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NEUROTECHNOLOGY

Neurotechnologies represent a group of technologies used to monitor, stimulate, manipulate and emulate the structure and the functions of the human brain and the nervous system.

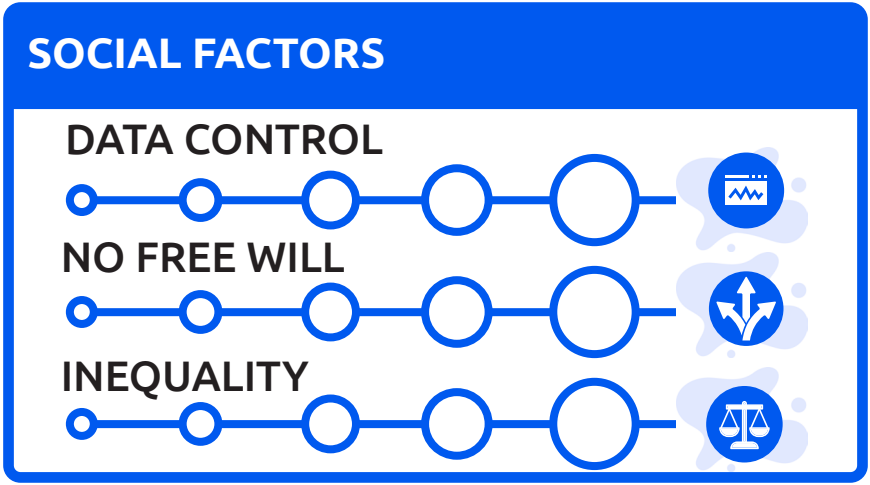

SOCIAL FACTORS

DATA CONTROL

NO FREE WILL

INEQUALITY

SOCIAL FACTORS



SOCIAL FACTORS

DATA CONTROL

NO FREE WILL

INEQUALITY

COUNCIL RESPONSE CARD

TECH AGE CARD ID:

ISSUE TO SOLVE:

ETHICS PROPOSITION:

COUNCIL RESPONSE CARD

TECH AGE CARD ID:

ISSUE TO SOLVE:

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COUNCIL RESPONSE CARD

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ETHICS PROPOSITION:

COUNCIL RESPONSE CARD

TECH AGE CARD ID:

ISSUE TO SOLVE:

ETHICS PROPOSITION:

TECH FAMILY

VOTE CARD

VOTE CARD

WORLD CARD

HARD

WORLD CARD

EASY

WORLD CARD

NORMAL

COUNCIL RESPONSE CARD

COUNCIL RESPONSE CARD

COUNCIL RESPONSE CARD

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COUNCIL RESPONSE CARD

COUNCIL RESPONSE CARD

COUNCIL RESPONSE CARD

TECH AGE CARD ID:

ISSUE TO SOLVE:

ETHICS PROPOSITION:

COUNCIL RESPONSE CARD

TECH AGE CARD ID:

ISSUE TO SOLVE:

ETHICS PROPOSITION:

NEUROSTIMULATION

Neurostimulation uses devices such as electrodes to simulate parts of the human nervous system and produce a certain behaviour. This can be used to help treat pathologies and reduce pain.

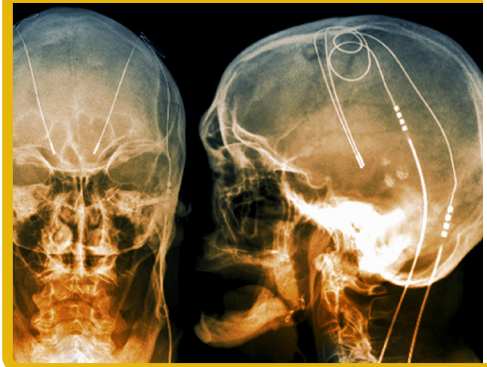
NEUROIMAGING

Neuroimaging technologies measure and monitor neurological activities and identify neuron circuits that are involved, for example, when people react to fear. Once identified, an intervention can target specific areas.

BRAIN-COMPUTER INTERFACE (BCI)

Brain-Computer Interfaces first read and collect brain activity data and signals related to thought and action. Then, they transform it into a desired result, such as moving a prosthetic limb, or a computer cursor.

MEDICINE



Neurotechnologies can better prevent and treat brain disorders, both neurological diseases like Parkinson's disease and epilepsy, and mental disorders like depression.

BENEFIT

Patients' quality of life is improved

ETHICAL CHALLENGE

Significant changes in personality

CRIMINAL JUSTICE

Neurotechnologies are used to identify the biological factors that contributed to somebody committing crime and determine the most appropriate punishment.

BENEFIT

Reducing the risk that people reoffend

ETHICAL CHALLENGE

Human traits like values, history and intentions stop mattering

HUMAN ENHANCEMENT

Users can improve their physical and psychological conditions. Using BCI and neuroprosthetics, people can control body parts, but also things like drones and automobiles.

BENEFIT

Body functions can be restored or improved

ETHICAL CHALLENGE

Going beyond one's normal healthy state

NEUROSURVEILLANCE

Neurodata can be used by state security agencies to understand the population's psychological state, or by employers to monitor employees' productivity.

BENEFITS

Greater focus in fields like medical surgery

ETHICAL CHALLENGE

Discrimination on the basis of brain profile

MARKETING

Neurotechnologies are used to better understand consumers' behaviour and preferences. Using that knowledge, marketing strategies can be personalised and targeted.

BENEFIT

More accurate insights about unconscious and emotional responses

ETHICAL CHALLENGE

Violation of privacy and data protection

MILITARY USE

Neurotechnologies are used to improve combatant's equipment and augment their cognitive, physical, and psychological capacities. BCIs can also help restore functions lost in combat.

BENEFIT

Combatants are more effective on the battlefield

ETHICAL CHALLENGE

Military conflict becomes more radical

ENTERTAINMENT

Neurotechnologies help users feel more immersed in entertainment content by stimulating their nervous system and giving them control over hardware and software.

BENEFITS

People can play games or do sports beyond their own capacities

ETHICAL CHALLENGE

Stimulation can cause addiction

TECH AGE 1

NT - I - 1

COUNCIL RESPONSE CARD

COUNCIL RESPONSE CARD

NEUROSTIMULATION

TECH AGE 2

NT - II - 1

TECH AGE 1

NT - I - 3

TECH AGE 1

NT - I - 2

NEUROIMAGING
NEUROSTIMULATION

TECH AGE 2

NT - II - 4

BCI

TECH AGE 2

NT - II - 3

NEUROIMAGING

TECH AGE 2

NT - II - 2

NEUROSTIMULATION
BCI

TECH AGE 2

NT - II - 7

NEUROSTIMULATION
BCI

TECH AGE 2

NT - II - 6

NEUROIMAGING
NEUROSTIMULATION

TECH AGE 2

NT - II - 5

PREDICTIVE DIAGNOSTICS

Early diagnostics allows the identification of signs that people might be predisposed to neurological diseases. This helps to prevent diseases or decrease their impact.

BENEFITS

Reduction of the incidence and costs of diseases

ETHICAL CHALLENGE

Knowing in advance changes how people see themselves

EDUCATION

Students' brain activity linked to curiosity, attention or stress is used to personalise learning. Devices can help with learning difficulties such as dyslexia.

BENEFITS

Better educational practices and greater autonomy

ETHICAL CHALLENGE

Less cognitive diversity and fewer points of view

How to preserve people' autonomy?

Neurotechnologies are often used for patients with physical or psychological disabilities, who might have limited autonomy to give consent. Furthermore, patients' autonomy can be negatively impacted if neurotechnology devices have more control over decision-making than themselves.

AUTONOMY

How can we ensure that human dignity is respected?

The capacities of neurotechnologies can strengthen the belief that human actions are determined by neurobiology. People might not be treated with the human dignity they deserve, in the name of preventing crimes and reducing reoffending.

HUMAN DIGNITY

How can physical and digital safety be ensured?

In non-medical settings, users might decide to undergo enhancement procedures with the desire to feel or perform "better". These procedures are highly invasive and entail known as well as unknown risks.

RISK REDUCTION

Who gets access to neurological data and on what terms?

Usually, people know for which data they give consent. The potential to extract mental imagery is unlimited. As a result, people might consent to handling data that they do not understand at that moment.

INFORMED CONSENT

How do we deal with the privacy concerns raised by neurotechnologies?

Mental privacy is the idea that people should have control over the data produced by their neurological activity. In certain cases, this data could be used for mental manipulation to influence the behaviour of specific target groups.

PRIVACY

Who should be considered responsible when neurotechnologies are misused?

Neurotechnologies can limit the freedom of the individual to act. For example, a BCI user could be made to act in a certain way by the BCI manufacturer or operator. Such cases raise questions on how the responsibility can or should be shared.

RESPONSIBILITY

How do we ensure the quality of hardware and software and avoid obsolescence?

As tech companies come and go, the prospect of consumers' neurotech devices becoming obsolete becomes real. If a company goes bankrupt, for example, users might not be able to use or even to remove their device.

SUSTAINABILITY

How do we ensure that we minimise inequality??

The use of brain images to predict and diagnose brain conditions could lead to discrimination. People diagnosed with neurological disease years ahead of their first symptoms might face discrimination at work or in relationships.

INEQUALITY

How do we respect and support neurodiverse individuals?

If mental conditions can be changed by neurotechnology, the diversity of individuals' unique mental features risks being reduced to "normal" development. Children might be directed to reach a similar level of mental capacity through neuro-education.

NEURODIVERSITY

MEDICINE

TECH AGE 3

NT - III - 1



NEUROIMAGING
BCI

TECH AGE 2

NT - II - 9


NEUROIMAGING
BCI

TECH AGE 2

NT - II - 8

NEUROSURVEILLANCE

TECH AGE 3

NT - III - 4

HUMAN ENHANCEMENT

TECH AGE 3

XR - III - 3

CRIMINAL JUSTICE

TECH AGE 3

NT - III - 2

ENTERTAINMENT

TECH AGE 3

NT - III - 7

MILITARY USE

TECH AGE 3

NT - III - 6

MARKETING

TECH AGE 3

NT - III - 5

IMPACT CARD AGE 2

EDUCATION

TECH AGE 3

XR - III - 9

PREDICTIVE DIAGNOSTICS

TECH AGE 3

NT - III - 8

AUTONOMY

HUMAN DIGNITY

RISK
REDUCTION

INFORMED
CONSENT

PRIVACY

RESPONSIBILITY

SUSTAINABILITY

INEQUALITY

NEURODIVERSITY

IMPACT CARD AGE 3

NEURO-
STIMULATION

NEUROIMAGING

BRAIN-
COMPUTER
INTERFACE

IMPACT CARD AGE 1

TURN SUMMARY

I. PLAYER ROUND

(1. TECHNOLOGY FAMILY)

2. TECH AGE EVOLUTION

3. OPEN DEBATE

4. CITIZEN WORLD COUNCIL DECISION

II. WORLD ROUND

1. IMPACTS

2. ETHICAL ISSUES

3. CITIZEN WOLRD COUNCIL RESPONSE

4. TECHNOLOGY TREE

5. END OF GAME?

TURN CARD

CREDITS

THIS GAME WAS DEVELOPED BY THE EU-FUNDED PROJECT TECHETHOS, BASED ON NEW RESEARCH CARRIED OUT BY ITS PARTNERS.

FOR MORE INFORMATION, VISIT:
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CREDITS