Chapter 6

Neuronal Interfaces and Policy

The important anthropological and ethical consequences resulting from the development of direct neuronal interfaces and the associated possibilities for the mind to interact with cyberspace cannot be evaded or ignored. These range from largely theoretical philosophical questions to practical concerns regarding possible inappropriate applications of present and future technologies. As the European Parliament's 2009 Science and Technology Options Assessment's report entitled *Human Enhancement Study* indicated:

> [W]orries arise when one considers who is responsible for one's actions, if these can be incited by technology-induced affective responses. Although there seems to [be] quite a huge gap between such worries and the scientific state of affairs, there are clearly moral worries along these lines that are already topical.[1]

In the use of neuronal interfaces, the medical principle of informed consent becomes a very difficult notion to define, as does the concept of moral responsibility for an action. Who should be held accountable for any resulting damage: the patient, the device or the healthcare professional who implanted it and turned it on? [2]

The European Parliament report concludes: 'Neurophilosophers, neuroethicists, neurosociologists and neurojurists are presented with a challenging case . . . What to think of "the self" if its essential attributes of mood and emotions can be manipulated at will.' [3]

So far, legislation regulating the actions and behaviour of persons has generally been restricted to human persons and is based on human rights

and dignity. However, as already noted, with the development of neuronal interfaces, the concept of the 'human' may increasingly become unclear, which may then blur the understanding of inherent human dignity, which is the very foundation of human rights and human legislation. As a result, new national and international legislation may be seen as necessary to address some of the cyberneuroethical challenges presented previously. As Ienca and Andorno indicate: 'In contrast to other biomedical developments, which have already been the subject of standard-setting efforts at the domestic and international level, neurotechnology still largely remains a *terra incognita* for human rights law.'[4] More specifically they argue that new legal systems may have to be prepared to address the challenges that may arise from the emerging neurotechnologies, especially in the context of human rights.[5]

New Cybercrimes

Cybercrimes are usually defined as crimes that involve a computer and a network, and are committed against individuals or groups of individuals with a criminal motive.[6] They also include offences in which individuals seek to illegally access the computers of others (known as hacking). As such, the 'cyber' prefix is used, as in many other settings, in a very general and loose sense.[7]

Nonstate actors as well as individuals can participate in cybercrimes, including espionage, financial theft and other offences that may affect millions of individuals, private businesses and governments.[8] When national governments target and use computers and networks of other governments for both offensive and defensive operations, such as cyberattacks, espionage and sabotage, this is usually defined as cyberwarfare.

Within this context, large amounts of money are invested every year by states, banks, businesses and organisations in seeking to protect themselves from such attacks. In the following sections, however, only cybercrimes that may become relevant to those using neuronal interfaces will be addressed.

Mental Integrity

In the development of a neuro-oriented human rights framework, one of the most important principles that may need to be considered reflects the notion of cognitive liberty. This is presented as a right to mental self-determination, which includes both an individual right to use emerging neurotechnologies and a right to be protected from any coercive and unconsented use of such technologies. Thus cognitive liberty reflects the right for individuals to be able, or to refuse, to change their mental states using neurotechnology.[9]

Such a right to be protected from unauthorised interventions in the brain seeks to address the (already mentioned) risks presented in the Japanese animated science-fiction series *Ghost in the Shell*. In this, computer technology is so advanced that many members of the public have enhanced cyberbrains, allowing their biological brains to interface with various networks. But this high level of inter-connectedness also makes the brain vulnerable to attacks from highly skilled hackers, including those who will hack a person to completely control their will, change their memory and deliberately distort their subjective reality and experience. This means that it may be possible for future WiFi neuronal interfaces to be used by a hacker, or even a certain government, to remotely influence the brains of other persons or their devices in order to seek to subconsciously or even consciously control them or change their way of thinking.[10]

In this regard, Ienca and the Dutch philosopher and psychologist, Pim Haselager, defined the concept of 'malicious brain-hacking' as neurocriminal activities that directly affect neural computation in the users of neurodevices in a similar manner to the way in which computers may be hacked in computer crime.[11] Accordingly, it is not only the users' mental privacy and the protection of their brain information that are at risk, but also their physical and mental integrity. [12] More specifically, Zoltan Istvan explains:

> To me, the biggest need in the future will be cyber security coders, who will create ways to protect people that are basically interfacing directly with the web with their mind. Ultimately, I think we'll have a police force that can carefully and quickly stop cyber crime, including that in our minds. That will be necessary in order for humanity to upload its thoughts to the machine world and feel safe – otherwise, we'll never do it.[13]

On this account, Article 3 of the EU's Charter of Fundamental Rights may be relevant, since this recognises that 'everyone has the right to respect for his or her physical and mental integrity.' Consequently, Ienca and Andorno indicate that for an action to qualify as a threat to mental integrity, it must:

(i) involve the direct access to, and manipulation of, neural signalling;
(ii) be unauthorised – in other words, it must occur in absence of the informed consent of the signal generator;
(iii) result in physical and/or psychological harm.[14]

However, it has been proposed that the right to mental integrity could legally be transgressed in some very specific circumstances. For instance, if moral enhancements can be shown to be safe and effective, then an argument could be made for the compulsory, controlled and temporary violation of this right to mental integrity for some dangerous individuals.[15]

Identity Theft

Because of the amount of personal information now available in cyberspace, cybercrimes involving identity theft are increasingly becoming a problem. Such crimes use the personal information of a victim to exploit the benefits of his or her identity for a whole range of criminal purposes.[16] Moreover, because they use part of an individual's sense of self, victims usually experience the crimes as very disturbing and invasive. Instances of blackmail and extortion may take place, as well, which threaten to reveal personal information or destroy reputations.[17]

In the future, criminals may also be able to use the personal identity of a person as well as his or her private thoughts, ideas or memories for their own benefit. In other words, crimes relating to the very integrity and probity of an individual could develop. Stealing sufficient information could even enable criminals to completely take over their victims' offline or online identities.[18]

This means that society should be ready for such kinds of crimes against persons and organisations that may become possible in cyberspace. New technology may need to be developed against instances, such as mining large datasets as well as cross-referencing a range of personal and other information.[19,20]

But because the distinction between online and offline identities may continue to diminish in the future, a person's identity and privacy may increasingly become difficult to protect. Moreover, if persons spend more and more time in cyberspace, the re-evaluation of the identity of a person in cyberspace may mean that offences to this identity may need to be re-evaluated.

Demonstrating Causality

Usually, in order to identify who is responsible for an outcome, it is important to analyse the causal chain for an action. This means that an individual can be held responsible for a certain outcome if he or she has a causal connection to it, is aware of the eventual result and did not act under compulsion or duress.[21] As O'Brolchain and Gordijn indicate, 'if a person is to be considered morally responsible for a particular event or action, that person must have been able to exert some kind of influence on that event and must have known that in doing so a certain consequence would most likely have ensued'.[22]

Demonstrating such a responsibility, however, may not be easy in the use of neuronal interfaces, since determining who is really in control, and of what, may be unclear or complex. As already noted, with procedures such as neuroimaging, scientists may be able to detect a correlation between a particular behaviour and brain structure or brain activity. But such an association

cannot be considered as reliable evidence of causation. For example, if a correlation is shown to exist between brain structure and political conservatism or liberalism,[23] it may be impossible to conclude that certain brain structures cause a particular political disposition. Instead, it may be that certain political views may cause differences in brain structure or that both political beliefs and brain structure were the result of some other cause.[24]

It follows that concepts of causality in neuroscience are not always similar to those that are used in law. If it is proposed that an action is the cause of a certain outcome in a court of law, then it must be proved that this result would not have occurred but for the original action. This means that investigations are required to demonstrate any element of causality.[25] If these showed, for instance, that an injury changed the brain structure, resulting in a change of behaviour, then it may be possible that a causal link existed.

For a person to be guilty of a crime, both an *actus reus* (a wrongful act) and *mens rea* (actual criminal intent or at least a gross and wrongful recklessness as to the consequences of one's actions) is required. Thus, if a person is unconscious and, as a result, is incapable of forming criminal intent, he or she cannot have *mens rea*. Equally, automatism (as in sleepwalking) can be a defence, as can an involuntary action (as in sneezing whilst driving a car). Or again, the state of a person's mind may be such that he or she may nonetheless plead diminished responsibility to lessen his or her culpability for his or her actions.

In the context of cyberneuroethics, however, the logical end point of such a discussion over responsibility may be difficult to fathom. The role of the law raises questions that are more often implicit than explicit concerning the relationship of law, science and society. Accordingly, legislation may only be seen as effective if it reflects societal values and priorities. Perhaps, this may also mean that there should be a limit beyond which a person should not go in law, a point at which the courts say 'this far and no further'.

Such a perspective is important, for instance, in discerning what the attitude of the courts would be if they are ever confronted with the proposition 'it was not me; it was my neurons' or 'it was not me; it was the computer programme'. It also means that whatever scientific evidence is presented, there may be a legal line over which, on policy grounds, a person should simply not go. Otherwise, no one would ever be guilty of any crime, which may not be considered acceptable to the society in which the law was drafted.

How then will cyberneuroethics eventually be reflected in law? In reply, it should perhaps be recognised that because the law tends to develop step by step and, to some extent, is influenced by social values, it may be difficult to see what direction this may take. In addition, any new laws may have some influence on shaping society and for promoting what could be considered as 'normal' behaviour in the future.

Future Cybercrimes

With the continued development of virtual realities and cybercommunities, a new setting is created, which, if no regulations are established, may eventually result in individuals being harmed and responsibilities being blurred. For example, when a soldier is connected to computers through a neuronal interface to control military drones and one of these accidentally bombs the wrong target, questions could be asked as to who should be blamed. Is it the soldier, the neuronal interface connected to the computer or the programmer who designed the system?

At present, the law makes a distinction between human operators and technical systems, while requiring operators to be responsible for these systems. But the situation would change if the operators' cognition was enhanced by a neuronal interface appliance linked to a computer. It would then be difficult to separate the human operator from the system and the concept of responsibility would become unclear.

Of course, some parallels already exist with the use of drugs to control thoughts and behaviour, making persons more efficient and attentive, but the exact nature of the concept of free will and responsibility may have to be reconsidered in many contexts where new neuronal interface systems are used. At the same time, if an ever-increasing amount of information is available about a person's thoughts, it may become possible to examine a person's intentions to commit a crime. This could then be used by law enforcement organisations similar to the 'Precrime' specialised police department in the film *Minority Report*, which apprehends future criminals based on foreknowledge.

But, in a way, this may not be so new, since psychiatrists already find themselves in similar situations when they discover that one of their patients represent a very significant danger to society, though he or she has not yet committed any crimes.

What Is Real and What Is Virtual?

With the development of neuronal interfaces, it is also possible to question whether a crime committed in cyberspace, such as between two *Second Life* avatars, should be considered a crime in real life and to what extent. To a certain degree, the extension of the law's jurisdiction into *Second Life* and other virtual reality settings is already taking place, in that an English court settled a divorce case on the basis of a spouse's adulterous avatar.[26] In other words, this may have happened because what took place in cyberspace affected real physical persons.

But since only real persons can be affected with moral values, at present, this may mean that the way in which cyberspace and its virtual realities affect

real human persons is important.[27] For instance, if a person, who exists in real life, sets out to deliberately cause harm or loss to other real persons as a consequence of his or her actions or omissions in cyberspace, then there may be a case for his or her prosecution. What is important is the concept of cause and effect on real persons or organisations.

Moreover, the Parliamentary Assembly of the Council of Europe indicated in 2017 that responsibility and accountability for an act should always lie with a human being, adding:

> References to independent decision making by artificial intelligence systems cannot exempt the creators, owners and managers of these systems from accountability for human rights violations committed with the use of these systems, even in cases where an act causing damage was not directly ordered by a responsible human commander or operator.[28]

A difficulty may also arise if an individual is not considered to be as responsible for a crime in cyberspace as in real life. Indeed, this might have a detrimental effect on the character of the person in real life. He or she may begin to enjoy the feeling of committing a crime without penalty in virtual reality, which may then have repercussions in real life.

In this context, however, it should be remembered that many games, even for children, may involve the killing of one of the players in the imaginary world, though this is not considered to be a significant danger in the real world. In this case, the strong imaginary element may downplay the reality of the destruction, while the rules of the game take into account, right from the beginning and with all the players' knowledge, the fact that some of their avatars may be killed.

Policy Concerns

The philosopher of medicine and medical ethicist Hillel Braude mentioned in 2016 that the former Israeli President Shimon Peres (1923–2016) had come to the conclusion that people 'cannot govern the world without at least understanding how does [sic] the brain govern us', adding that it is '[t]he greatest hope that we shall begin to understand how does [sic] our own brain function, and then we shall not be beggars of the brain, but choosers of its machinery, of its function'.[29]

However, significant concerns have also been expressed, with the American physician and ethicist Christopher Hook indicating:

> Not only will our cybernetic connectedness provide opportunities for others to have access to us. How much more will individuals be subject to those who

> wish to control and influence them? Will we be able to separate out and eliminate images, instructions, or 'thoughts' meant to influence us, both from commercial and governmental sources? How much further will our privacy erode when the last bastion of our privacy, our mind, is open to the cybernetic web? And as a further danger, will there be new types of electronic viruses that can damage out brains as well as the cybernetic equipment we are 'attached' to?[30]

Whether human persons will ever be able to entirely control their own or other people's brains is open for debate. But such proposals may serve to exemplify the extensive questions already being raised within cyberneuroethics. The important consequences of developing a direct neuronal interface with an appliance, such as a computer, and the resulting possibilities for the mind to interface with cyberspace cannot be sidestepped. These range from largely theoretical anthropological and philosophical questions to practical concerns regarding possible inappropriate applications of present and future technologies.

The brain of a person is indeed a very sensitive organ and any use of a neuronal interface may have consequences for the individual and the way in which he or she interacts with others. Robert Blank indicates that: 'As the center of personal autonomy and identity, the brain enjoys special status, and modifying it even slightly raises concerns of manipulation.'[31] Consequently, because of the special and unique quality of the brain of a person, any intervention threatening its integrity may be considered as an assault on personhood and autonomy.[32]

Other risks may also exist for society as a whole. For instance, such technologies may serve to increase competitiveness between persons or undermine equality if they become the reserve of the rich. Discrimination may then ensue, especially towards those who cannot afford, or refuse to use, the new interfaces.[33]

At the same time, due to the seriousness of the possible concerns, it is difficult to know what kind of policy developments and regulations will become necessary. Neuronal interfaces are likely to require constant vigilance as the quality and potential for connectivity increases. Indeed, there may be a need for redefining issues such as privacy, identity and what constitutes cybercrime. Legislation relevant to issues such as data protection and confidentiality may also have to be revised.

In this regard, the following policy dimensions would be important:

– The manner in which support is given to research and development of neuronal interfaces; because a significant amount of this research for both civilian and military purposes is supported by public money, society as a whole should be involved in deciding how these funds are used.

– The manner in which new neuronal interfaces are used for individual applications; because the way in which such applications may be used may challenge social values relating to the self, privacy, discovery, justice, health and rights, care is required when they are being considered in political settings.
– The manner in which the combined consequences resulting from neuronal interfaces may affect a population. This should, for example, examine the way in which neuronal imaging may be used to categorise personalities and how this could affect legal responsibility or equality of opportunity, such as in employment.[34]

A whole new structure addressing cybercrimes may also become necessary, though this will most likely be based on already-existing principles. As the report from the European Group on Ethics in Science and New Technologies to the European Commission concerning the ethical aspects of information and communication technologies implants in the human body indicated in 2005:

> [T]he legal background should be derived from general principles underlying national legislation and international instruments. Such general principles can provide the guidance required to outline the legal standards necessary for the regulation of a technology that modifies the body and its relationship with the environment and thereby impacts deeply on personal identity and life.[35]

These legal principles should be sourced from texts relating to the different relevant subject matters, such as international legal instruments on bioethics, data processing, privacy, the limitations on consent and the definition of medical devices.[36]

Of course, it is also important that the role of ethics in the context of policy and regulation should not only be reactive and restrictive, by addressing any misuses and harmful consequences, but also proactive, while looking to future possibilities. Ethical examination would then assist in the implementation of neuronal interfaces in society so that they can support beneficial outcomes, while improving the lives and welfare of citizens.[37] As Blank concludes: 'Brain policy, then can be permissive, affirmative, regulatory, or prohibitive.'[38]

However, new regulations may still be very different depending on whether neuronal interfaces are used in either medical or nonmedical contexts. Indeed, the manner in which the risks and advantages will be considered for appliances which do, or do not, have any medical purposes will be different.[39]

For an example of policy recommendations relating to neuronal interfaces, it is possible to consider those suggested by the Scottish Council on Human Bioethics, which can be found in the Appendix.

Notes

1. European Parliament, *Human Enhancement Study*, 90.
2. Ibid., 91.
3. Ibid., 92.
4. Ienca and Andorno, 'Towards New Human Rights', 8.
5. Ibid. 5.
6. Halder and Jaishankar, *Cyber Crime*.
7. Moore, *Cyber Crime*.
8. Harvey, *Can Histories of Previous Technological Breakthroughs?*; Wall, *The Future Challenges of Identity Crime in the UK*.
9. Bublitz, 'My Mind is Mine!?', 234, quoted in Ienca and Andorno, 'Towards New Human Rights', 10.
10. O'Brolchain and Gordijn, 'Brain–Computer Interfaces and User Responsibility', 169–70.
11. Ienca and Haselager, 'Hacking the Brain'. The attack of a person's brain activity through unauthorised use of neurodevices by third parties is called 'brainjacking' in Pycroft et al., 'Brainjacking'.
12. Ienca and Andorno, 'Towards New Human Rights', 17–18.
13. DeVoe, 'Transhumanism and Crypto: Interview with Zoltan Istvan'.
14. Ienca and Andorno, 'Towards New Human Rights', 18.
15. Persson and Savulescu, 'The Perils of Cognitive Enhancement', mentioned in Ienca and Andorno, 'Towards New Human Rights'.
16. Wall, *The Future Challenges of Identity Crime in the UK*; Government Office for Science, Foresight, *Future Identities*, 30–31.
17. Ibid.
18. Wall, *Identity-Related Crime in the UK*.
19. Banerji, 'David Hemler'.
20. Government Office for Science, Foresight, *Future Identities*, 30–31.
21. Royal Society, *Brain Waves Module 4*, 5–6.
22. O'Brolchain and Gordijn, 'Brain–Computer Interfaces and User Responsibility', 166.
23. Kanai et al., 'Political Orientations'.
24. Royal Society, *Brain Waves Module 4*, 5–6.
25. For example, see the use of natural experiments such as twin studies discussed in Rutter, 'Proceeding from Observed Correlation to Causal Inference'.
26. Morris, 'Second Life Affair Leads to Real-Life Divorce'.
27. Heim, *The Metaphysics of Virtual Reality*, 124; Waters, *From Human to Posthuman*, 56.
28. Parliamentary Assembly of the Council of Europe, *Technological Convergence*, para 9.
29. Peres, 'Israel Brain Technologies', quoted in Braude, 'Enhancing Cognition in the "Brain Nation"', 133.
30. Hook, 'Cybernetics and Nanotechnology', 64.
31. Blank, *Intervention in the Brain*, 68.
32. Ibid., 27.

33. Blank, 'Regulating Cognitive Enhancement Technologies', 247–48.
34. Blank, *Intervention in the Brain*, 79–80.
35. Secretariat of the EGE, *The Ethical Aspects of ICT Implants in the Human Body*, 13.
36. Ibid.
37. Chan and Harris, 'Neuroethics', 84–85.
38. Blank, *Intervention in the Brain*, 79–80.
39. Medicine and Healthcare Products Regulatory Agency, The Revision of European Legislation on Medical Devices, 10, quoted in Maslen, 'Toward an Ethical Framework', 286.

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