Brain-Computer Interfaces: Can Machines 'read minds'? and Associated Privacy Concerns

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Background

- **BCIs** are rapidly emerging technologies that raise several **ethical concerns**.
- The notion of **'mind-reading'** has been noted in academic literature and media, but concerns **fail to consider technical features** of BCI processes.
- Regulation of BCI technology must be informed by how **BCI processes differ**.

Research Questions

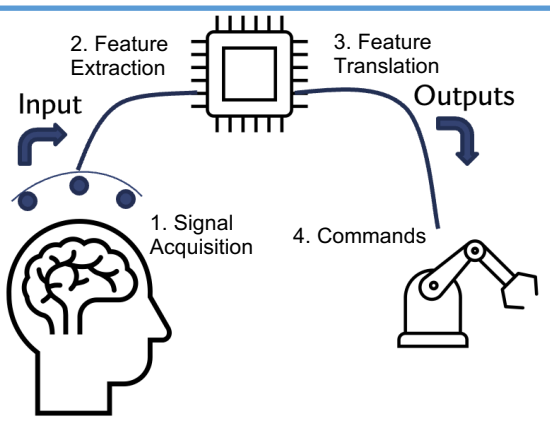
1. What does it mean for a BCI to **'mind-read' in an ethically concerning way?**
2. What factors will shape **associated privacy concerns?**

Aims

- Developed a **neuroethical framework** which outlined what **features** of a **BCI 'mind-reading'** process should be considered to **assess its ethicality,** together with factors that will affect **privacy concerns**.
- This was a **theoretical project**, with an **ethical scope** in assessing BCI 'mind-reading'.

Basic Concepts

- Working definition of 'mind-reading': Access to **mental contents**, mediated through **interception of neural signalling** that is **enabled through a BCI.**
- BCI: A device which records from the **central nervous system** to translate neural data into **meaningful output.**



BCI Classification

- Active BCI: Requires processing of **voluntary user inputs**.
- Passive BCI: Does **not require** the user to engage in any **voluntary activity**.
- Reactive BCI: Records **unconsciously produced neural activity**.

Methodology

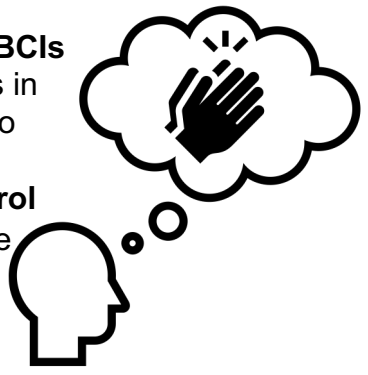
1. Reviewed the BCI literature for **relevant empirical features** such as imaging methods, neural signal paradigms and current BCI capabilities.
2. Critically surveyed the BCI ethical and empirical literature for **claims related to 'mind-reading'.**
3. Reviewed the ethical literature on BCI **privacy** and **autonomy**.
4. Identified relevant features related for an **ethical assessment of BCI 'mind-reading'**, and factors that affect associated privacy concerns.
5. Developed a **neuroethical framework** to ethically assess **'mind-reading'** processes and **associated privacy concerns**.

'Mind-reading' Framework

- Features are relevant as they affect:
  1. How **autonomy** is exercised
  2. The **meaning** of a BCI inference

- User Input
  Active BCI systems afford **greater opportunity for autonomy.**
- Nature of mental activity
  Inference of **covert speech** may generally have **greater capacity to convey meaning** compared to other kinds of inferences.
- Awareness of target mental activity
  Users will be **less informed** of inferences to mental processes they are less aware of. Such activities may also be **less intended** to be **conveyed.**
- Relationship between inputs and outputs
  When input and outputs are **similar,** operation of the BCI can be **more intuitive** and **autonomous.**

In **active motor BCIs** the user engages in **motor imagery** to operate the BCI, allowing for **control** over how they are **subject to 'mind-reading'.**



Privacy Factors

- Privacy infringements depend on:
  1. The **account of privacy** considered
  2. **Sensitivity** of data
- This project incorporated ***personhood***, ***control*** and ***contextual*** privacy theories.
- Privacy: Complex **social rituals** that **confer personhood**. Notions of personhood are **socioculturally** formed, whilst one has **control** in shaping their privacy through **voluntary disclosure**.
- BCIs infringe privacy in **two ways:** by **intruding** on **mental privacy** that is integral to the development of **relational identity**, and by accessing **sensitive information**.

- Sensitivity: Information which is **subjectively personal** for each person.

Other Ethical Considerations

- Consent: Must be **informed**, **voluntary** and made by a **competent** individual.
- Accuracy: The extent to which a BCI inference tracks the user's true mental activity. **Inaccurate BCI inferences** do **not 'mind-read'** in an **epistemic sense**.

Conclusion

- Not every BCI 'mind-reading' process is equally ethically concerning.
- Processes that **limit user autonomy** or **convey meaningful information** have greater potential to be unethical.
- Privacy infringement is **not identical** to 'mind-reading' ethical infringement.
- **User input** is the most ethically relevant feature to consider.