FROM ACOUSTIC VIBRATIONS TO NEURAL OSCILLATIONS: USING LOW-INTENSITY TRANSCRANIAL FOCUSED ULTRASOUND TO CONTROL THE RHYTHMS OF THE BRAIN

A Data Management Plan created using DMPonline.be

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Project abstract:

Neural oscillations underly many healthy and pathological brain processes. Gamma and alpha oscillations are associated with memory and vision, while some brain diseases are treated by disrupting pathological oscillations. A neuromodulation technology to control neural oscillations in a safe, spatially precise and non-invasive way would have great potential as a research tool for cognitive neuroscientists and as a therapeutic tool for clinicians. Low-intensity transcranial focused ultrasound (TUS) is a non-invasive technology that uses high-frequency sound to stimulate the brain. Studies show TUS is safe in humans and may have a range of neuromodulatory effects. However, TUS is an emerging technology. Its full potential, working mechanisms and optimal parameters have yet to be discovered. Here, we will use a rat model to develop a novel TUS approach for controlling neural oscillations – oscillatory TUS (o-TUS). We will use cutting edge high-density neural probes to characterize the TUS mechanism. We will then translate o-TUS to humans and use it to manipulate alpha oscillations in visual cortex in healthy volunteers. The electrophysiological effects of o-TUS in humans will be quantified via EEG. Finally, o-TUS will be used to modulate visual perception. Thus, this project will develop and translate a novel approach for using TUS to control neural oscillations and provide new mechanistic insight. If successful, o-TUS will have wide impact on cognitive and clinical neuroscience.

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DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

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GDPR

GDPR

Have you registered personal data processing activities for this project?

- Yes

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Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

Articles for a literature study and as a basis to write papers will be used. Raw data from neural recordings and tFUS will be analyzed, processed and disclosed to the public. Statistical analysis of this data and its results will also be data types of my project. Physiological data of the rats will be obtained as well. cFOS images, siRNA sequences, immunohistochemistry data from the safety staining, data from the western blot experiments, genomics data and post-mortem brain tissue will also be acquired. In healthy volunteers EEG data, MRI data and behavioral paradigm data will be collected. Other data types that will be generated are Matlab scripts, figures made for publications and presentations, PowerPoints, papers, posters and 3D printed cones for the tFUS device.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

Myles Mc Laughlin will be responsible for all data storage during and after the project.
Central network drives and external hard disks will be used during and after the project to store the digital data since they back up automatically and are relatively safe. A lab journal will be used to monitor rats' physiological parameters which will also be transferred to a central drive. The blueprints of the cones can be saved digital as well but the 3D printed versions will be stored in a storage space in the lab together with printed posters and other materials. Results from Western blots and immunohistochemistry will also be digitalized. A freezer will store the brain tissue before analysis of the slices. Data will be preserved for minimum 5 years after the project. Lab serves with a capacity of 10 TB are available

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

N/A

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

Personal data from the healthy volunteers will be collected. This will be stored on a password secured serve which is automatically backed up

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

A large amount of data will be obtained so it is important to have enough space to store this for a long time. Currently, with the central network drives this is not really a hurdle

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FWO DMP (Flemish Standard DMP)

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1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
NePo	32channel neural recording probe	New data	Digital	Experimental	.dat	<1TB	
NeuroPixels	Neuropixels recording probe	New data	Digital	Experimental	.dat	<5TB	
Matlab scripts	Matlab scripts to analyses data	New Data	Digital	Software	.m, .mat	<1GB	
Histology	Safety staining and channel blocker	New Data	Digital and physical	Experimental	.img	<100GB	Slides from 100 rats
Cones	Cones made for transducer	New data	Digital and physical	Experimental	.csv	<1GB	Phyiscal cones
siRNS	siRNA sequences	New Data	Digital	Experimental	.txt	<1GB	
Genomics	Data from RNA sequence	New Data	Digital	Experimental	fastq	<100GB	
EEG	EEG data from healthy volunteers	New Data	Digital	Experimental	.biosemi	<1TB	
MRI	MRI scan of healthy volunteers heads	New Data	Digital	Experimental	.img	<1TB	
Models	Acoustic modeling data	New data	Digital	Simulations	.csv	<1TB	

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

N/A

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- Yes, human subject data
- Yes, animal data

Ethical approval is necessary, and has been obtained for both the animal and healthy volunteer experiments.

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- Yes

Personal data collection will be limited to subject name, age, address and meeting the inclusion criteria. This data will not be used in the experiment but will be stored on a secured document. All healthy volunteer experiment data will be link to an anonymised subject number to make it unidentifiable.

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

All information about the collection of the data will be written down in notebooks, methodology sections in papers, README.txt files and metadata.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- Yes

In the lab there is a structure in place to arrange the data and metadata. For every analysis there is a script that describes the data.

3. Data storage & back-up during the research project

Where will the data be stored?

Shared network drives & large volume storage from the KU Leuven will be used.

How will the data be backed up?

Every night a back up will be made by the KU Leuven ICT department.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

There is sufficient storage, 10 TB are still available and there is still the possibility to purchase more storage

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The data is password protected and can only be accessed by people from the lab

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

The costs are covered by my PI from project costs and are expected to be around 1500 euro for 4 years.

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All digital data will be preserved for at least 5 years after the project end

Where will these data be archived (stored and curated for the long-term)?

They will be stored at the same place as they are during the project.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

To store the data on the L-drive, the cost is 500 euro for 5 TB a year. So to store more or less 5 TB for 5 years, 2500 euro costs are expected. The PI (Myles Mc Laughlin) will cover this.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in an Open Access repository

Data that will be collected with the Neuropixels probe will be made publicly available.

If access is restricted, please specify who will be able to access the data and under what conditions.

N/A

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

Currently not known

When will the data be made available?

After publication

Which data usage licenses are you going to provide? If none, please explain why.

Creative Commons Attribution license.

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- No

What are the expected costs for data sharing? How will these costs be covered?

No extra costs are expected as the data will be stored anyway. If others want to access it, a request can be made and access can be provided.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Myles Mc Laughlin

Who will manage data storage and backup during the research project?

Myles Mc Laughlin

Who will manage data preservation and sharing?

Myles Mc Laughlin

Who will update and implement this DMP?

Myles Mc Laughlin