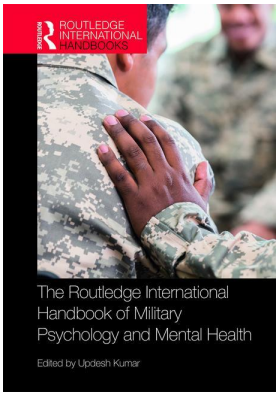

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MILITARY PSYCHOLOGY AND THE FOURTH INDUSTRIAL REVOLUTION

Implications for the South African National Defence Force's Directorate psychology

Petrus C. Bester

"The world we now inhabit is changing at a pace and in a manner that is unprecedented in human history. Revolutionary advances in technology are reshaping the way people work and live. They are transforming the way people relate to each other, the way societies function and the way they are governed" (Ramaphosa, 2019). These are the words of the South African president, Mr Cyril Ramaphosa, emphasising the importance of the Fourth Industrial Revolution (4IR) when announcing the appointment of a Presidential Commission on the 4IR to serve as a national overarching advisory mechanism on digital transformation. He warned that if it does not adapt to new technologies, South Africa faces the grim prospect of being rendered irrelevant and facing stagnation as a country (University of Johannesburg, 2019a).

Technology is correspondingly vital in war because Symonds, as cited in The Economist (2018), emphasises that although war is still a contest of wills, its character is changing because of geopolitical competition and technology. Military organisations profoundly rely on technology, and as one of the elements of state power and more particularly "hard power" (Nye, 2009), the South African National Defence Force (SANDF) needs to be aware of the importance of technology. The defence industries are usually among the early adopters of new technology, specifically in the aerospace, automotive and manufacturing industries (Lele, 2019; von Scheel, 2016). The way humans use this technology changes war, not the technology in itself (Tuck, 2019).

It can thus be postulated that both the SANDF and its opponents can benefit from new technologies emanating from the 4IR. Bester's (2016) definition of military psychology describes it as the application of research technology, principles and methods of psychology in the military environment to address challenges, which leads to improved behavioural capability of own forces and countering the potentially diminishing effects the opposing forces' activities might have on the human capabilities of own forces. This indicates that military psychology as a discipline would be able to provide support in dealing with the challenges and benefits emanating from the changed 4IR environment to ensure optimised human performance.

Therefore, this chapter aims to address a number of questions, of which the first is what exactly the 4IR is, how it will influence warfare in general and more specifically the SANDF, how the 4IR will affect the SANDF's Directorate Psychology and, lastly, how it should respond. This discussion is based on the assumption that the SANDF will reach a point in future where it cannot be successful without responding to the 4IR by embracing and participating in it.

Contextualising military psychology in the South African National Defence Force

As mentioned in the introduction, the SANDF is a manifestation of South Africa's hard power. It consists of various services and divisions, of which four are noteworthy, namely the South African Army (SA Army), South African Navy (SAN), South African Air Force (SAAF) and the South African Military Health Service (SAMHS). The SAMHS delivers military healthcare to all services and divisions within the SANDF, including a military psychological service.

The embodiment of this military psychological service can be found in the SAMHS's Directorate Psychology, which ensures the application of military psychological principles and practices in the culturally diverse military community to ensure the operational effectiveness of the SANDF's various user systems in terms of physical and mental combat readiness. In a discussion document compiled by the SANDF's Deputy Surgeon General, it is postulated that in future the main purpose of Military Health Psychological Services will be: "… *mental and cognitive superiority over our opponents* …" (Ndhlovu, 2019, p. 19).

The Director Psychology's draft statement of intent for 2019–2024 (Burgess, 2018) emphasises that the Director Psychology (and his directorate) is responsible for providing the strategic direction and policy required for the governing of a comprehensive military psychological service, for the management of the pool of military psychologists and for exercising functional control over all processes and services regarding psychology in the Department of Defence (DOD). The vision of the military psychological service is "*A psychologically healthy and effective military organisation*" and the mission is "*To support the SANDF by providing a quality psychological service for the full range of military deployments and to sustain and promote the health and mental functioning of the organisation, members of the armed forces, their families and others eligible for care by the SAMHS*" (Burgess, 2018, p. 8). Hence, it implies ensuring mental and cognitive superiority over the SANDF's opponents in the present state and/or a future state characterised by the 4IR.

The services centralised under the SAMHS' Directorate Psychology include *inter alia* a clinical service and specialised operational military psychological service for deployed soldiers, as well as psychological assessment related to human resources (HR) for selection and placements, organisational development, development and learning leadership assessment and finally general psychological research. These services manifest themselves in several programmes focusing on force health protection and force health support (Burgess, 2018). These programmes are: primary psychological care; tertiary psychological care (including neuropsychological assessment; inpatient and outpatient support to hospital departments and patients and specialised clinics); aviation psychology (for the SAAF); maritime psychology (for the SAN); special forces and parachute specialised contingency services; selection and separation assessments; development and learning assessment and training; organisational development; behavioural research and development; operational psychology/human factor combat readiness services; Defence Intelligence psychology; hostage and escape evasion and survival psychology and a number of accredited internship programmes for industrial, clinical, research and counselling psychology. With the positioning of military psychology and the services it presents within the SANDF as background, the next step is to gain understanding of what the 4IR is.

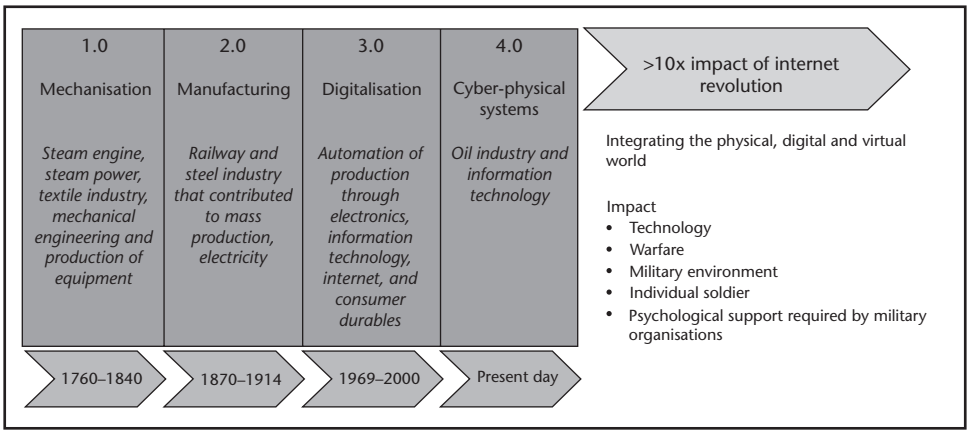

Figure 6.1 The four industrial revolutions.

Source: Adapted from Society for Industrial and Organisational Psychology [SIOPSA], 2019.

Fourth industrial revolution defined

The term "Industry 4.0" was first coined in 2011 at the Hanover Fair, Germany (Lele, 2019), signifying that an industrial revolution[1] is about the beginning of a new industrial age. The Society for Industrial and Organisational Psychology in South Africa (SIOPSA, 2019), Lele (2019) and von Scheel (2016) broadly demarcate the different revolutions as the *first*, driven by mechanisation made possible by the steam engine, steam power, the textile industry, mechanical engineering and production of equipment from about 1760 to 1840; the *second***,** made possible by electricity and the railway and steel industries, with production lines that enabled mass production (manufacturing) from 1870–1914; the *third*, which made use of electronics and information technology to automate production (digitalisation) from 1969–2000, and lastly the 4IR, enabled by the oil industry and information technology that developed machines that are more human-like (cyber-physical systems) from about 2000. Campbell (2017), Lele (2019) and African Daily Voice (2019) refer to the last mentioned as a digital revolution, but Mostert (2019) observes that it is rather seen as a variation of the 3IR. For the purpose of this discussion, the four revolutions are categorised as mechanisation, manufacturing, digitalisation and a cyber-physical system. As illustrated in Figure 6.1, there is thus general acceptance in the literature that the 1IR was characterised by steam and water, the 2IR by electricity being used for mass production, the 3IR by internet and communication technologies and adoption of major digitalisation processes and the 4IR as the integration of man and machine, hence the cyber-physical system. According to the SIOPSA (2019) the 4IR is likely to have ten times the impact of the internet revolution (digitalisation) and will consequently have an impact on technology, warfare, the military environment, the individual soldier and the psychological support required by military organisations.

The 4IR, referred to as cyber-physical systems, is essentially a very interesting phase in integrating the digital, physical and virtual worlds (Lele, 2019; von Scheel, 2016). An overview of 4IR literature (Campbell, 2017; Lele, 2019; von Scheel, 2016) identifies the following as the

1 Revolution implies change of great magnitude.

core elements or domains of the 4IR: robotics (man-to-machine, machine-to-man, machine-to-machine), mobile connectivity, bioinformatics, nanotechnology, mass customisation, advanced connectivity, internet of things, autonomous vehicles, cybersecurity, neurotechnology, genetic engineering, wearable technology, blockchain software, cloud services, quantum computing, 3D printing (additive manufacturing), energy storage, advanced material, sensoring, artificial intelligence (AI) and big data 2.0. In many instances it is not so much about developing new technologies, but about continually finding new ways of using existing technologies.

One of the areas in which fundamental change is occurring is that of speed, with interconnectedness dominating (University of Johannesburg, 2019b). It implies, for example, that AI will replace the notion that computers will only react to human instructions; they will start to make their own decisions (Mostert, 2019). Consequently, the differentiation between the real and technological or virtual worlds becomes diffuse and blurred, as alluded to above.

In the military environment, it implies that the distinction between humans and machines will become more diffuse and soldiers and "things" (such as weapons and combat systems) will connect at any time or in any place for any need, whether written or verbal communication, data, information, intelligence, satellite navigation systems or neurobiological monitoring systems. Therefore, the next section will address the 4IR's impact on warfare, with specific reference to the SANDF. Thomas (2019) emphasises that by forecasting the shape of future wars, one can determine the capabilities a military, like the SANDF, requires to impede its opponents and what issues to include in budget requests.

4IR and future warfare

The conduct of war is a continuously evolving phenomenon (Andresky & Henderson, 2018; Del Monte, 2018; Hughes, 2018; Kamieński, 2017; Lele, 2019; Miller, 2019; O'Hanlon, 2018; The Economist, 2018; Thomas, 2019) and is often assumed to be a particularly technological human enterprise (Tuck, 2019). Also, *The Economist* (2018) observes that combat speed will be so high that humans will not be able to keep up. It is therefore no surprise that Christian Brose, the former staff director of the United States Senate Armed Forces Committee, refers to the coming changes in warfare as a "revolution in military affairs" (Miller, 2019). Consequently, new technologies such as AI, machine learning and big data will be some of the driving forces influencing future military operations. Military forces will operate in complex environments against peer competitors across all domains (cognitive, land, air, outer space, maritime and cyberspace), the electromagnetic spectrum, and the information environment (Andresky & Henderson, 2018; Thomas, 2019) where own forces and/or their opponents are likely to be roboticised units (Del Monte, 2018) or a mixture of humans and robots. Human factors such as will, fear, decision-making and even human brilliance may become less evident (The Economist, 2018).

One can consequently, contrary to what one is used to, expect fewer humans and more (swarms of) machines as part of a larger-scale heterogeneous force delivering a greater volume and higher velocity of firepower than ever before on the battlefield. There is also going to be biotechnological integration of man and machine (Kamieński, 2017), where bio-enhancement and eksoskeletons (Gutsche, 2018) will enable soldiers to perform super-human tasks, such as lifting very heavy objects or to see at night and/or over long distances.

The view of fewer humans is supported by Mostert (2019), who observes that not only will fewer humans be required, but they will also be excluded from various interactions between machines. For example, a situation may occur where self-driving or automated tanks will challenge each other on the battlefield without any soldiers physically opposing one another.

Even the maintenance of this equipment will be done by robots with sophisticated diagnostic tools, which can exchange information on solving mechanical problems through robotics and autonomous systems. Militaries are thus likely to increase the use of digital technologies such as big data, cloud computing, mobile devices and social networking on an organisational level.

This automation through AI has its advantages, as AFRIBLOG (2019) postulates that certain life-threatening jobs, such as dealing with bombs and terrorist threats, will be performed by robots. This will minimise the loss of life or human casualties should the check-point be attacked by, for example, a suicide bomber. Guards can be replaced by efficient remote monitoring and access control systems. The same type of technology can also be used by military health personnel who have to deal with patients infected with deadly diseases, such as Ebola haemorrhagic fever. These systems will by themselves, or by merging humans and systems, ensure interoperability, decentralisation, analysis in real time, flexible services, high transmission speeds and rapid reactions. According to Thomas (2019), the main goal will be speed, synchronisation, concurrency and overwhelming all-over superiority, while relying in real time on computers, telecommunications and satellite communications. Therefore, Gareyev, cited in Thomas (2019), postulates a high level of dynamism and manoeuvrability along non-coherent fronts.

In support of the above, Del Monte (2018) emphasises the use of AI, automated weapon systems and what he refers to as genius weapons, where the decision to act and kill will be made by a machine without the interference of man. These machines will depend on data, information and intelligence that will form part of a "global brain" from which a military user system can get information, for example, on weather conditions on the battlefield. Such autonomous systems will be able to independently compose and select among different courses of action to accomplish objectives based on their knowledge of the situation, themselves and world (The Economist, 2018). Campbell (2017) and von Scheel (2016) conclude that 4IR technology will be a game-changer, bringing about significant improvement in operational efficiency, productivity, analysis and system integration.

From the above, one can thus conclude that military user systems such as anti-aircraft, unmanned aerial vehicles (UAVs), artillery and anti-tank weapons will be a network of people, data and machines. Moreover, these will continuously collect data, display it to the operator (soldier) either before or after processing it through advanced analytics into real-time intelligence to provide actionable information that allows predictive analysis for the operator to make more accurate decisions, accompanied by improved maintenance and operational processes. In some instances, there will be no operator and the machine will do everything.

These higher levels of automation, greater speed and accuracy that characterise the 4IR will, singularly or jointly, offer various options to improve a force's operational readiness (Lele, 2019). Consequently, this kind of warfare will be propagated because it is economical in that decisions can be made at a higher speed, it reduces cost and personnel, dependence on communication, human error and fatigue, and it minimises human losses. Del Monte (2018) even claims, for example, that killer robots can respect international humanitarian laws better than humans.

As implied above, the 4IR will have a significant impact on the cyber domain and consequently on information warfare. *The Economist* (2018) states that cyber warfare will become a contest between algorithms. Disinformation, for example, can affect societies in general and more specifically those where reliable information is in short supply. An aggressor can rely on loosely defined networks of pro-aggressor actors using traditional and social media to influence opinions both at home and abroad (Robinson, 2018). Advanced technologies, such as bots and cyborgs enhanced with deep fake technology, result in a proliferation of sources spreading false information that seems authentic and is difficult to verify. Thomas (2019, p. 90) identified the concept of "behavioural wars," which refers to: "*manipulating behavior* [sic] *algorithms, habits, activity stereotypes etc, that have been installed in us by our social group, and also by our biographies and*

cultural environment." It will consequently have a noteworthy impact on cybersecurity and the authentication of information used in psychological operations against own forces, which in turn can be countered by technology emanating from the 4IR. Hence the contest between algorithms.

Future warfare will thus be characterised by a high operational tempo where war is conducted at any time by night or day, at breathtaking speed, non-stop, mostly by machines, although man-machine integration will become the norm, and usually beyond the biological limitations of the mind and body of humans.

South Africa's current economic situation requires the SANDF to function with a greatly reduced budget (Kings, 2019), and it is very unlikely that it will right away reap the benefits that the 4IR can provide to the military. Conversely, the contextual application of the SANDF is the African battle space (ABS) that is described as the "*environment in which the South African soldier would increasingly be placed in asymmetric situations against opponents who are not easily identifiable, are probably better armed and equipped and have access to better communications and technology*" (Bester & O'Neil, In press). This compels the SANDF to acquire more advanced technology and equipment to maintain a competitive edge over its adversaries, despite financial constraints. It is thus expected that this will happen, although not at the pace seen in more advanced economies such as the United States and China. This supports the view of Lele (2019), who states that the manufacturing of defence equipment is usually a technologically advanced and innovation-driven system and takes time for a state to implement.

Mostert (2019), however, refers to a maxim among futurists that the future is already here, but it is not yet equally distributed. One can thus expect that although the SANDF is already in the 4IR, it will not change overnight into an "SANDF 4.0",[2] although nothing prevents a state from importing technologies once they exist while still developing its own capabilities to become self-reliant. The technology will thus have to be "equally distributed". The 4IR is a reality with which the SANDF will have to deal, sooner rather than later. Thus, when adding the military applications of 4IR technology to the ABS, one can postulate that it will have a significant influence on the South African soldier and his or her workplace.

The impact of the 4IR on the soldier and his or her workplace

The 4IR will be a "game-changer" in the conduct of war and it can thus be hypothesised that the SANDF will be affected in three domains, namely military hardware (weapons), its organisational structures (architecture of the organisation) and what Uzzell, cited in Campbell (2017), refers to as the "human footprint".

Although initially the 4IR will not immediately influence South African soldiers, as it takes time for new technology to be integrated into the military, one can expect that they might first come across such technologies and especially military hardware on the battlefield, whether in conventional warfare or during asymmetric conflict.

When referring to the impact on organisational structures, one can foresee that existing "hard" hierarchical structures are likely to be replaced by more "soft" and less hierarchical or hybrid organisational structures, the requirement of new competencies, an integration of different workplaces across international borders, virtual workers, complex matrix structures, open work hours and agility in the workplace (Mostert, 2019; Visser, 2019). Therefore, one must start to anticipate the challenges and opportunities that arise from using such technologies in new structures, with specific reference to the impact on the soldier.

2 "SANDF 4.0" suggests a fully functional military force based on the technologies of the 4IR.

Kamieński (2017, p. 205) emphasises the impact on the human footprint when he refers to the growing pressure on soldiers who will be the "weakest element" on the battlefield, where war will be fought at a murderous operational tempo. This suggests not only focusing on kinetic matters, but also on the behavioural sciences. This requires changes in the workforce, whether through interventions such as training, development, socialisation in a 4IR society or through recruitment and selection of a new kind of soldier for future wars. These soldiers will be required to function on the edge of human capability with greater stamina, improved alertness and cognitive skills and the proficiency to function in an environment where their own abilities are enhanced through fused man-machine interfaces (Kamieński, 2017).

Military psychology consequently has a role to play in all these three domains, whether considered individually or in combination. It is thus clear that the pace and scale of technological change in the 4IR has a significant impact on humankind in general and more specifically military personnel. Burgess (2018) emphasises the importance of human beings by indicating that despite tremendous growth in military technology and doctrine, individual human beings remain the main resource of the SANDF. He emphasises the importance of military psychology when he states that new combat and support systems still have a human interface and the right (healthy and competent) man or woman will be required for the job.

4IR and military psychology

Annen, Nakkas and Gehring (2017) and Bester (2016) identify several tasks or activities in which military psychologists are usually involved when dealing with the "human footprint" in military organisations such as the SANDF. The next part contextualises some of those military psychology-related activities in the 4IR.

The 4IR will affect *recruitment and selection* criteria for SANDF soldiers to successfully participate in future wars. The SANDF HR division for which the military psychologists work must review current recruitment and selection criteria to obtain the best talent for its future needs. Information on competencies identified during job analysis on future posts need to be fed back to this division, which is responsible for the recruitment and appointment of future soldiers. In this way, the new competencies can be used to search for the right talent.

Subject matter knowledge is not enough to thrive, and Kriel (2018) emphasises that those hiring should look beyond education received from a traditional university. Practitioners should search for candidates who are prepared for the future world of work (4IR-related) and who can apply knowledge practically in a creative way. This also emphasises the important role of the Faculty of Military Science at the South African Military Academy of the University of Stellenbosch in bridging the gap between theory and practice when educating the SANDF's future leaders. Military psychologists will thus play a vital role in *competency design* and the training of SANDF personnel to enable them to do targeted recruitment, to manage and establish selection boards for efficiently identifying the best candidates with veracious competencies for the future.

Moreover, the Directorate Psychology should explore the use of 4IR technology in its processes, such as selection, training and diagnosis of *mental health-related matters*, especially when testing for mental health fitness. Within the next 20 years, technology such as AI will no longer be an isolated industry, but will be integrated into all facets of life (Zhou, in AFRIBLOG, 2019). AI has machine learning as a subsystem, in which machines teach themselves to solve problems (AFRIBLOG, 2019). In this way, algorithms can be compiled that make more accurate diagnoses of psychopathology than a psychologist could do. Phillips (2019) refers to recent research at the New York University School of Medicine that created an algorithm which, through

analysing patient interviews, sorts through tens of thousands of variables in their speech that are imperceptible to the human ear to identify audio markers of post-traumatic stress disorder (PTSD) to make an accurate diagnosis. This type of technology is costly to develop, but will cut costs through early identification of the disorder, excluding practitioner bias in shaping diagnosis, thus yielding more accurate diagnosis, as disorders such as insomnia and anxiety share many symptoms with PTSD, and making it possible to reject false claims for compensation based on PTSD. This can be done by an application on a device such as a smart phone. Furthermore, Kott (2018) emphasises that future resilience training should include dealing with adverse situations due to technological surprise in warfare when confronted with a weapon system that was not expected.

Rosenbaum (2019) states that AI employed by IBM is 95% accurate in predicting which employees will leave a job by using its "predictive attrition program". Information obtained can be used to predict better who is likely to be successful in a particular job and who is not. This kind of information can be used to retain employees. Military psychologists are also likely to deal with people's fear that AI may cause them to lose their jobs (AFRIBLOG, 2019). INVESTEC (2019), however, emphasises that technology replacing jobs is nothing new, but based on history, technology has the power to create as much work as it displaces, though Mostert (2019), postulates that there will be job losses. Military psychologists are already facing *new kinds of psychopathology,* such as internet addiction and remotely acquired post-traumatic disorder related to the use of technologies making it possible to kill people in a foreign country over a long distance by an operator manning remotely controlled weapon systems in his or her home country.

SANDF soldiers use mobile devices to communicate, access the internet for shopping, read the news, participate in various forums, complete surveys and fill in tax returns. Consequently, a wide range of varied activities have excellent potential for various types of data to be collected. This creates an opportunity for military research psychologists to do *psychological research* on various matters, in huge volumes that was impossible or very difficult to research in the past. Consequently, owing to the vast scale and scope, more complete, in-depth and updated studies can be done of various phenomena. In addition, Pinter, Toninelli and de Pedraza (2015), point out that in human daily activity, data are constantly flowing through satellites, cameras, sensors, radio frequencies, cars, private appliances, tablets, mobile phones and the like. Smart watches that can monitor various psychophysiological activities of humans, such as sweat and heart rate, can be included in this list. Furthermore, more advanced software enables data collection through these devices that can keep a record of human behaviour in its various facets. This will have an impact on the way in which informed consent is obtained, as research has the potential to be very intrusive in the private lives of individual soldiers.

Aside from the *ethical issues* arising in the psychological research domain and opinions on whether machines must exclude humans from decision-making, the human will still be affected. Emotional strain will be placed on soldiers, especially in cases with humans in the decision-making loop of weapons with much more destructive and remote killing capabilities – even across different continents (The Economist, 2018). Consequently, military psychologists need to anticipate and identify future stressors that require new ethical considerations.

Klaus Schwabb (in World Economic Forum, 2018) emphasises that individual workers will have to engage in lifelong learning to remain employable. Companies should thus focus on reskilling and upskilling strategies for selected talent in new appointments and job transitions. Therefore, most, if not all, soldiers will have to be retrained (Rosenbaum, 2019), which suggests another important role for the South African Military Academy. This training may include more training on simulators, coaching for cognitive superiority where commanders make better decisions, and hardiness or mental toughness training that makes soldiers more resistant to

stress and trauma (Bar-Gil, 2018). Furthermore, where training or retraining is required, new technologies can also be used, thus having a significant influence on *development and learning*. The SIOPSA (2019) postulates that the 4IR could introduce much development and creativity in the areas of learning and development. Therefore, military commanders must link learning and development with the military strategy of the SANDF, which must also be aligned with the 4IR. Development and learning will assist soldiers to adapt their existing behaviour, and these new behaviours will assist the SANDF to achieve excellence during deployments.

The SIOPSA (2019) reports that a 2018 survey by the international company, Deloitte, found that the so-called "soft skills" will become a critical future priority and 80% of the respondents indicated that the so-called Generation Z[3] is increasingly "tech savvy"[4] but may lack the soft skills required in the digital world. Although the study was conducted in the private sector, one can expect that the same can be said for the military, as the military is usually a representation of the broader community. Furthermore, it was found that learner development remained a key retention tool for employees, but it needs to be more learner-centric than content-centric. One of the matters raised about learning is what is referred to as "learning on demand" (SIOPSA, 2019), which implies that it is difficult to make time for training and it will thus be important to take the learning to where the soldiers are. Gutche (quoted by AFRIBLOG, 2019) emphasises the use of augmented reality in training, where various scenarios can be role-played as if they are actually being experienced. Prospective military leaders can be placed in scenarios where real-life-like decision-making would be required, which can be assessed in real time, thus enhancing training to prepare more realistically for war.

From a behavioural sciences perspective, the military psychologists of the SANDF's Directorate Psychology will be best equipped to facilitate the *changed approach to learning*. They will also have to identify opportunities for learning, education and development that will make the transition to the digital environment easier. The Chinese entrepreneur Jack Ma made the following statement at the World Economic Forum: "*If we do not change the way we teach, thirty years later we will be in trouble*" (2018). He furthermore stated that people must move away from knowledge-based teaching and teach their children something unique to ensure that machines can never catch up with them.

Consequently, the SANDF will have to plan, implement, embed and evaluate change interventions, which is addressed under the discipline of *change management* (Busby, 2017). In many instances one can expect that machines will take over the functions that humans used to do. Military psychologists will facilitate the emotional impact on humans where the physical, mental and cyber domains start to overlap and interact. As mentioned above, there will always be the fear that machines will take over their functions and duties, as machines can be more creative. Although machines lack social interaction skills, they are likely to fare better in activities that require physical dexterity and mobility (Mostert, 2019; SIOPSA, 2019). Considering Ma's (2018) warning above, humans will consequently have to develop what Mostert (2019) refers to as agile competencies in areas such as continuous learning, and to focus on not acting like computers but rather nurture and develop specific human skills, such as imaginativeness, creativity, the ability to make connections that cannot otherwise be made (systems thinking) and the general ability to think about the future (anticipation) that makes them competitive to machines.

The SANDF 4.0 will require a new approach to the *career management* of its HR. Mostert (2019) emphasises that workers have significantly different expectations in the workplace because of the lack of stability and predictability due to the dynamic nature and the speed at which change occurs

3 People born from the mid-1990s to the early 2000s.

4 Well-informed about the skilful use of modern technology.

in the 4IR. The psychological contract between a soldier and the SANDF will also take on another form and in some cases it will need to be renegotiated. Military psychologists will thus have to anticipate and plan for dealing with the new challenges and processes mentioned above and will in most cases drive change management in the SANDF or at least provide advice on the matter.

Change management also deals with *changes in organisational culture* and especially with changes in structure towards a matrix or hybrid organisational structure with remote or virtual workers, workplaces across international borders, flexible working hours and a constantly changing work environment. With the introduction of virtual workers with flexible work hours, roll call may be done online, where employees log on to a computer and their work is electronically or digitally monitored. An HR practitioner may, for example, work from home, doing leave administration that is submitted electronically with customised software. There might also be new ways of establishing work teams, although some areas in the military will be more flexible than others. More agility and flexibility will be required from workers, involving less bureaucratic red tape, but more digitally monitored outcome-based performance assessments. This will have a psychosocial impact on virtual or remote workers who must deal with loneliness when they are unable to interact personally with their co-workers.

The changed work environment is likely to cause changes in the *physical work space* of soldiers that will require new thinking and advice on design thinking for work flow and work processes. In this regard, knowledge of ergonomics will be essential. Military psychologists will thus not focus on the human only, but also on the design of the environment in which the soldier functions.

The 4IR and its changing environment, sophisticated technology, information accessibility and cultural challenges will complicate the challenges facing future leaders (Cooper, 2009). Thus, when considering that Seiler and Pfister (quoted by Annen, Seiler & Jonas, 2010) explained leadership behaviour in terms of complex interaction between individual factors, group processes, organisational factors, context variables and situational factors, it is clear that there is a requirement for a fresh look at leadership at the tactical, operational and strategic level of the SANDF. This consequently requires renewed focus on *leadership development and assessment,* such as adaptability, agility and self-awareness, as well as critical and creative thinking, to name a few (Cooper, 2009; Mostert, 2019). Cooper (2009) suggests creating early opportunities to gain experience, professional education at an in-residence service college (such as the South African Military Academy and the various Service Schools), and an approach of life-long learning. This includes the competencies of imaginativeness, creativity, systems thinking and anticipation that make people different from machines, as stated above. Military psychology will thus play a vital role in equipping and preparing future military leaders to meet future challenges.

It is also likely that military psychologists will be required to assist with the management of *new threats in the information warfare domain*. Recent research by the British Broadcasting Cooperation refers to "deep fake technology" that uses machine learning and AI to create, for example, convincing videos representing events that never happened (Robinson, 2018). In this regard military psychologists can play a role in assisting computer engineers from the Council for Scientific and Industrial Research with the development of machine learning to help recognise and counter manipulated information, especially that coming through the media.

New 4IR-related technologies can also assist with *monitoring* and *evaluation*. The Directorate Psychology can seize the opportunity to monitor and evaluate in real time some of the services provided. These can include both health- and non-health-related interventions. It can be used to optimise service delivery and to ensure that services are delivered in the most efficient and cost-effective manner possible.

All of the above will lead to *requirements for a new policy and regulatory framework* within the DOD in general and more specifically the Directorate Psychology. All the above changes

enforced by the 4IR will create several policy challenges. In this regard military psychology is likely to become a significant role-player in providing policy advice, developing policy and regulatory frameworks for new user systems that will be implemented.

Conclusion and recommendations

The 4IR with its integrated cyber-physical systems is a reality, and future warfare will be radically different in terms of speed, duration, intensity and human involvement. The SANDF must come to terms with the accompanying internal dynamics and physical changes and optimise its forces within the allocated budget. Both the SANDF and the Directorate Psychology need to ride the coming wave of cutting-edge technology with its vast potential and vast risks. Technology and physical advances are, however, not the only means to improve the force, as it requires highly trained and effective soldiers with different skills and competencies to take advantage of technology. Military psychology as a discipline is ideally equipped to work both with and against technology to develop optimally functioning soldiers for an efficient and capable future force.

In some instances, military psychology will retain its "traditional" roles, but it must look at these roles in new ways and adopt new roles after reorienting itself in terms of the development and internal dynamics of the SANDF, looking at the future and focusing on force design, force development, force support and force deployment (operations) as field practitioners. In addition to the recommendations cited above, the recommendations below are suggested for the Directorate Psychology. Implementation will ensure delivery of the best quality and a highly responsive military psychological service to the 4IR military community. In the process, military psychologists will work side by side with engineers and physical scientists to advance soldier and system performance.

First, military psychologists need to understand what future wars require from humans and the impact these will have on them to gain insight into future human behaviour in the military. Moreover, knowledge of the new generations entering the military from society (generations X and Y, millennials and others) is essential to prepare the organisation for them. In this way those responsible will know what to recruit and select for. Consequently, new ways of recruitment and selection should be explored, with the possibility of migrating from a more hierarchical structure to a more matrix-like organisation when considering the notion of virtual workers, flexible working hours and organisational culture change.

Second, since postulating future configurations of technology and humans, military psychologists should not only react to technology, but should also utilise it. These new technologies can be integrated into their current and future service delivery processes, such as training on demand, online assessments and diagnosis supported by technology. Considering the skills required, as well as the complexity and cost of developing new technologies, the Directorate Psychology should consider public-private partnerships for developing technology that has both military and commercial benefit.

Third, new research possibilities can be explored and the collection of formerly unknown structures of data will give new insight into human behaviour. It is essential for the current way in which informed consent for research is obtained to change, as there is potential for more intrusion into the privacy of soldiers. Research areas should include competencies for future posts and ergonomic design to integrate humans with new technologies. Military psychologists involved in leadership development should also determine future leadership requirements.

Fourth, in addition to private-public partnerships, the Directorate Psychology should also involve stakeholders from academia as an integrated and comprehensive way to respond to the challenges and opportunities emanating from the 4IR. These role-players can contribute

significantly to policy formulation. Fifth, the Directorate Psychology needs to develop more responsive governance by identifying and recommending policies, strategies and plans that will position it as an irreplaceable role player in supporting the broader SANDF to position itself as a competitive military force in fulfilling its obligations at national, regional and continental level. These must include state-of-the-art psychological support for all aspects of missions.

Sixth, besides these governance issues, the Directorate Psychology also has to provide strategic direction and guidance to subordinate psychologists in providing a comprehensive military psychological service in the context of the 4IR. Moreover, informing the various role-players on the SAMHS's Futures Forum[5] on the 4IR will stimulate them to seek creative solutions. Lastly, it is worth noting that the military psychologists of today need to become the experts of tomorrow if they want to make a difference in the future SANDF.

Note: This is an academic document and contains facts and opinions that the author alone considered appropriate and correct for the subject. It does not necessarily reflect the official policy or the opinion of the South African Government or Department of Defence and Military Veterans.

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