POPULAR UNDERSTANDING OF NEURONAL INTERFACES

At this stage, it may be useful to seek to examine how the general public may consider the possibilities arising from neuronal interfaces and how it is developing its views. This is important in framing the cultural setting of any ethical discourse, though it should be noted that public opinion generally only reflects the cultural values of large sections of a society and at a particular point in time. Moreover, the actual content of societal values may reflect a whole spectrum of attitudes towards science, technology and medicine.

In this respect, while many people may be ready to accept the benefits of modern technology and there is generally no generic public distrust of science, concern usually exists relating to the risks and dangers that may accompany specific developments. There is a fear that no one may be really 'in control' or 'knows what will happen' and doubts remain about the amount of trust to be given to governments in actually preventing or controlling potential lasting negative consequences.

In addition, a negative emotional reaction amongst the general public may exists towards certain technologies that should not simply be dismissed, in ethical considerations, as irrational or sentimental concerns. Rather, such a response may reflect an underlying but inarticulate social intuition. Moreover, if people feel an emotional reaction towards a procedure, this may be important and relevant to the moral positions, deeply held beliefs and intuitions of a society.

The English philosopher Mary Midgely warns against thinking of feelings as though they had no rational object or of considering the concept of reason

as though it was, or should be, unaccompanied by feelings. If some persons seriously believe something to be wrong, then strong feelings will generally accompany that belief. Emotional reactions may be appropriate or they may be inappropriate, and to decide which '[w]e must spell out the message of the emotions and see what they are trying to tell us'.[1]

However, a spontaneous reaction can also be exploited for many different purposes, including its 'entertainment value'. As already noted, this already happened in modern science fiction treatments, which may then influence the general public, to varying degrees, towards their perception of new technology.

But media commentators such as Adam Keiper regret that novels and films on neuronal interfaces do not always represent scientific reality. He explains that 'public understanding of this research is shaped by sensationalistic and misleading coverage in the press; it is colored by decades of fantastical science fiction portrayals; and it is distorted by the utopian hopes of a small but vocal band of enthusiasts who desire to eliminate the boundaries between brains and machines'.

However, Keiper also recognises that this is not something new.[2] For example, many scientists may now regret the influence of English novelist Mary Shelley's (1797–1851) classic novel *Frankenstein*, published in 1818, about the existential trauma of a living monster created from the body parts of the deceased. However, the Frankenstein story may still have a place in the context of debate about changes to humanity since it seeks to explore, express and represent some of the revulsion, anxieties and emotions relating to crossing biological boundaries. It also portrays the frightening prospects of what can go wrong when scientists, working in secret and without any ethical oversight, end up creating new beings that can only be considered as 'monsters'.

The basis of the emotional reaction relating to some neuronal interfaces may similarly arise from the position that different biological and electronic elements should be kept apart, since mixed entities do not fit neatly into existing categories. From this perspective, human-computer cyborgs that cannot be clearly put into a specific category are usually considered as monstrous not merely because of their hideousness (which is merely an aesthetic expression of a lack of wholeness), but because they are seen as bringing disorder to an ordered setting.

With respect to neuronal interfaces, an important distinction may also be related to the different types of interfaces used. Indeed, some may not be seen to be as threatening as others to the identity or species status of the resulting being.

Interestingly, it may be the external appearance of the neuronal interfaces that creates the most aversion amongst the general public in contrast to any

combination of nonvisible internal organs. This is because the public would immediately be confronted with an inability to identify the significant visible species distinctions which are important for any classification of living beings. The entity would be a 'something-in-between' and may be deemed to have no place in ordered society. Such feelings are obviously heightened when one of the parts is human, since additional questions of identity, legal rights and psychological issues come into play.

In order to understand public reactions, it is also necessary to explore the fundamental differences that exist in philosophical worldviews. Thus, according to the materialist and reductionist worldviews, biological beings are just made up of several types of complex substances composed of molecules that are common to all species, the only differences between species being merely the result of minor changes in the ordering of these molecules. For instance, the difference between proteins from cattle and human beings could be completely described by compiling a catalogue of the genetic differences that code for the proteins.

This worldview does not accept the idea of qualitative breaks in nature that then looks rather like a well-blended soup. Within this paradigm, species differences are a matter of drawing an arbitrary line and are to some degree illusory and unreal.

Public Understanding in the Media

As already noted, in seeking to develop an ethical perspective relating to neuronal interface systems, it is important to comprehend how society may consider these new technologies by examining, for example, popular and societal views and understandings. This may be done through public discussions, but also by studying the way in which the public is confronted with neuronal interfaces, such as the manner in which popular science-fiction films and books are used to portray possible new future technologies. As the scientist and Church of England priest Justin Tomkins states:

> The fact that the impact of technology upon society is not determined by the technology itself but by its interaction with society means that novels and films provide a significant means of exploring these issues. What is required is not simply a scientific analysis of the technology but an imaginative exploration of human society and how our behaviour is affected by a changing technological context.[3]

But, as already mentioned, another benefit of science fiction is that it enables possible neuronal interfaces to be considered in the light of future ethical questions examining the advantages and risks of new technologies.

In the case of neuronal interfaces, this began with bestselling science-fiction books, including the 1972 novel written by the American Michael Crichton (1942–2008) entitled *The Terminal Man*. This recounts the story of a man with brain damage receiving experimental, computer-controlled electrodes in his brain designed to prevent seizures, but that he eventually abuses for pleasurable aims.

Concerns that new brain–computer interfaces could possibly be misused by a government or the military have also been examined. In the 1981 BBC serial *The Nightmare Man*, a futuristic mini-submarine is wired by a brain implant to its captain, who then turns to murder after having ripped out the implant.

However, perhaps the most prominent early science-fiction novels relating to brain–computer interfaces were written by William Gibson. In 1981 he published *Johnny Mnemonic*, which tells the story of a young data trafficker who has undergone an operation enabling him to have a large data storage system implanted in his head. This was then followed in 1984 by a novel entitled *Neuromancer*, which was the first to be characterised under the 'cyberpunk' genre, which is a subgenre of science fiction featuring advanced technological and scientific achievements. In the book, mercenaries are enhanced through the use of brain implants that are linked up through a 'matrix' (which is the first time the term is used in this context).

Gibson's writings initiated an explosion of similar books, films and other media exploring brain–computer interfaces, such as the 1989 role-playing game *Shadowrun*. His book *Johnny Mnemonic* was even made into a film with the same title in 1995, which was directed by Robert Longo. This story was also the basis of the 1999 film entitled *The Matrix* and its subsequent sequels.

Another example of neuronal interfaces being used in fiction is the 1989 Japanese manga illustrated series entitled *Ghost in the Shell*, written by Masamune Shirow (the pen name of Japanese manga artist Masanori Ota), which follows a fictional counter-cyberterrorist organisation in the mid twenty-first century.[4] Computer technology is so advanced that many members of the public have enhanced (augmented) cyberbrains allowing their biological brains to interface with various networks. It is even possible to transplant human brains into completely robotic bodies so that individuals have permanent access to cyberspace.[5] This gives them a vastly increased memory capacity, total recall and the ability to view another person's memories on external viewing devices, as well as to initiate telepathic conversation with other cyberbrain users. But this high level of interconnectedness also makes the brain vulnerable to attacks from highly skilled hackers, including those who will hack a person in order to completely control their will, change their memory and deliberately distort their subjective reality and experience.

This has now been developed in a number of films which use the possibility of human brains being hacked in the story, such as in the 2018 film *Upgrade,* directed by the Australian Leigh Whannell.

A further science-fiction novel in the dystopian and cyberpunk genres reflecting a surprising degree of accuracy in predicting future technological development, as well as the associated ethical and anthropological challenges, was written in 2002 by American Matthew Anderson entitled *Feed.*[6] It depicts a future where the 'feednet', which is a super-computer network (a sort of precursor of an advanced form of the Internet), is directly connected to the brains of about three-quarters of Americans through the means of an implanted device called a 'feed'. This enables individuals to mentally access vast digital knowledge databases, to experience shareable virtual-reality phenomena and to communicate telepathically. In this world, privacy and self-ownership are constantly being challenged to fit individuals into consumer profiles. It also raises questions concerning corporate power, consumerism, information technology and the forms of discrimination, as well as limitations, that may exist for those who do not have the latest versions of technology. Data mining that extracts information from large quantities of data and transforms it into an understandable structure for further use is also examined in the novel.

A final example is the cyberpunk-themed action-role-playing video game *Deus Ex* developed by the American company Ion Storm and published in 2000 by Eidos Interactive. The game addresses the nature and impact of human enhancement with regard to a wide variety of prosthesis and brain implants. With the third game in the series, *Deus Ex: Human Revolution*, which is set in 2027, players can access enhanced human characters including those with implanted neurochips to improve their abilities, such as processing speeds and spatial awareness. They can even have a brain–computer interface allowing other persons, in other locations, to control their actions. The game raises questions about the possible disadvantages that such a society may represent to those who object to being enhanced (or cannot afford it) and the eventual risks for such individuals of becoming completely disenfranchised.

The success of these games, books and films demonstrates that society is interested in, and aware of, some of the ethical concerns, risks and advantages related to neuronal interfaces and the consequences that this may have on mind–cyberspace interactions. They also suggest different (fictional) ways in which society may respond to, and assimilate, new developments that are important in trying to understand how real future societies may seek to balance the possible advantages against the perceived risks.

Notes

1. Migeley, 'Biotechnology and Monstrosity', 9.
2. Keiper, 'The Age of Neuroelectronics', 4.
3. Tomkins, *Better People? Or Enhanced Humans?*, 121.
4. This gave rise to several films, including the 1995 Japanese animated science-fiction film entitled *Ghost in the Shell* and directed by Mamoru Oshii.
5. Similar technology is presented in the 1987 American cyberpunk action film *RoboCop*, directed by Paul Verhoeven, in which the brain and part of the digestive system of a policeman, who was shot, are integrated into a robotic body to form a superhuman, law-enforcing cyborg.
6. Anderson, *Feed*.

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