

# GLOSSARY



**Big data:** a broad term for datasets and information that are so large or complex that they cannot be processed by standard applications.

**Bionic:** refers to the replacement or enhancement of organs or other body parts by mechanical applications. Bionic implants differ from prostheses by mimicking the original function very closely, or even surpassing it. The term may have been coined from the ancient Greek 'bion', meaning 'unit of life' and the suffix 'ic', meaning 'like' or 'in the manner of'. Alternatively, it may have come from the terms 'biology' and 'electronics'.

**Brain–computer interfaces:** a direct interface between a brain and a computer system.

**Closed-loop system:** a system that has the following major components: (1) the participant; (2) signal acquisition; (3) signal analysis; and (4) signal feedback.

**Cloud computing:** the storage and processing of data in third-party data centres.

**Cognitivism:** asserts that computational states are necessary for minds.

**Computed tomography (CT):** a procedure that uses X-rays to visualise brain anatomy in sections.

**Consciousness:** the quality or state of being aware of an external object or something within oneself.

**Cyborg:** implies an undefined relationship between the cybernetic and the organic. The Cyborg deliberately incorporates nonliving components into a living organism so that it can be adapted to new environments.

**Cyberpunk:** a subgenre of science fiction featuring advanced technological and scientific achievements, such as information technology, giving rise to a degree of breakdown or radical change in social order.

**Data mining:** extracting information from large quantities of data and transforming it into an understandable structure for further use.

**Electroencephalogram (EEG)/magnetoencephalography (MEG):** using electrodes (EEG) or sensors (MEG) attached to the scalp to measure activity. These detect very small electrical currents and associated magnetic fields from the aggregate activity of many hundreds of thousands of neurons. The procedures can directly measure neuronal activity and has superior temporal resolution in comparison to the indirect measurements of fMRI.

**Enhancement:** the use of technology and science to increase the human functioning of a healthy individual beyond the norm for that person and in the absence of any identified dysfunction. However, it does not generally include the creation of capacities in beings that have never previously existed in humans (which may be considered under the concept of transhumanism).

**Functional MRI (fMRI):** an imaging procedure that measures changes in the oxygenation level of the blood and that can detect aspects of neuronal activity if used on the brain.

**Haptic (or kinesthetic) communication:** technology used to re-create the sense of touch to the user by applying forces, vibrations or other motions.

**Implantable medical device:** a medical device that is intended to be totally or partially introduced into the human body or by medical intervention into a natural orifice and that is intended to remain after the procedure.

**The Internet of things:** represents the network of physical objects embedded within electronics, software, sensors and connectivity, enabling them to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices.

**Locked-in patients:** patients who retain cognitive functions or who have a minimally conscious state, but who cannot move or communicate verbally due to complete paralysis of nearly all voluntary muscles in the body.

**Metaverse:** the space created when physical reality is enhanced by a virtual space. The word is derived from the prefix ‘meta’ (meaning ‘beyond’) and ‘universe’. It is normally used to describe a future version of the Internet in which persistent, shared, three-dimensional virtual spaces are linked to create a perceived virtual universe.

**Monads:** self-contained and secluded nonmaterial entities with no spatial or physical properties expressing rational or autonomous activities (from the Greek *monas* meaning ‘singularity’ which is itself derived from *monos* meaning ‘alone’).

**Nerve:** composed of different types of axons through which electrical nerve impulses are transmitted.

**Neural:** characterises what is associated with nerves or the nervous system.

**Neuroessentialism:** the belief that moral identity can be reduced to the brain.

**Neuronal:** characterises what is associated with neurons.

**Neuronal interface systems:** describe a range of devices that enable a network of neurons to be connected with an appliance. This can include interfaces between neuronal networks and machines such as between a brain and a computer. These neuronal interfaces can usually be classified in one or more of the following categories:

**Direct neuronal interface systems:** a range of devices that enable a network of neurons to be directly connected with an appliance.

**Input neuronal interface systems:** provide stimulation to specific parts of the nervous system.

**Output neuronal interface systems:** record signals from neuronal networks. These can be used in two possible ways:

**Open-loop prediction neuronal interfaces:** record neuronal activity from multiple sites to predict behaviour.

**Closed-loop control neuronal interfaces:** record neuronal activity to guide a device. The user then receives sensory feedback and is able to learn to better control the system in the future.

**Passive neuronal interface systems:** record the user's neuronal activity and converts this information into instructions. Used in a game, for example, this could adjust general parameters to sustain a desired state of immersion.

**Active neuronal interface systems:** record the user's neuronal activity, but enables him or her to deliberately alter his or her level of brain activity to control the equipment. In a game, the user might imagine movement to make a character move on a screen.

**Reactive neuronal interface systems:** record neuronal activity that is triggered by the user responding to events. This may be an uncontrolled reaction to sudden loud noise or the appearance of a particular character or feature in a game.

**Neurons:** the cells present in the brain, spinal cord and peripheral nerves.

**Neuroprosthetics:** artificial devices that restore or replace a missing brain function that has been lost through trauma, disease or congenital conditions.

**Positron emission tomography (PET):** a procedure in which a radioactive tracer molecule is injected into the body whereby detectors placed around the head or other body part being imaged can sense the radioactive decay of the tracer molecule. This allows the reconstruction of images of the brain or other organs where the image is sensitive to the particular molecule used.

PET allows for both measurement of blood flow changes consequent to brain activity as well as the distribution and quantity of specific brain receptors, so long as a radio-ligand that targets that receptor can be synthesised.

**Posthumanism:** the idea that possible future beings that originated from humans or humanity can be developed, whose basic capacities so radically exceed those of present humans as to no longer be considered as human in any significant degree or form.<sup>1</sup>

**Prosthesis:** an artificial device that replaces a missing body part that has been lost through trauma, disease or congenital conditions. From the ancient Greek *prósthesis* ('addition, application, attachment'), such a device is also used to help a person 'look' more normal.

**Right to be forgotten:** the perceived right for individuals to determine the development of their life in an autonomous way, without experiencing discrimination as a consequence of a specific past action.

**Strong artificial intelligence:** asserts that computational states are necessary and sufficient for minds to exist.

**Structural Magnetic Resonance Imaging (MRI):** an imaging procedure that measures brain anatomy using a strong magnetic field combined with radio frequency waves.

**Transhumanism:** the idea that humanity can transcend or overcome the limitations of human nature.<sup>2</sup> Transhumanism is different from the concept of enhancement in that it seeks to create beings that have never previously existed in the history of humankind. These beings would retain some human characteristics, such as with human-nonhuman interspecies beings or cyborgs that combine the human and the robot. Transhumans should, however, be distinguished from posthumans.

**Virtual reality:** replicates an environment that simulates physical presence in both the real or imagined worlds and lets the user interact in that world. This usually takes place through a computer screen, though other infrastructures may also be used.

**Voxel:** represents each of an array of elements of volume that constitute a notional three-dimensional space, especially each of an array of discrete elements into which a representation of a three-dimensional object is divided.

**WiFi:** represents wireless fidelity technology for wireless local area networking with specific electronic devices.

**World Wide Web:** an information space where documents and other web resources may be identified, interlinked and accessed via the Internet.

## Notes

1. Savulescu, 'The Human Prejudice and the Moral Status of Enhanced Being', 214.
2. McNamee and Edwards, 'Transhumanism, Medical Technology and Slippery Slopes', 513–18.

## Bibliography

- McNamee, M.J., and S. D. Edwards. 2006. 'Transhumanism, Medical Technology and Slippery Slopes', *Journal of Medical Ethics* 32, 513–18.
- Savulescu, J. 2009. 'The Human Prejudice and the Moral Status of Enhanced Being: What Do We Owe the Gods?', in J. Savulescu and N. Bostrom (eds), *Human Enhancement*. Oxford: Oxford University Press.