemination of network centric technology Demchak may have overstated her point, ignoring an important benefit which comes from adopting the equipment of the leading nation, especially if it is an ally. The procurement of

[66] Christine Demchak, 'Creating the Enemy: Global Diffusion of the Information Technology-Based Military Model' in Emily Goldman and Leslie Eliason (eds.) *The Diffusion of Military Technology and Ideas*. (Stanford, California: Stanford University Press, 2003).

[67] Paul Dimaggio and Walter Powell 'The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields' *American Sociological Review*, 48 (1983), 147-60.

digital technology may indeed have been expensive for subordinate militaries and sub-optimal in terms of their immediate and independent security needs. However, the procurement of compatible equipment allows these states to cooperate with the United States. While independently irrational, network centric technology may generate collective benefits in terms of alliance interoperability for smaller states around the world which require US security assistance. By procuring the same equipment (from US companies), they are able to conduct militaries operations with US forces. While Demchak may have exaggerated the case in terms of technology, her status argument seems to be immediately applicable to digital camouflage, as the UCP case makes abundantly clear. Unlike network-centric technology, in functional terms, uniforms - and especially their specific colouring – have little effect on whether troops can work together on operations; soldiers can work together whatever (within reason) they are wearing. A clear status process seems to be evident in the case of UCP and digital camouflage more generally. In the cases of the Canadian army, the US Marines and, especially, the US Army, a major motivation had less to do with objective combat performance and more to do with the projection of a new corporate identity especially in relation to institutional rivals at a time of intense institutional pressure.[68]

[68] Although not a digital design, the introduction of the UK's Multi-Terrain Pattern seems to have been similarly, at least partly motivated, by status considerations. During the campaign in Helmand, British troops found that their standard issue desert camouflage did not perform well in the 'green zone', the fertile arable area around water ways. Accordingly, a requirement appeared for an alternate camouflage pattern, which ideally performed well in both arid and verdant areas. The UK's Special Forces had adopted Crye Precision Multicam as its chosen uniform during the Iraq Campaign in 2005-6 and, with the growing interactions between regular and Special Forces in Afghanistan, the Multicam pattern gained credibility among British forces especially since they assumed that if the Special Forces used it, it must be effective. At the same time, from 2006 to 2008, there was considerable anxiety about the attire and performance of British troops in Afghanistan. Partly because of the perceived inadequacy of issued camouflage and the pressures of campaigning, standards of dress among combat troops declined dramatically to the consternation of British commanders. Indeed, American generals had apparently warned their peers that the British Army was starting to look like the US Army in Vietnam, fighting bare-chested, in non-regulation, dirty uniforms often scrawled with graffiti. A decision was taken to introduce a new universal uniform which would be effective in Helmand but would also crucially re-inscribe discipline on British forces and re-assert the corporate identity of the Army. Digital camouflage was seen as inappropriate in this context. The problems of UCP was, by then, well known

Conclusion

In the last ten years, a camouflage revolution is evident across the world's armed forces. A paradigm shift is observable. The disruptive pattern materials which became the hegemonic military style between the 1970s and 2000 are gradually being displaced by pixilated digital designs or by designs like Multicam which are based on the same scientific principles and methods. There is little doubt that the level of understanding and the amount of research into visual science and camouflage has increased in the last few decades. Systematic testing has replaced the naturalistic practices which were typical of the twentieth century. Moreover, drawing on this expertise, there is little doubt that many of the new digital designs perform extremely well. This article is in no way suggesting that the effectiveness of digital camouflage is an illusion and that any other camouflage – or no camouflage- might do as well. However, while designs like CADPAT or MARPAT have been successful, their effectiveness has nothing

in military circles and senior British commanders wanted to eschew any association with failure. They wanted a camouflage pattern which was multi-purpose and which was connected symbolically to previous DPM patterns and, therefore, to Army traditions. At this point, Crye Multicam became the prime candidate since it served both requirements. Crye Multicam also had the advantage that it was already in service with UK and US Special Forces and therefore had attained a very high symbolic status. In fact, like all 'universal' camouflages, Crye Multicam performed well in the arid or dry grassy environments for which it was designed but was poor elsewhere; much worse than the UK's temperate DPM, for instance, in woodlands. Despite the darkening of Multicam to produce Multi-Terrain Pattern, the new design is minimally a compromise and it seems likely that it too could be submitted to the kind of criticisms levelled against digital camouflage. Its introduction is underdetermined on purely functional grounds. Indeed, like North American forces, the British Army self-consciously saw the introduction of Multi-Terrain Pattern as much as a statement of corporate identity and status (in a constrained budgetary context) as of optimal functionality. Indeed, in the British Army, it is accepted that quite arbitrary cultural standards often determine military preferences for equipment and clothing; British soldiers talk of items being 'ally' and use an aphorism that 'ally [i.e. wearing or using desirable equipment or clothing] saves lives'. Because of its associations with Special Forces, Multi-Terrain Pattern could be seen as 'ally' and would therefore be accepted by regular soldiers as compatible with their own definitions of their status (personal interview, Commanding Officer, Infantry Trial and Development Unit, 14 May 2013).

to do with the fact that they are pixilated. It has been suggested that the prime motivation for the selection of digital camouflage can be best understood by seeing camouflage not as individual cultural artifacts generated by relating the target to be concealed to an environment. Rather camouflage forms a symbolic structure consisting of a horizontal system of differences. Against the disruptive camouflage paradigm, the selection of digital camouflage has been a means by which the armed forces can physically represent their own transformation. Digital camouflage allows professionalizing militaries to re-assert their distinctiveness from the past and to affirm their status over their rivals. It is able to do this particularly well because digital camouflage connotes the digital revolution which has itself transformed the military; above all the pixel symbolizes the visualization of the battlefield as new means of surveillance and observation have been developed. The pixel has no great merit as camouflage but few other shapes are as redolent with contemporary meaning as this small, computer-generated square.

At the beginning of this paper, it was suggested Abler's argument about the symbolism of military dress in the eighteenth and nineteenth century might be applied to the apparently purely functional and scientific uniforms of the twenty-first century.[69] The dolman and pelisse, czaptka and kurkta of Hungarian hussars and Russian Cossacks were not ideal for campaigning but they were powerful signifiers of elite warrior identity and status. Digital camouflage with its pixilated designs seems to have a similar effect. Independently of its function, the pixel associates the soldier with the digital revolution and with high-tech twenty-first century warfare – and above all with the visualization of warfare - just as the hussar's pelisses tied the cavalryman to the wild steppes of Eastern Europe. It seems to be precisely because of this association of the pixel with the digital revolution that digital camouflage has been so evocative. Precisely, because it claims

[69] Abler, *Hinterland Warriors and Military Dress.*

to be based on science and to be a piece of technology rather than a form of artwork, digital camouflage communicates military status and identity in the twenty-first century, no less successfully than the Hussar's pelisse of the eighteenth and nineteenth centuries.

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