

**The Human Factor:
The Fourth Dimension in Digitising the Battlefield**

by Professor Richard Harper

Richard Harper is Professor and Principal Researcher of Socio-Digital Systems at Microsoft Research, Cambridge. In this comment on Dr Jim Storr's article in our October edition, he draws attention to two views of the human soldier – the human as a machine acting with a machine, and the human trained to be machine-like – and suggests that the boundary between them is opaque but must be understood.

If, as Von Clausewitz said, there are three dimensions to war – loosely speaking, *time* (when), *space* (where) and *intensity* (how much firepower) – then a fourth dimension could be, or ought to be, the *human* one. This is certainly the implication from Dr Jim Storr's provocative paper *The Failure of Digital Command and Information Systems*.¹ It is this fourth dimension I would like to write about in this response to Storr's paper. But my angle on the human dimension is not quite the same as the one that Storr offers (nor might it necessarily fit well with Von Clausewitz's ideas, but that is another matter!).

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Dr Storr identifies four ways in which the human intrudes upon the digitisation process. First, when the human user is unable to tell the 'techies' what they need; second, when the humans controlling the processes for technology procurement insist on the disaggregation of these processes, which results in technological systems themselves not fitting together; third, when there is a lack of continuity in the human leadership of the digitisation programme leading to the programme goals shifting over time, which in turn undermines the achievement of any goal in particular; and fourth, when the humans in charge of the system development processes refuse to allow the iterative testing of prototypes, resulting in systems not being properly tested before they are bought.

It would certainly seem that if Storr is right, and these *are* the problems that beset battlefield digitisation, then one can certainly agree that these are human in nature, albeit that

the problems in question aren't only to do with particular persons (leaders) or sets of persons (users), but also to do with organisations and their cultures – with the cultures of the military and with the very different cultures of technology companies.

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But I think one could also say that digitising the battlefield would be likely to suffer especially from the human factor in a bigger sense than Storr defines it. I think this not because military and technology organisations have peculiar people or peculiar processes, nor because they require peculiar technology. It has to do with what 'humanness' or 'being human' means when understood from the perspective of technology design *and* from the perspective of military organisations. One is to be expected in relation to the digitisation process (allowing engineers to configure their systems to a model), the other less so (being more to do with military discipline), but both are important nevertheless to what in the end is the topic that Storr wants to raise: what is the result of all the investment on new digital technologies for the military?

Two Views of the Human

Let me explain. The first view I am thinking of treats the human as machine-like, or at least emphasises the information-processing features of the human. The trades that use this view are *human factors* and *ergonomics* – experts in these sciences are commonplace in the organisations that design and deliver military hardware. This view entails seeing the human not as a moral animal, but as a system of levers and hinges, centred around a multi-sensory information processing system, a brain. The task of human factors / ergonomics is to produce models of the human thus conceived that can allow technical systems to be designed that 'fit' the properties of the human 'machine'. In this view, the human is simply part of an overall system, the fleshy element alongside the metal and computational element in a socio-technical system. Such amalgams of human and machine are, of course, not unique to military settings, and can be found in all those domains where large, complex or hazardous machines are required – from manufacturing to mining, from traffic systems to warehousing.

The second view is commonplace in military organisations, but has nothing to do with hardware or technology. This

view has a natural affinity with the view of human factors and ergonomics but its concern (or purpose, if you prefer) is related to the task of making members of the military as 'machine-like' as possible. This concern is entirely about human matters, not technological. I am thinking here, of course, of the problem of how to make men (and women) into soldiers. Experts with this concern in military affairs are not the same as the experts who offer ergonomic or human factors insights. These experts don't really have a professional name either: they consist of staff at various levels and seniority. But whatever label they have or whatever status, what they do is produce *doctrine* – which I am using in a roundabout way as a label for the organisational rules and procedures designed to ensure that humans can become soldier-like (machine-like, in a phrase) so as to become effective military personnel. Over the years doctrine has naturally altered and evolved as the particular technological and social context of war-making has altered. Training a man to stand in rank while the enemy fires shots at them (say, in the Napoleonic wars) entails a different doctrine to situations where the people making war might not see each other, as in scenarios from the Cold War.

The way I have described these two very different views on the human should make it clear, I would hope, that humans are different and that they do different work. But it seems to me that a likely problem in the context we are thinking of has to do with the fact that they are *both* used to address the topic of digitising the battlefield. When they are so used, it is very likely that the point at which one of these views has reached its practical limits is often blurred with where the other view has its own limits, and the resulting mixing of the two boundaries can create confusion, confusion about what is a design matter for a socio-technical system perspective and what is a doctrine matter as I have defined it. One has to do with the human as a biological machine, the other as a moral agent; not the same at all.

An Example: from Keyboards to Warriors

One of the things that Storr's paper and Brigadier Bristow's response to it in the same issue makes clear is that it is probably unwise to illustrate any argument with examples from the military. There are simply too many interpretations possible in any particular case. So let me take a completely prosaic piece of technology and the associated views of the human used to deliver it, and show how those views cannot be used to answer all the questions that some uses of the *same* technology might pose.

A keyboard can be designed around a model of the human hand and its movements so as to produce an optimal person-machine interface. This interface does not require the user to see the keyboard itself (since the user does not look at the keys as he presses them) but only what the keyboard produces on screen. What matters in this design task are calculations of the optimum speed with which a human 'operator' can select and press keys. The speed with which fingers can move

is one dimension (i.e. up and down, the touch or pressing of a finger tip), the distance between keys is another (and hence the speed with which a hand can move across a keyboard). All these concerns can be modelled around the perfectly reasonable assumption that, from this perspective, the human is a machine. Measures of the human hand can be taken and population level norms identified, average speeds calculated, and keyboard designs devised and tested against these models.

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This is the view of the human from the tradition of human factors and ergonomics. This view can produce good keyboards. As it happens, this view would not lead to a Qwerty keyboard design, but something other. Qwerty keyboards were not designed to be optimal for the user but to be optimal for the machinery of a typewriter. For the purposes of this argument it doesn't matter what might be better than a Qwerty keyboard – though British forces are regularly confronted with US alternatives to the Qwerty with all the retraining that implies.

Be that as it may, if the well-designed keyboard allows the human to use his fingers to produce text quickly, no amount of modelling of the human *in this fashion* will ensure that the text that a keyboard produces is of good quality. That task, an ability to express concisely and pertinently, say, or persuasively and encouragingly, cannot be delivered through treating the human in machine-like terms. On the contrary, to understand how concision, pertinence, persuasion or encouragement can be delivered requires a different understanding, one that treats the human 'user' in another way. For here it is not the speed with which a text is produced that matters, it is the moral consequences of the text, the purposes of the text, that does. It is not a model of speeds and processing that is pertinent, but the intentions and goals of the human. Understanding this cannot be achieved through the calculus of a science like human factors. It requires a more philosophical approach, closer to the work of those who develop and manage *doctrine* than those who do the work of human factors.

The Production and Use of Information

I say this because I am trying to argue that there is a difference between the production of information and the use of information. The latter is always to be answered by querying what effect that information is expected to have on those to whom it is communicated – those who read it. In contrast, the

former is much more easily judged quantitatively – as in the performance of a machine.

This suggestion can hardly come as a surprise to those involved in digitising the battlefield. The problem, though, is that the way I have described the difference between production and use of information gives the impression that these two things are easily differentiated. In the case of the military setting, in the case of the battlefield, this may not be so. After all, one of the most commonly used words to describe and evoke the relationship between the battlefield and the production and use of information is *fog* – indeed, I think it was Clausewitz who first coined the phrase ‘the fog of war’ nearly two hundred years ago. The rub of my argument is not that this is unrecognised; of course it is. The argument, rather, is that the programme of digitising the battlefield turns not just on an expectation of more useable technology, but technology that, in being seamlessly linked and ubiquitous, somehow helps to clear the fog. It is not expected that the fog will disappear altogether, but it is thought that it will be reduced, even blown away in some places. In this view, digitising the battlefield means *seeing the battlefield*.

This is without doubt a laudable goal, and indeed I would be willing to accept that it is one that can be achieved to some degree. The doubts I have are related to where the boundaries of this fog might be pushed back to; how these boundaries might not be seen as the same from the different perspectives in question (what I have called for the sake of simplicity the human factors / ergonomics one and the military doctrine one); and whether these differences are likely to have (and are likely to lead to) continuing confusion as regards what technology might do, how it might be designed, and how it might be evaluated – in other words, to making judgements about how far the fog of war has been rolled back or whether it has been rolled back at all.

An Opaque Boundary

The trouble is, it seems to me, that something about the context of military affairs will make this boundary especially opaque. This is because, as I have remarked, it is the nature of the military institutions to view their human members as machine-like, even when they are not considering the design of machinery. It is the nature of warfare that instilling a machine-like capacity to perform is essential, otherwise the human operative resorts to what can only be described as the all-too-human reaction that one would expect when people are confronted with a chaos of organised murder and maiming. That is to say, soldiers will react with an all-encompassing fear. As all military historians will agree, an army is simply a mob waiting to break out, and it is only training, discipline and the adroit cultivation of doctrine that ensures that this doesn’t happen and the soldiers behave like machines. Yet this also means that when digitising of the battlefield is approached there is likely to be a confusion about which matters ought to be proceduralised, which made mechanical (and hence analogous to the typing tools mentioned above), and at what

point the individual soldier should be allowed to exercise his human mind more creatively (and hence be engaged in producing argument, the output of a typewriter).

Senior staff will want to ensure that all the ‘argument’ is theirs, for example, and that those in lower orders simply gather and relate information to them as if they were merely typewriters. And surely a great deal of information about the battlefield can be gathered and shared easily by junior staff acting as typewriters. But the term ‘fog of war’ is not meant to label a lack of information-gathering technology so much as to label the facts of war: chaos as I mentioned above, and the all-too-human orientations and reactions to it. In this regard, ‘argumentative’ interpretations are sometimes all that junior soldiers can produce whatever their commanders might desire and command; sometimes, too, argumentative (rhetorical?) ways of persuading those same junior soldiers to keep on soldiering despite the apparent fog is all that senior staff can do. It is all very well for commanders to think that digital technology will ensure that junior levels only produce information; it is altogether another thing for the humans involved to be able to deliver it.

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The Fourth Dimension

In other words, Storr’s paper and the responses to it highlight the fact that the question for digitising the battlefield is not simply one of mechanising all aspects of the battlefield, but knowing where this boundary might lie, the boundary between the human acting like a machine with a machine (a digital one) and the soldier acting like a human (disregarding the fact that he or she is using a digital machine). In military organisations, there is a desire to use technology – digital technology – to support the former and extend its scope, but this can come at the cost of neglecting the fact of the latter and what it means for system design, evaluation and use. It seems to me that this is the fourth dimension; this is the human factor in war. This has to be understood if the human is to be recognised and taken into account in programmes of digitisation. For it is not just a matter of making machines, it is also a matter of making men (and women) into warriors. ■

NOTES

¹ Dr Jim Storr, ‘The Failure of Digital Command and Information Systems’, *RUSI Defence Systems*, Volume 12 No 2, October 2009, page 28