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TRENDS

The international magazine on Arab affairs

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How def tech can benefit the world

SOLDIERS OF TOMORROW

HOW TECHNOLOGY IS SHAPING THE FUTURE OF WARFARE

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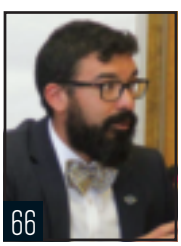

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E-mail: businesspr@mediaquestcorp.com

Consulting Editor:
Nathalie Bontems
nathalie@mediaquestcorp.com
Business Editor:
Anup Samuel Oommen
a.oommen@mediaquestcorp.com
Deputy Creative Director:
Jean-Christophe Nys

ADVERTISING
Commercial Director:
Khalil Tabbara
k.tabbara@mediaquestcorp.com
+(971) 50 5566988

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Europe: 27-29 rue Raffet – 75016 Paris, France
Tel: +33 1 40 50 54 16 – Fax: +33 1 40 50 54 54
GCC: Dubai Media City, Zee Tower
Office 206, Dubai, U.A.E.
Tel: +971 4 369 7573– Fax: +971 4 390 8737
Lebanon: Dekwaneh, Fouad Chehab boulevard,
Afrah Plaza Center, 7th Floor, Beirut, Lebanon
Tel: +961 1 49 28 01/2/3 – Fax: +961 1 492 801

Founder: Yasser Hawari
CEO: Alexandre Hawari
General Manager - Business: Victor Kiriakos
Head of Finance and Accounting: Girish Kumar
Distribution & Circulation Coordinator: Jyne Del Castillo
circulation@mediaquestcorp.com
VP Operational Lebanon: Aziz Kamel
aziz@mediaquestcorp.com, Tel: +961 81 238 263
KSA GM: Yehya Mokhalati
yehya@mediaquestcorp.com, Tel: +966 50 1951342
North Africa GM: Manuel Dias
dias@arabies.com, Tel: +33 1 4766 46 00

www.mediaquestcorp.com

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Neuroscience and Warfare

As the world looks to weaponize neuroscience and make human brains a target, Moran Cerf, Professor of Neuroscience and Business at the Kellogg School of Management, offers a word of caution.

By Anup Oommen, Dubai

How has neuroscience begun to shape the future of warfare?
The next era is going to be the era of neuroscience. Most of the technologies that are currently dominant come from neuroscience. Artificial intelligence, machine learning and computer vision – all of these things come from our understanding of the brain. In order to try and simulate the intelligence of the brain, we need to first understand the brain. These technologies are governing the world right now. Also, these are the real threats for the future. While a lot of politicians around the world are talking about the threat of immigrants taking over jobs, the reality is that in the near future, intelligent machines rather than people will threaten jobs – even the jobs of soldiers and defense players.

Historically, every time humanity came up with the possibility of a weapon, it was used to do harm in the world before the world got better. Whether it is guns, or increased firepower, or nuclear weapons, they were first used to do something terrible before they became deterrents. The same is true with neuroscience and the possibilities it brings.

How will neuroscience enhance current defense capabilities?

Right now, we think about the brain as an isolated entity. But with neuroscience, we can start thinking about it as a tool for sharing thoughts. The possibilities this brings about are fascinating. For instance, I can send a mouse into the enemy zone, which can scamper around without being detected or caught, and therefore, learn the map of the enemy location. When the mouse is called back, the map can be 'downloaded' from the mouse's brain. So now, you have a human who can actually learn the maze as if they were actually there, and already 'know' the entire map of the location.

Many of these things are already happening: we know how to take a thought and move devices based on it, for example. But it has not yet been done in a way that can make it viable in the field. So, we know that it is possible but it will take time before it comes into being.

What is the direct impact of neuroscience on soldiers?

In the future, soldiers will not need to go into the battlefield, as they will have proxies fighting their wars. Already, we have drones that are controlled by soldiers remotely. And this will only become more seamless with sensors feeding the content that the drone experiences directly to you.

We know more about sensations and sensors than we ever have. Right now, your arms and your legs are connected to your brain directly and behave and move accordingly. However, in theory, even if your arms are not connected to your body, you can send the signal that feeds into your arms from far away, as long as there is connectivity between the neurons in your hands and your brain wirelessly. The arms will still be able to do whatever the brain wants it to, even though they are not physically connected.

Similarly, we can imagine connecting drones to the brain. You see what the drone sees; you feel the temperature that the drone feels; you think about moving left, and the drone moves left. If you merely think, the drone can strike a target.

"The battlefields of the future will involve attacking the brain itself. If there is any information in the brain, we can extract that. There are no more secrets."

This can give rise to the ultimate sensing 'avatar' – a robot proxy of a soldier – that goes to the battlefield. The soldier at the armed forces base will share all of the same visual and sensory experiences in real time. Soldiers will be able to see through the eyes of the 'avatar;' they will be able to feel the temperature and every other sensory experience. In this way, soldiers will be able to 'fight' through their proxies on the battlefield, but no humans will be harmed.

The negative impact of fighting wars through proxies is that this could lower empathy among soldiers. It is easier to launch a bomb or attack an enemy as a proxy than if you actually have to do it yourself or see the pain you inflict. When we move from facing the enemy in reality to pressing a button to do the same, it causes soldiers to be less empathetic.

Is the brain becoming a target?

The battlefields of the future will involve attacking the brain itself. For instance, if an enemy with certain critical information or intelligence is captured, the traditional way of extracting information out of such a person is to make a deal or torture them. While this works on some individuals, it may not work on others. Some people spill their secrets while others take it to their graves, irrespective of what methods are used. The best that can be done is to ▶

"Imagine connecting drones to the brain. You see what the drone sees; think about moving, and the drone moves. If you merely think, the drone can strike."

somehow convince these people to share their secrets.

Neuroscience changes this completely. With neuroscience, I do not have to try convincing anyone anymore. I know where to access that information in their brain. I can get into their brains and extract the information I need without them doing or saying anything.

This also means that the rules of engagement may be revisited. Maybe humans would not be privy to sensitive information at all, or maybe saving a 'robot' with information will be so critical that government will be willing to risk human life for it – think *Saving Private Ryan*, but where private Ryan is a robot.

There are two ways to look at this. Firstly, if there is any information in your brain, we can extract that. So, there are no more secrets. If any soldier has information, that is potentially available to anyone who captures him. Secondly, there is the possibility to change the information inside your head. The reasons that soldiers fight a war for Side A instead of Side B is because in those soldiers' brains are memories and a history causing an allegiance to a particular side. But if I can hack into their brains, I can just reverse that to change sides.

That is why, I think, there is a move to attack either remotely or autonomously without humans in the battlefield. Instead, we are sending machines as proxies; we attack virtually through cyber-wars, etc. This is partially because it is possible to inflict more damage with a machine than with a human, and partially because humans are very vulnerable and, therefore, the least useful in war.

How are the rules of engagement changing?

Over the past few centuries, the rules of engagement in conflict have incorporated the notion of proportionality that required military action to be a proportional response to a given threat. For instance, if you bring tanks to the battlefield, then I can bring tanks to the

battlefield too. There is the notion of 'proportional response'. It is unacceptable for me to throw a nuclear bomb if you come with tanks and guns. It is an unspoken rule that soldiers must have a proportional response to an attack.

However, when it comes to cyber-attacks, there are no clear rules of engagement yet. For instance, if a person hacks into a server and deletes some files, is it justified to fire a gun at them? What if the hackers shut down the power in a location and people in hospitals die as a consequence – is killing hackers then 'proportional?' This is a murky area because it is a fact that people can do real damage by hacking; they can even kill people. Yet, it is unclear whether it is acceptable to inflict real harm in return.

"There is a move to attack autonomously without humans in the battlefield. Humans are very vulnerable and, therefore, the least useful in war."

Interestingly, neuroscience can actually play a role here as well, as we can use neural measures to quantify empathy – to measure how the brain processes damage, revenge, risk... and help identify what the proportional responses to various attacks should be.

What are the benefits of neuroscience to civilians?

Neuroscience not only gives us the ability to live longer, but also to live better. If you look, right now, at the life of a person, we could all live between 100 to 150 years of age. We are doing a really good job of extending lives. Now, one of the growing problems that are facing the world is mental disorders. Some of us may live to be 150 years maybe, but what does life mean if you do not have your mental faculties? If we do not have our memories or clarity in our thoughts? Here, focusing on advancing neuroscience is crucial as we are heading to such a world where we increase longevity, and want to also improve the quality of life. Neuroscience can help people learn how to live happily and peacefully. We can help people talk to their brains in order to understand what exactly they need and want, and create an alignment between what people want and what they get. ■