FWO DMP Template - Flemish Standard Data Management Plan

Project supervisors (from application round 2018 onwards) and fellows (from application round 2020 onwards) will, upon being awarded their project or fellowship, be invited to develop their answers to the data management related questions into a DMP. The FWO expects a **completed DMP no later than 6 months after the official start date** of the project or fellowship. The DMP should not be submitted to FWO but to the research co-ordination office of the host institute; FWO may request the DMP in a random check.

At the end of the project, the **final version of the DMP** has to be added to the final report of the project; this should be submitted to FWO by the supervisor-spokesperson through FWO's e-portal. This DMP may of course have been updated since its first version. The DMP is an element in the final evaluation of the project by the relevant expert panel. Both the DMP submitted within the first 6 months after the start date and the final DMP may use this template.

The DMP template used by the Research Foundation Flanders (FWO) corresponds with the Flemish Standard Data Management Plan. This Flemish Standard DMP was developed by the Flemish Research Data Network (FRDN) Task Force DMP which comprises representatives of all Flemish funders and research institutions. This is a standardized DMP template based on the previous FWO template that contains the core requirements for data management planning. To increase understanding and facilitate completion of the DMP, a standardized **glossary** of definitions and abbreviations is available via the following link.

1. General Project Information	
Name Grant Holder & ORCID	**Peter Janssen 0000-0002-8463-5577**
Contributor name(s) (+ ORCID) & roles	**Tom Theys co-promotor 0000-0001-7595-3234** **Renaud Detry co-promotor 0000-0003-0597-1167**
Project number[1] & title	**C14/22/134** NEUROBOTICS: BLENDED BRAIN-MACHINE CONTROL FOR HUMAN ASSISTANCE USING HYBRID SMART SYSTEMS
Funder(s) GrantID[2]	**C14/22/134**
Affiliation(s)	X KU Leuven ☐ Universiteit Antwerpen ☐ Universiteit Gent ☐ Universiteit Hasselt ☐ Vrije Universiteit Brussel ☐ Other: Provide ROR[3] identifier when possible:

[1] "Project number" refers to the institutional project number. This question is optional since not every institution has an internal project number different from the GrantID. Applicants can only provide one project number.

[2] Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

[3] Research Organization Registry Community. https://ror.org/

Please provide a short project description	Connecting brains to machines will change the lives of thousands of patients suffering from brain or spinal cord disorders. However, driving the many inputs of an assistive articulated arm or wheelchair through brain signals only has proven impractical and conversely, artifical control systems have not yet reached a point where they can reliably cope with the complexity of the real world entirely on their own. If we want to help patients with brain or spinal cord injuries regain autonomy in their daily life by means of robotics proxies, it is crucial to integrate the subject's brain signals with the artificial-intelligence layers of their robotic helpers. Therefore, we want to decode neural activity recorded in human and nonhuman primates by means of an invasive brain-machine interface and blend these signals with computer vision and robotic systems into 'hybrid' intelligent systems, with human-robot shared control as a guiding principle. Our multidisciplinary approach will pave the way for restoring independent living by means of smart robot assistance in patients with untreatable brain disorders.

2. 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[4].

				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
Electrophysiological recordings and behavioral data in monkeys		☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Observational ☒ Experimental ☐ Compiled/ aggregated data ☐ Simulation data ☐ Software ☐ Other ☐ NA	☐ .por ☐ .xml ☐ .tab ☐ .csv ☐ .pdf ☐ .txt ☐ .rtf ☐ .dwg ☐ .tab ☐ .gml ☒ other: Matlab ☐ NA	☐ < 100 MB ☐ < 1 GB ☐ < 100 GB ☐ < 1 TB ☐ < 5 TB ☒ < 10 TB ☐ < 50 TB ☐ > 50 TB ☐ NA	
Electrophysiological recordings and behavioral data in patients		☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Observational ☒ Experimental ☐ Compiled/ aggregated data ☐ Simulation data ☐ Software ☐ Other	☐ .por ☐ .xml ☐ .tab ☐ .csv ☐ .pdf ☐ .txt ☐ .rtf ☐ .dwg	☐ < 100 MB ☐ < 1 GB ☐ < 100 GB ☐ < 1 TB ☐ < 5 TB ☐ < 10 TB ☒ < 50 TB ☐ > 50 TB	

[4] Add rows for each dataset you want to describe.

				☐ NA	☐ .tab ☐ .gml ☒ other: Matlab ☐ NA	☐ NA	
Object manipulation datasets, that include images of objects and scenes and associated manipulation parameters (ESAT)		☒ Generate new data ☐ Reuse existing data	☒ Digital ☐ Physical	☐ Observational ☐ Experimental ☐ Compiled/ aggregated data ☒ Simulation data ☒ Software ☐ Other ☐ NA	This project will generate data through robot experiments. The data will consist of time-series of sensor and robot data, including camera images and robot trajectories. The data will be released in open formats when available (for images, for instance), or in carefully-documented, standard-based formats for less common data (trajectory data). Here, we will base our formats on open standards such as HDF or XML. In addition to sensor data, we will include contextual data such as a webcam feed of the experiment, and, when available, the	☐ < 100 MB ☐ < 1 GB ☐ < 100 GB ☒ < 1 TB ☐ < 5 TB ☐ < 10 TB ☐ < 50 TB ☐ > 50 TB ☐ NA	

					hand-made annotations that encode the objective of the task.		

GUIDANCE:

DATA CAN BE DIGITAL OR PHYSICAL (FOR EXAMPLE BIOBANK, BIOLOGICAL SAMPLES, …). DATA TYPE: DATA ARE OFTEN GROUPED BY TYPE (OBSERVATIONAL, EXPERIMENTAL ETC.), FORMAT AND/OR COLLECTION/GENERATION METHOD.

EXAMPLES OF DATA TYPES: OBSERVATIONAL (E.G. SURVEY RESULTS, SENSOR READINGS, SENSORY OBSERVATIONS); EXPERIMENTAL (E.G. MICROSCOPY, SPECTROSCOPY, CHROMATOGRAMS, GENE SEQUENCES); COMPILED/AGGREGATED DATA[5] (E.G. TEXT & DATA MINING, DERIVED VARIABLES, 3D MODELLING); SIMULATION DATA (E.G. CLIMATE MODELS); SOFTWARE, ETC.

EXAMPLES OF DATA FORMATS: TABULAR DATA (.POR,. SPSS, STRUCTURED TEXT OR MARK-UP FILE XML, .TAB, .CSV), TEXTUAL DATA (.RTF, .XML, .TXT), GEOSPATIAL DATA (.DWG,. GML, ..), IMAGE DATA, AUDIO DATA, VIDEO DATA, DOCUMENTATION & COMPUTATIONAL SCRIPT.

DIGITAL DATA VOLUME: PLEASE ESTIMATE THE UPPER LIMIT OF THE VOLUME OF THE DATA PER DATASET OR DATA TYPE.

PHYSICAL VOLUME: PLEASE ESTIMATE THE PHYSICAL VOLUME OF THE RESEARCH MATERIALS (FOR EXAMPLE THE NUMBER OF RELEVANT BIOLOGICAL SAMPLES THAT NEED TO BE STORED AND PRESERVED DURING THE PROJECT AND/OR AFTER).

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.	

[5] These data are generated by combining multiple existing datasets.

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, please describe these issues further and refer to specific datasets or data types when appropriate.	☒ Yes, human subject data ☒ Yes, animal data ☐ Yes, dual use ☐ No If yes, please describe: electrophysiological recordings obtained in nonhuman primates and in patients.
Will you process personal data[6]? If so, briefly describe the kind of personal data you will use. Please refer to specific datasets or data types when appropriate. If available, add the reference to your file in your host institution's privacy register.	☐ Yes ☒ No If yes: - Short description of the kind of personal data that will be used: - Privacy Registry Reference:
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.	☐ Yes ☒ No If yes, please comment:
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 to what data they relate and what restrictions are in place.	☐ Yes ☒ No If yes, please explain:

[6] See Glossary Flemish Standard Data Management Plan

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 to what data they relate and which restrictions will be asserted.	☐ Yes ☒ No If yes, please explain:

3. 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).	1 The electrophysiological recordings and behavioral data obtained in monkeys will be stored on the KU Leuven storage facility. All data files will be in Matlab format according to a standard developed in the research group. Together with the data, we will store an explanatory word file detailing the data structure (data organized per monkey and per experimental task). All other imaging data (anatomical MRIs, CT scans) will be stored at the same place in a format that is readable with MRICro (freeware). 2 The anonymized recordings and imaging data (CT images and fMRI) obtained in human patients will be stored at the storage facility of the university hospital Leuven. An explanatory word file describing the task and stimuli will be stored at the same place.

Will a metadata standard be used to make it easier to **find and reuse the data**? If so, please specify which metadata standard will be used. If not, please specify which metadata will be created to make the data easier to find and reuse. *REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.*	☐ Yes ☒ No If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used: If no, please specify (where appropriate per dataset or data type) which metadata will be created: There is no internationally accepted metadata standard for experiments in nonhuman primates or patients. The behavioral and electrophysiological data will be stored in Matlab format, in a format that has been developed in the research group. All data files will be stored with the date on which they were acquired and the name of the subject. We will add an explanatory text file to describe the structure of the data.

4. Data Storage & Back-up during the Research Project	
Where will the data be stored?	Data obtained in animals will be stored at the storage of KU Leuven, the data obtained in patients will be stored at the storage facility of the university hospital Gasthuisberg.

How will the data be backed up? *WHAT STORAGE AND BACKUP PROCEDURES WILL BE IN PLACE TO PREVENT DATA LOSS? DESCRIBE THE LOCATIONS, STORAGE MEDIA AND PROCEDURES THAT WILL BE USED FOR STORING AND BACKING UP DIGITAL AND NON-DIGITAL DATA DURING RESEARCH.*[7] *REFER TO INSTITUTION-SPECIFIC POLICIES REGARDING BACKUP PROCEDURES WHEN APPROPRIATE.*	The data will be stored at the KU Leuven storage and at the university hospital storage with automatic daily backups.
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 ☐ No If yes, please specify concisely: We expect to buy an additional 15 Tb of storage space. If no, please specify:
How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons? *CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY, NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND TRANSFERRED DATA ARE SAFE.* [7]	We will create a separate project folder on the L drive of KU Leuven with access restricted to the PIs and the PhD students involved in the project. For the human data, access will be restricted to the PI involved (Tom Theys) and the PhD students who will perform the experiments.

[7] Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

What are the expected costs for data storage and backup during the research project? How will these costs be covered?	The storage will cost approximately 150 euro per Tb per year. This will be paid from the C1 grant during the period of the grant (has been calculated in the consumables), and from other sources such as overhead of European projects in the years afterwards.

5. 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 data will be retained until at least 10 years after the end of the project.
Where will these data be archived (stored and curated for the long-term)?	The human data will be stored at the storage facility of the university hospital Gasthuisberg until 5 years after the end of the project, and on permanent hard drives that will be kept in the hospital after that time.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?	The database will be approximately 15 Tb, which will amount to a total cost of 11250 euro for the 5 years retention period. This cost will be covered from overheads of European projects.

6. Data Sharing and Reuse	
Will the data (or part of the data) be made available for reuse after/during the project? Please explain per dataset or data type which data will be made available. *NOTE THAT 'AVAILABLE' DOES NOT NECESSARILY MEAN THAT THE DATA SET BECOMES OPENLY AVAILABLE, CONDITIONS FOR ACCESS AND USE MAY APPLY. AVAILABILITY IN THIS QUESTION THUS ENTAILS BOTH OPEN & RESTRICTED ACCESS. FOR MORE INFORMATION: HTTPS://WIKI.SURFNET.NL/DISPLAY/STANDARDS/INFO-EU-REPO/#INFOEUREPO-ACCESSRIGHTS*	☐ Yes, in an Open Access repository ☒ Yes, in a restricted access repository (after approval, institutional access only, …) ☐ No (closed access) ☐ Other, please specify: All patient data will be anonymized. Patients will be asked to give consent for sharing of the data. All datafiles will be made available upon reasonable request and after the studies have been published.
If access is restricted, please specify who will be able to access the data and under what conditions.	Tom Theys will be able to access the human data, Peter Janssen will be able to access the animal data.
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 per dataset or data type where appropriate.	☐ Yes, privacy aspects ☐ Yes, intellectual property rights ☒ Yes, ethical aspects ☐ Yes, aspects of dual use ☐ Yes, other ☐ No If yes, please specify: All patient data will be anonymized. Patients will be asked to give consent for sharing of the data.
Where will the data be made available? If already known, please provide a repository per dataset or data type.	Because of the large volume of the data, we will share the data upon reasonable request. The human data will be available on request after signing a data sharing agreement.

When will the data be made available? *This could be a specific date (dd/mm/yyyy) or an indication such as 'upon publication of research results'.*	We will make the data available after publication of the results.
Which data usage licenses are you going to provide? If none, please explain why. *A data usage license indicates whether the data can be reused or not and under what conditions. If no licence is granted, the data are in a grey zone and cannot be legally reused. Do note that you may only release data under a licence chosen by yourself if it does not already fall under another licence that might prohibit that.* *Example Answer: E.g. "Data from the project that can be shared will be made available under a Creative Commons Attribution license (CC-BY 4.0), so that users have to give credit to the original data creators."* [8]	None
Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, please provide it here. *Indicate whether you intend to add a persistent and unique identifier in order to identify and retrieve the data.*	☐ Yes ☒ No If yes:
What are the expected costs for data sharing? How will these costs be covered?	We estimate that cost for data sharing will be less than 500 euros. This will be covered by the C1 grant.

[8] Source: Ghent University Generic DMP Evaluation Rubric: https://osf.io/2z5g3/

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	Peter Janssen will be responsible for data documentation and metadata for the data obtained in animals, and the virtual reality data. Tom Theys will be responsible for the human data. Renaud Detry will be responsible for the simulation data.
Who will manage data storage and backup during the research project?	All three PIs will be responsible for data storage during the project. Backup will be provided by KU Leuven and UZ Leuven.
Who will manage data preservation and sharing?	All three Pis will be responsible for data preservation and sharing.
Who will update and implement this DMP?	The PIs bear the end responsibility of updating & implementing this DMP.