Researcher explains why we should care more about converging technologies

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Professor Dirk Helbing of ETH Zurich and Austria's Complexity Science Hub expects future digital technologies to penetrate the human body even more in the future. However, he believes that society is not prepared for the risks involved. In a new article, he puts forward a new legal framework to protect our most intimate data from misuse.

The work is published in the journal *Ethics and Information Technology*.

"In my research, I deal with the consequences of digitalization for people, society, and democracy. In this context, it is also important to keep an eye on the convergence in the computer and life sciences—i.e., on what becomes possible when digital technologies increasingly grow together with biotechnology, neurotechnology, and nanotechnology," says Prof. Helbing.

"Converging technologies are seen as a breeding ground for far-reaching innovations. However, they are increasingly blurring the boundaries between the physical, biological, and digital worlds. As a result, conventional regulations become ineffective. In a joint study together with my co-author Marcello Ienca, we have recently examined the risks and societal challenges of technological convergence—and concluded that the effects for individuals and society are far-reaching.

"We would like to draw attention to the challenges and risks of converging technologies and explain why we consider it necessary to accompany technological developments internationally with strong regulation.

"For several years now, in the context of digitalization, everyone could observe the consequences of leaving technological change to market forces alone without effective regulation."

Misinformation and manipulation on the web

Prof. Helbing continues, "In 2015, almost ten years ago, the Digital Manifesto was published. One of us and eight other European experts issued an urgent warning against scoring, i.e., the evaluation of people, and against big nudging, a subtle form of digital manipulation. The latter is based on personality profiles that are created using cookies and other surveillance data.

"A little later, the Cambridge Analytica scandal alerted the world of how the data analysis company tried to manipulate voting behavior in democratic elections using personalized ads (microtargeting).

"By now, democracies around the world are under great pressure. Propaganda, fake news, and hate speech are polarizing and sowing doubt, while privacy is dwindling. We are in a kind of international information war for our minds, in which advertising companies, tech corporations, secret services, and the military are fighting for influence over our thinking and behavior. Meanwhile, the European Union adopted the AI Act in an attempt to curb the aforementioned dangers.

"However, digital technologies have developed at a breathtaking pace, and new possibilities for manipulation are already emerging. Because when digital and nanotechnology merge with modern biotechnology and neurotechnology, revolutionary applications become possible that were hardly imaginable before."

Microrobots for precision medicine

"In personalized medicine, for example, the advancing miniaturization of electronics is increasingly making it possible to connect living organisms and humans with networked sensors and computing power. The WEF

proclaimed the 'Internet of Bodies' as early as 2020," says Prof. Helbing.

"One example that combines conventional medication with a monitoring function is digital pills. These could control the medication and record a patient's physiological data.

"Experts expect sensor technology also to reach the nanoscale. Magnetic nanoparticles or nanoelectronic components, i.e., tiny particles invisible to the eye with a diameter up to 100 nanometers, would make it possible to transport active substances, interact with cells, and record huge amounts of data on bodily functions.

"If introduced into the body, it is hoped that diseases could be detected at an early stage and treated in a personalized manner. This is also often referred to as high-precision medicine."

Nano-electrodes record brain function

Prof. Helbing adds, "Miniaturized electrodes that can simultaneously measure and manipulate the activity of thousands of neurons and ever-improving AI tools for the analysis of brain signals are two approaches that are now leading to much-discussed advances of the brain-computer interface. Brain activity mapping is also on the agenda. Thanks to nano-neurotechnology, it is imagined that smartphones and other AI applications could soon be controlled directly by thoughts.

"Large-scale projects to map the human brain also benefit from this. In the future, brain activity mapping could, in principle, read out our thoughts and feelings but also make it possible to influence them remotely—the latter would probably be a lot more effective than previous manipulation methods, such as big nudging.

"However, conventional electrodes are not suitable for a permanent

connection between cells and electronics—this requires durable and biocompatible interfaces. One proposal is therefore to transmit signals optogenetically, i.e., to control genes in special cells with light pulses. In this way, amazing circuits could be implemented."

The downside of convergence

"Admittedly, the applications mentioned above may sound futuristic. They are still mostly visions or in the early stages of development. However, a lot of research is being carried out worldwide and at full speed. Military circles are interested in using converging technologies for their own purposes as well," says Prof. Helbing.

"The downside of convergence is that there are considerable risks, such as state or private actors gaining access to highly sensitive data and misusing it to monitor and influence people. The more connected our bodies become, the more vulnerable we are to cybercrime and hacking. It cannot be ruled out that military applications exist already. One thing, however, is clear: Long before precision medicine and neurotechnology work reliably, these technologies can be used against people.

"The problem is that the existing regulations are specific and insufficient to keep technological convergence in check. But how are we to retain control over our lives if it becomes increasingly possible to influence our thoughts, feelings and decisions by digital means?"

Converging global regulation is needed

"In our recent paper, we conclude that the way to regulate converging technologies would have to be based on converging international regulations. Accordingly, we outline a new global regulatory framework and propose ten governance principles to close the looming regulatory

gap," explains Prof. Helbing.

"The framework emphasizes the need for safeguards to protect bodily and mental functions from unauthorized interference and to ensure personal integrity and privacy, for example, by establishing neuro rights.

"To minimize risks and prevent abuse, future regulations should be inclusive, transparent, and trustworthy. The principle of participatory governance is key, which would have to involve all relevant groups and ensure that the concerns of affected minorities are also taken into account in decision-making processes.

"Finally, we need to regain control over our personal data. For this, we need genuine informational self-determination. This would also have to apply to the digital twins of our body and our personality because they can be used to hack our health and our thinking—for good or for bad.

"With our contribution, we would like to initiate a public debate about converging technologies. Despite its great relevance, we believe that too little attention is being paid to this topic. A continuous discourse on benefits, risks and sensible rules can help to steer technological convergence in such a way that it serves people, not harm them," he concludes.

More information: Dirk Helbing et al, Why converging technologies need converging international regulation, *Ethics and Information Technology* (2024). DOI: 10.1007/s10676-024-09756-8

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