

# Shedding light on motor-independent communication

Citation for published version (APA):

Nagels-Coune, L. M. J. (2024). *Shedding light on motor-independent communication: fNIRS-based brain-computer interfacing for everyday life*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20240418ln>

**Document status and date:**

Published: 01/01/2024

**DOI:**

[10.26481/dis.20240418ln](https://doi.org/10.26481/dis.20240418ln)

**Document Version:**

Publisher's PDF, also known as Version of record

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.umlib.nl/taverne-license](http://www.umlib.nl/taverne-license)

**Take down policy**

If you believe that this document breaches copyright please contact us at:

[repository@maastrichtuniversity.nl](mailto:repository@maastrichtuniversity.nl)

providing details and we will investigate your claim.

## **Shedding Light on Motor-Independent Communication: fNIRS-based Brain-Computer Interfacing for Everyday Life**

Patients with locked-in syndrome are almost completely paralyzed while at the same time being fully awake and aware. These fully conscious humans are in need of motor-independent communication. A brain-computer interface (BCI) circumvents normal output pathways through use of voluntarily evoked brain signals. A BCI thus translates brain activation into intended meaning. In this thesis, functional near-infrared spectroscopy (fNIRS) is used to measure hemodynamic brain signal changes in the context of a BCI. The three studies in this thesis aimed to develop and validate straightforward, robust, efficient and cost-effective communication paradigms that can be tailored to individual users and eventually be used in daily life. In **chapter 2**, a binary fNIRS-BCI was tested with mental drawing for “yes” and resting for “no”. In **chapter 3**, a binary fNIRS-BCI with spatiotemporal encoding was tested, *i.e.*, unique imagery tasks and time windows for each answer option. In both studies, roughly half of the participants were able to communicate using the binary fNIRS-BCI. In **chapter 4**, participants used a four-choice BCI with a single mental task. All six participants could communicate using the fNIRS-BCI via three sensory modalities (visual, auditory and tactile) across three consecutive days. Two participants even communicated using the fNIRS-BCI in a cafeteria. The results in all three chapters show that fNIRS-BCIs are promising and worth further development and investigation in clinical contexts.