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Working

During data acquisition

Version 10

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Spinoza Centre, REC-L


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ABSTRACT

This protocol lists all the steps necessary to run your MRI experiment/data acquisition safely and in a way that yields high-quality data. Moreover, if you use the centre's QC/preprocessing service, it lists the steps necessary to make sure we can convert the data into BIDS and run them through the QC/preprocessing pipelines.

PROTOCOL STATUS

Working

We use this protocol in our group and it is working

GUIDELINES

Please make sure you're aware of the centre's user policy during scanning

- There should be an ERO (Emergency Response Officer, in Dutch: BHV, bedrijfshulpverlener) of REC L present in building L. Tinka Beemsterboer monitors this using your Calpendo bookings.
- The MR Operator specified for the booking should have a valid scan certificate of the Spinoza REC.
- All personnel who regularly assist during scanning should have a valid safety certificate.
- The MR Operator is responsible for screening participants and decides whether the participant may enter the MR (control) room.
- The MR Operator is responsible for providing information to the participant about the MRI procedure.
- The MR Operator is responsible for handling the console, inside MR room and at the MR computer.
- The MR Operator stays at the console or in the scanner room at all time when another person is in the scanner room.
- The MR Operator decides whether a person (also non-participants) is allowed to enter the scanner room.
- The MR Operator places PPU (peripheral pulse sensor) and Resp devices.
- The MR Operator sends data files from the scanner (like PPU and Resp data and MR data) to fmriProject or sFTP folder. No USB sticks are allowed in the MR computer, we want to avoid viruses.
- The researcher is responsible for checking whether the data was compeltely transferred to the fmriProject or sFTP folder directly after the scan session. Files are removed from the scan computer within 2 days.
- If the MR Operator or researcher notice something irregular on the scan of the participant it is possible to let this send to a radiologist. The participant should not be notified about this, the GP contacts the participant if it is an abnormality with clinical relevance (according to the radiologist and GP). More information about the procedure will be provided to the researchers starting a project and taking the MR Operator course.
- The researcher is responsible for a working paradigm / experiment and for giving instructions to the participant about the task and usage of response buttons.
- The researcher is responsible for handling additional stimulus equipment (except PPU and Resp). Most Spinoza REC staff (scan assistants) can help with the Eyetracker.
- The researcher should have a valid certificate, provided by the Spinoza REC-L, for using additional stimulus equipment.
- The researcher stays at the Spinoza Center until his or her last participant left the building.

SAFETY WARNINGS

BEFORE STARTING

Book your scanning hours at spinozarec.calpendo.com.

Please try to make a feasible planning. One thing to take into account is the group of participants; for example, participants belonging to clinical populations are harder to find and to schedule than students.

There are a number of 'booking rules' to assure an efficient usage of the scanner for all users. If there are urgent reasons to deviate from these rules, place the booking and send an email to Tinka Beemsterboer mentioning the booking and the reason to deviate from the booking rules. Tinka decides to approve or deny the booking.
Please try to make the MRI-bookings as follows (note that you only have to satisfy one of the conditions):

- A booking should be at least 3 hours
- **or** 'connecting' to another booking
- **or** starting at 9h or 18h (Mon-Fri)
- **or** finishing at 18h (mon-Fri).

Moreover, please take note of the following:

- **Weekends:** try to book slots consecutive to other bookings. Placing the first booking has no restrains concerning time.
- **Weekends and evening (after 18h):** For scanslots during the weekends or evening we always have to book a ScA because an ERO needs to be present at all time during test sessions. Please try to book your weekend and evening slots well in advance. If you do book it last minute, please send an email or text message to Tinka Beemsterboer.
- **Scanning Assistant:** When you don't have a scan certificate yet, you have to request a ScA for your scanslot. Make sure to choose "scanassistant" for "MROperator". Once a ScA is found, the booking will be approved. Make sure to book this well in advance. If you do book it last minute, please send an email or Whatsapp to Tinka Beemsterboer.

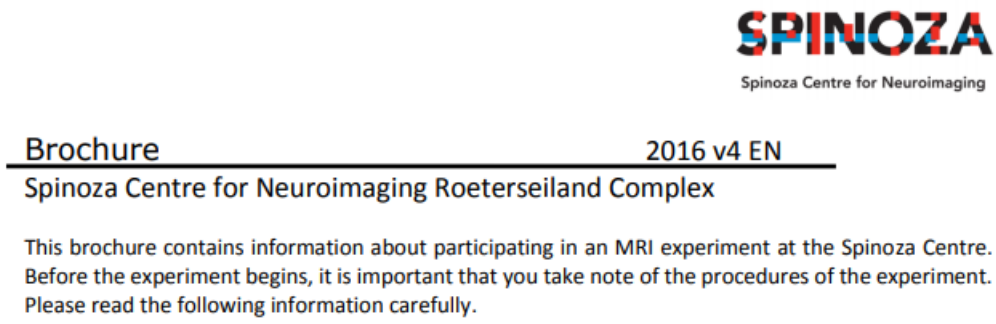
Make sure you're aware of the user policy

1 The user policy can be found in this protocol's "Guidelines" section.

Inform your participant about the procedure/experiment

2 **Make sure your participant is well and thoroughly informed about the MRI procedure in general and your experiment specifically.**

Always give the participant the opportunity and time to read the *information folder* about MRI research at our centre, even when the particpant is late for the appointment.


SPINOZA
Spinoza Centre for Neuroimaging

Brochure 2016 v4 EN
Spinoza Centre for Neuroimaging Roeterseiland Complex

This brochure contains information about participating in an MRI experiment at the Spinoza Centre.
Before the experiment begins, it is important that you take note of the procedures of the experiment.
Please read the following information carefully.

Check forms

3 **MRI screening form**

Before you let the participant into the operating room, make sure your participant is actually allowed to go into the operating room (i.e., if she/he is 'MRI-safe'). **As such, you should have the participant fill in the screening form *before* the participant has**

entered the operating room. While there is virtually no magnetic field present in the operating room, we do not want to take *any* safety risks.

After checking the screening form (pay attention to whether the participant actually signed the form), discuss any potential safety issues (tattoos, surgeries, etc.) with the participant again ***outside*** the operating room. If you're uncertain whether it's safe for the participant to participate in the experiment, you may consult Tinka or Lukas (whose phone numbers should be known by this stage of your experiment). Almost always, however, the recommendation is to send the participant home in case of uncertainty.

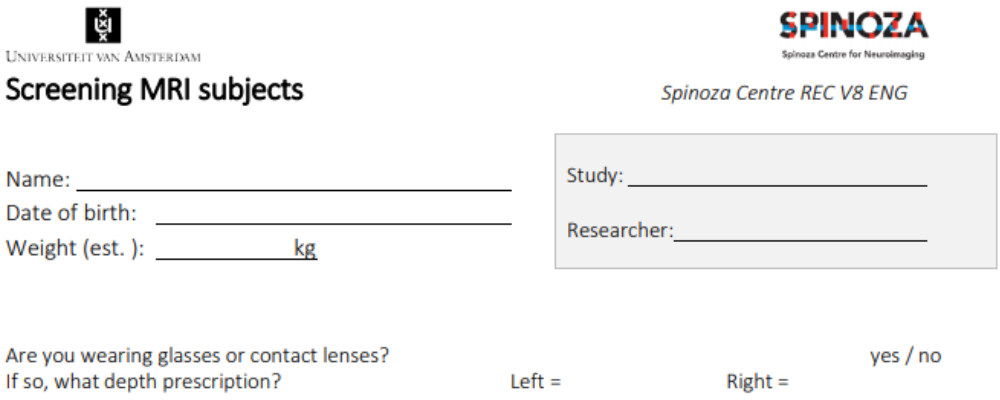
SAFETY INFORMATION

Things to remember w.r.t. participant anonymity:

- Never put the subject-identifier (e.g., sub-01) on the screening form (or any other document, for that matter). This is to ensure that there is never a connection between the actual participant's personal information and his/her subject-identifier;
- The above also holds for any online/offline 'log' or personal schedule of your experiment: never put the participant's personal info (name, D.O.B., address, etc.) and subject-identifier (e.g., sub-01) in the same document

Technically, this "connection" between a participant's personal information and subject-identifier may exist for 48 hours (coinciding with the participant's right to withdraw his/her data from the experiment), but afterwards it should be definitively 'disconnected'. As such, we recommend to err on the safe side and *never* connect these two source of information (unless you need this for your experiment, e.g. future sessions, but note that this should be explicitly approved by the ethical committee).

After the experiment, put the Screening form in the designated mailbox.



UNIVERSITEIT VAN AMSTERDAM

Screening MRI subjects

SPINOZA
Spinoza Centre for Neuroimaging

Spinoza Centre REC V8 ENG

Name: _____
Date of birth: _____
Weight (est.): _____ kg

Study: _____
Researcher: _____

Are you wearing glasses or contact lenses? yes / no
If so, what depth prescription? Left = Right =

4 General Practitioner Informed Consent

In addition to the screening form, the participant should fill in the 'General Practitioner Informed Consent', in which the participant writes down the name and contact details of his/her general practitioner (GP). This information is needed in the unlikely case that the researcher notices a potential structural abnormality in one of the anatomical scans. *Note:* if the participant does not have a GP or does not want to share the name/contact details or BSN or his/her GP, he/she is *not* allowed to participate in the experiment.

If there were no abnormalities noticed during the scan session, the form should be put in the blue (confidential) container upstairs. The form will be destroyed.

Informed Consent MRI General Practitioner

There is a small chance that we find abnormality in your brain during an MRI experiment. Often, these abnormalities are small deviations or normal variances; but in certain cases this could be severe (such as a brain tumour). If this is the case, the information will be

5 **Study-specific Informed Consent**

Apart from the GP Informed Consent, you should have the participant read and sign an informed consent specific to your experiment, which should have been approved by the university's ethical committee (EC) of Medical Ethical Committee (METC).

Prepare examination for preprocessing/qc (BIDS-compatible)

6 **The information below is only relevant if you want to use the centre's preprocessing/QC service.**
Make sure your exam cards are BIDS-formatted.

As discussed earlier, if you will use the centre's QC/preprocessing pipeline(s), it is of utmost importance to make sure our tool is able to convert the raw data to the BIDS-format and subsequently use the FMRIPREP and MRIQC pipelines. While during the pilot the exam cards were probably made such that they're already BIDS-compatible, please check the names of your exam cards once more; use the points outlined below to do a final check of the names of your exam cards:

- Are all the placeholders, i.e. *(this_is_a_placeholder)*, replaced with the relevant information? For example, *task-(taskname)_run-(nr)_bold* should be named (for example) *task-workingmemory_run-1_bold*
- Do all the exam cards have unique names? It's easy to have multiple runs of particular scan, but forgetting to update the *run-(nr)* field!

If you've double-checked the names of your exam cards, you can proceed to the next step!

7 **Use BIDS-compatible subject-identifiers**
Using BIDS-compatible subject-identifiers (e.g., sub-01) is very important for our BIDS-conversion and preprocessing/qc pipelines. You should use this identifier when creating a new "examination".

If you have a simple experiment and you don't have any (between-subject) factor in your experiment, and only have a single session you may skip the information about the subject identifiers in this step. As such, the following subject-identifier is completely valid (and probably the format most researchers will use):

- sub-01

Always "zero-pad" your numbers! That means: don't use sub-9, sub-10, etc., but do use: sub-09, sub-10, etc.

If you have any (between-subject) factor in your experiment, and/or multiple sessions make sure you use the BIDS format for subject identifiers in a correct manner. According to the BIDS-specification, subject identifiers should be formatted as:

- sub-[condition](number)[_ses-(identifier)]

Here, [condition] refers to an optional condition-identifier, helpful in between-subject designs (e.g., control vs. treatment). The (number) field is a mandatory number (e.g., '01' or '25'); the [_ses-(identifier)] part is an optional field to specify the specific session, in case of experiments with multiple sessions (e.g., _ses-01, or _ses-post).

For example, suppose you are testing 20 subjects, each two sessions, of which the first 10 subjects are in the 'control' condition ("CON") and the last 10 subjects are in the 'treatment' condition ("TRE"). In that case, you could use the following identifiers:

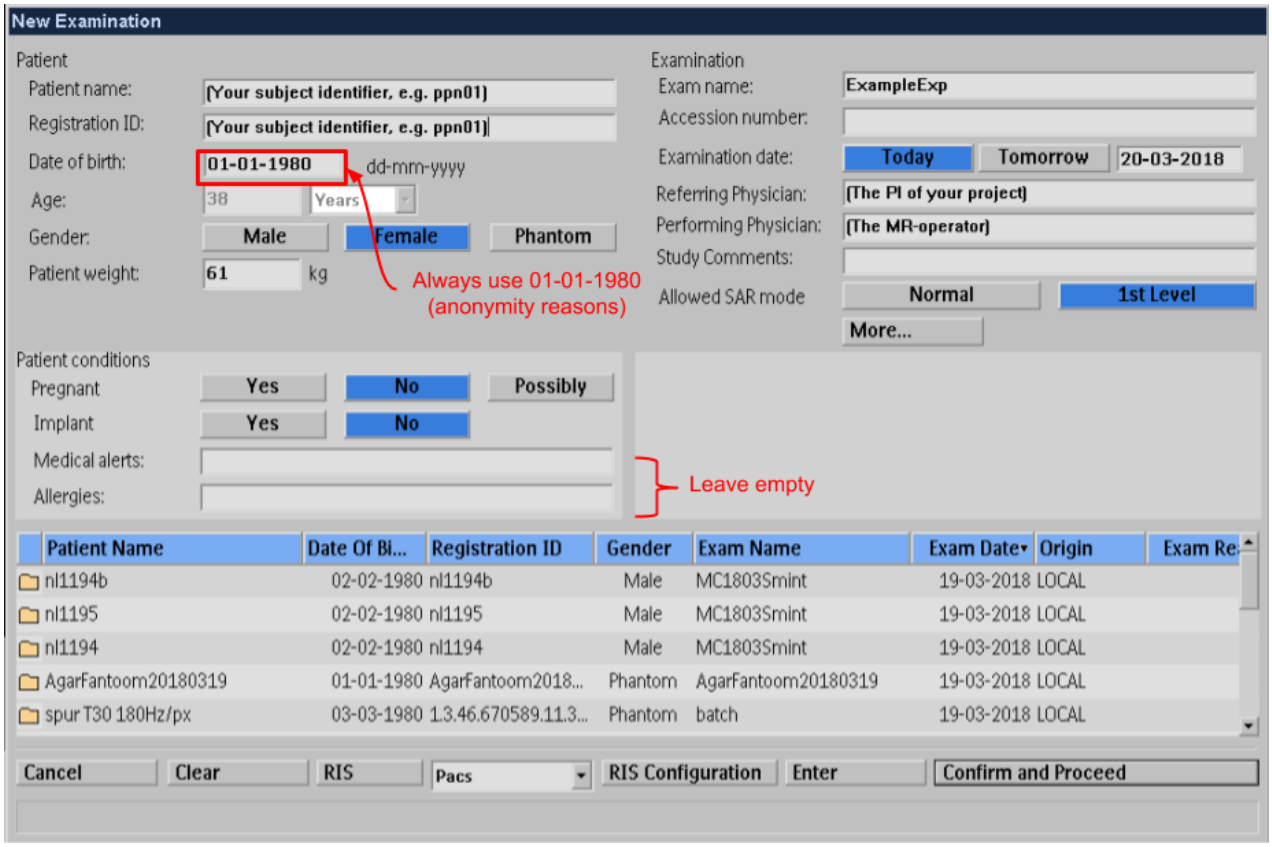
- sub-CON01_ses-1
- sub-CON01_ses-2

- sub-CON02_ses-1
- sub-CON02_ses-2
- ...
- sub-TRE20_ses-1
- sub-TRE20_ses-2

Note that you *only* have to use these identifiers in your patient name/registration ID fields of the "examination" (see next step); you **do not** have to add this to the exam cards.

Create a new examination

8 You can create a new examination on the scan-computer by clicking on 'Patients' in the menu bar and subsequently on 'New administration'. Here, you have to fill in some information about the participant. An example can be found in the image below:



Fill in the information as follows:

- **Patient name***: your BIDS-compatible subject identifier (more information below);
- **Registration ID**: same as patient name (i.e., your BIDS-compatible subject identifier);
- **Date of birth**: *always use 01-01-1980* (do ***not*** use the participant's real D.o.B. for anonymity reaons);
- **Gender**: fill in participant's gender;
- **Patient weight**: fill in participant's weight (is listed on screening form; this info is used to calculate the SAR);
- **Patient conditions**: the pregnant/implant fields should always be 'No', because these are strict **exclusion** criteria for participation at our centre. Leave the medical alerts/allergies fields empty (these are only relevant when using contrast agents);
- **Examination, exam name**: fill in whatever identifier you're using for your project (e.g., ExampleExp; preferably without spaces in the identifier);
- **Acession number**: leave empty;
- **Examination date**: Today;
- **Referring Physician**: the PI of your project;
- **Performing Physician**: the MR-operator;
- **Study Comments**: leave empty;
- **Allowed SAR mode**: 1st Level;

* If you use the centre's preprocessing/QC service, you need to be very specific about the subject-identifier. You can find some extra information about this in the previous step.

Safety check

9 Before entering the scanner room, **the MR-operator makes** sure to do a safety check together with the participant. Make sure he/she ...

- took his/her shoes off;
- took off her bra (if it contains metal, i.e. if i's underwired);
- his/her clothes aren't wet (if so, provide sweatpants and/or sweatshirt);
- wears 'covering' clothes (i.e., *not* shorts/skirts/tank tops/etc), otherwise skin-skin contact can cause loops (if necessary, provide sweatpants and/or sweatshirt);
- checks all of his/her pockets (of trousers, shirt, etc.);
- checks his/her hair for pins, clips, etc.;
- checks whether all of his/her jewelry (bracelets, necklaces, etc.) and watch are off (if the material is completely non-metallic, the participant doesn't have to remove it);

Also, check yourself whether the participant's clothes have any ferromagnetic pieces that may come off. In that case, we provide sweatpants and/or sweatshirts for the participant to wear instead.
After this check, make sure that you are yourself safe to enter the scanner room (i.e., check your pockets!). Afterwards, you can enter the scanner room with the participant; make sure to close the door after entering.

Note that it is the responsibility of the MR-operator to check wheter the participant may enter the scanner room. Also, the MR-operator has the final say in who may or may not enter the scanner room.

Communication with participants before/during scanning

10 MRI research can be quite 'intimidating' for participants, especially when they don't have any experience with MRI research.
As such, the MR-operator is responsible to explain what happens before (e.g., when putting the participant in the scanner) and during scanning.
The information given to the participant should at least include the following:

- There is a magnetic field active in de scanner room and therefore we have to make sure you are safe to go into the scanner room. We use this screening form and also we will check whether you have nothing of metal on your body before you enter the room;
- The scanner makes a lot of noise during scanning. For your comfort and for ear protection you'll get earplugs and headphones;
- You can't talk to us during the scans because of the noise, therefore you get an alarm button. Squeeze this button in case of an emergency or when you are don't want to continue with the scan.

We advise you to communicate with the participant (through the intercom) both *before* the start of the first scan and in between scans.
It is very important to make sure the participant is relaxed during scanning, both for ethical reasons (as participation is completely voluntary) and for reasons of data quality:
relaxed participants tend to move less which yields better-quality data! For this reason, it is advisable to remind the participant in between scans to move as little as possible (also in between scans, as to minimize the inhomogeneity of the magnetic field).

Copy (& rename) your physiology files

11

If you measure physiology (heart rate and respiration, or 'PPU/RESP' in Philips lingo), you'll have to copy it from the scan-computer to your export-folder.

Moreover, **if you want use the preprocess/QC service**, you'll have to rename the file to make sure it complies with the BIDS-format.
By default, the physiology-files are named 'SCANPHYSLOG*.txt'. To make it BIDS-compatible, rename it using the following format:

- sub-(identifier)[_ses-(identifier)]_task-(taskname)[_acq-(identifier)][_run-(nr)]_physio.txt

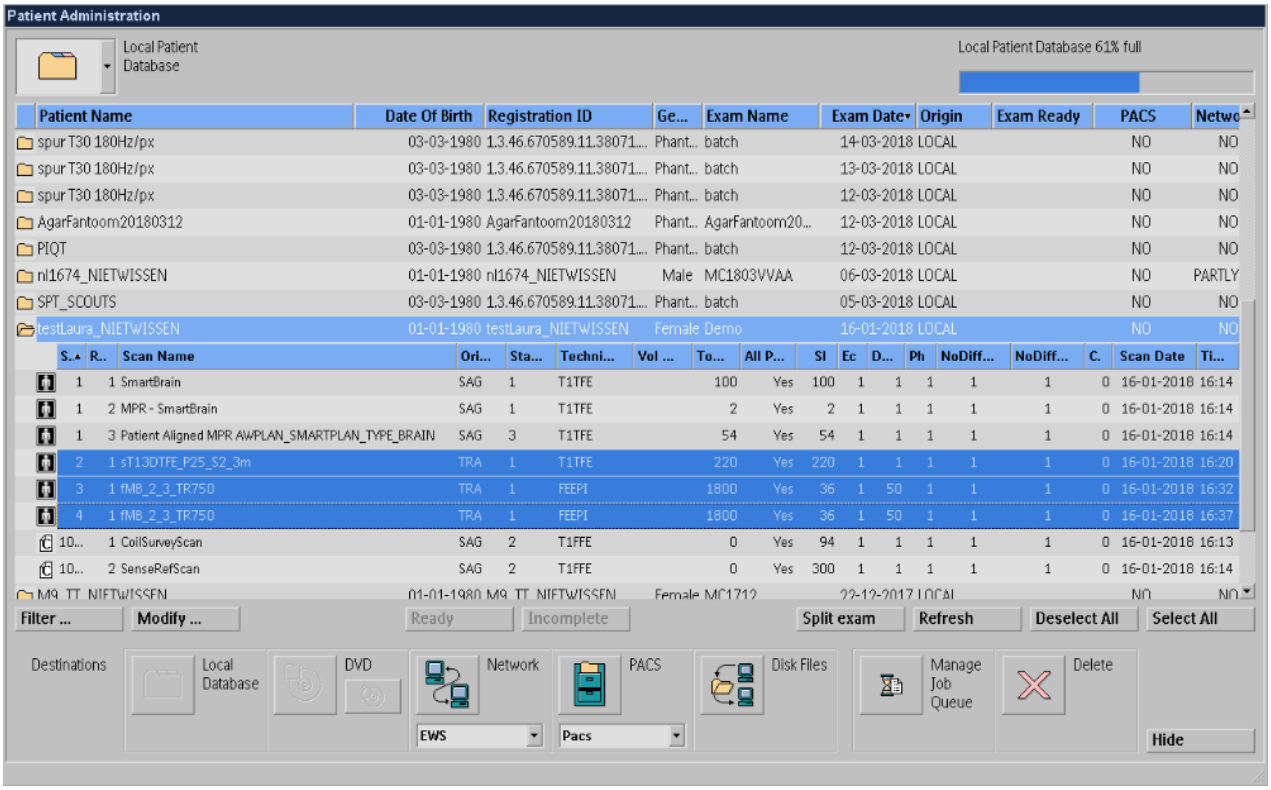
in which the parts in square brackets, [...], are optional. So, basically this is simply the concatenation of the subject identifier and the scan-name; importantly, the scan-identifier (most likely *_bold*) is replaced by *_physio*.

At this moment, we're not yet able to completely convert the physiology-files according to the BIDS-format (it's work-in-progress).

Export data

12 **After data acquistion, the MROperator exports the data to the 'fMRI Projects' folder (UvA researchers) or 'Dropbox' folder (external researchers)**.

- To export the data, click on 'Patients' in the menu bar and subsequently click 'Administration'
- Find the examination (participant) that you want to export. Double-click the relevant examination and select all relevant scans (you *won't need the following scans:* SmartBrain, MPR - SmartBrain, CoilSurveyScan, SenseRefScan, and B0_PreScan)

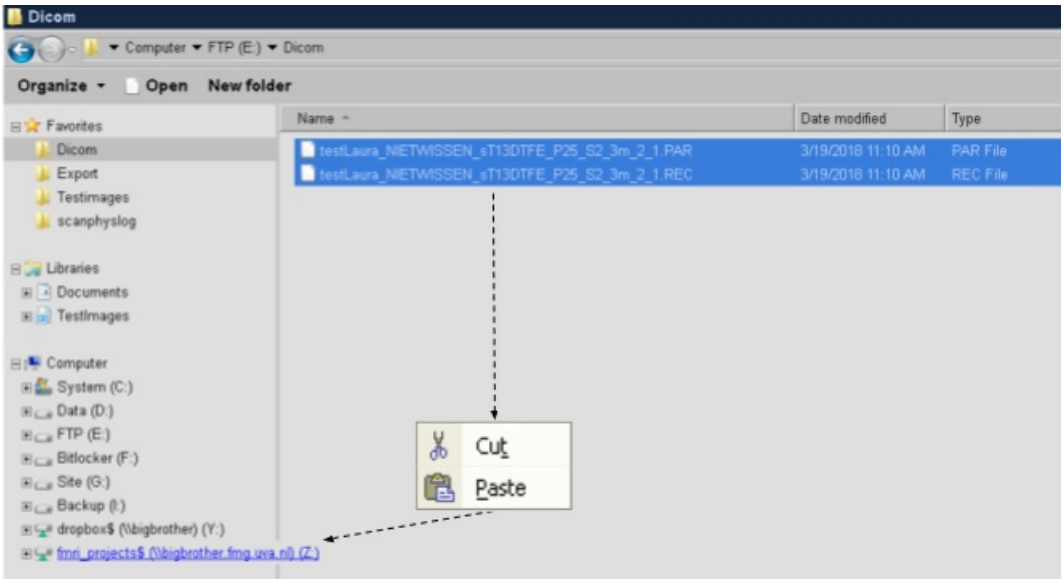


- Click on 'Disk Files'. This will prompt a new window with export options. Choose either 'Dicom Export' or 'Non Dicom Export' (we recommend 'Non Dicom Export'). In case of Non Dicom Export, *make sure to check the boxes next to the 'Use Scan Name' and 'Sort' options!*
- Also, for Non Dicom Export, you need to choose the format of your data (XML-REC, PAR-REC, NIfTI, FSL-NIfTI); we recommend PAR-REC (this is the native Philips format which contains most meta-data). For both types of export, you need to *first* export the data locally (you may use the default location *e:\dicom*). You can specify the path under the 'Destination:' box.

SAFETY INFORMATION

If you use the preprocessing/QC service, ***you have to use the Non Dicom Export with PAR/REC filetype.*** Do *not* export nifti-files as well (this will make the *bidsify*-pipline crash).

- Click 'Proceed' to start the export to the local drive
- After the local export has finished, go to the specified local path (e.g., *e:\dicom*) and simply cut & paste your files to your *own* export folder (e.g., cut from *e:\dicom\sub-01_T1w.PAR* and paste to *Z:/fMRI Project ExampleExp*)



SAFETY INFORMATION

WARNING: MRI-data is two days after acquisiton to make sure there is enough space on the hard disk for new scans. Make sure to export your data right after scanning and, importantly, the researcher should immediately check whether the data has been exported correctly.

Structure your export-data (preprocessing/QC service only)

13 Make sure your exported data is structured accordingly.

If your using the centre's QC/preprocessing service, it is important to structure your export folder in such a way that it allows our automatic BIDS-conversion tool to copy the data from your export folder to the analysis server, convert/run QC/preprocess it, and copy it back to your export folder. Our tools expect that you export your data to a subfolder called raw within your export folder. Within the raw folder, each subject (and optionally session) should get its own subfolder. For example, suppose you plan to scan 20 subjects, each two sessions, and your export folder is called 'fMRI Project ExampleExp'. You should export the data from subject sub-01_ses_01 to the following location:

```
fMRI Project ExampleExp
└── raw/
    └── sub-01
        └── ses-01
            ├── sub-01_ses-01_T1w.PAR
            ├── sub-01_ses-01_T1w.REC
            ├── sub-01_ses-01_task-Nback_acq-SeqSense2Mm3_bold.PAR
            └── sub-01_ses-01_task-Nback_acq-SeqSense2Mm3_bold.REC
```

If you don't have multiple sessions, you may export all files directly to the subject-directory, e.g.:

```
fMRI Project ExampleExp
└── raw/
    └── sub-01
        ├── sub-01_T1w.PAR
        ├── sub-01_T1w.REC
        ├── sub-01_task-Nback_acq-SeqSense2Mm3_bold.PAR
        └── sub-01_task-Nback_acq-SeqSense2Mm3_bold.REC
```

Note that you cannot create directories in your export folder from the scan-computer; you can use the 'scan-assistant' computer (right of the

scan-computer) for that.

Every day at 11pm, we will check the export folders (fMRI Projects or Dropbox) corresponding to the currently active experiments at our centre. If we find 'new' data, we will copy it to our server and start BIDS-conversion and QC and, if desired, preprocessing. Then, after 24 hours or so (depending on the desired parameters used in the preprocessing pipeline), we will copy the BIDS-converted data, quality control results, and/or preprocessing results to your export folder, using the following structure:

```
fMRI Project ExampleExp
└── raw
└── bids
        ├── sub-01
        │       ├── anat
        │       ├── dwi
        │       ├── fmap
        │       └── func
        └── derivatives
                ├── fmriprep
                │       ├── sub-01
                │       │       ├── anat
                │       │       ├── dwi
                │       │       ├── fmap
                │       │       └── func
                │       └── sub-01.html
                ├── freesurfer
                │       └── sub-01
                └── mriqc
                        ├── sub-01
                        ├── sub-01_ses-01_task-Nback_acq-SeqMm3_bold.html
                        ├── sub-01_ses-01_T1w.html
                        ├── group_bold.html
                        └── group_T1w.html
```

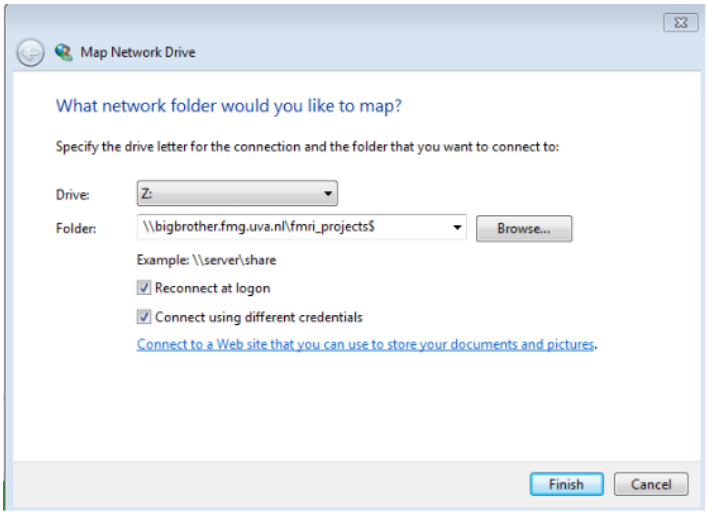
This automatic pipeline is very much work-in-progress! The data (under bids/) should generally be available the next day. If the BIDS/preproc/QC data do not show up in your storage folder, or the output is not as expected/desired, please send Lukas an email.

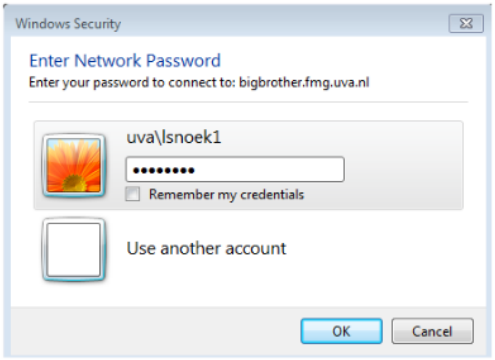
Export data

14 Export your event-files (logfiles from experiment) to your export folder.

To transfer files from the stimulus-computer to your export folder (fMRI Projects or Dropbox), you first need to exit the computer's 'testing mode' (red desktop background = testing mode). To do so, double click the green start button on the desktop. This will enable internet access. Then, you need to map the BigBrother drive:

- Go to 'This Computer' and click on 'Map Network Drive' in the menu bar;
- Select a drive (e.g., *Z:*) and fill in the appropriate folder (*\\bigbrother.fmg.uva.nl\fmri_projects$* or *\\bigbrother.fmg.uva.nl\Dropbox$*
- Select both 'Reconnect at logon' and 'Connect using different credential' (see left image below);
- Click 'Finish' and fill in your credentials (for UvA employees: prepend your UvANetID with 'uva\'; see right image below);
- Now, you can transfer (copy-paste) your files (e.g., from *C:\data\<user>/some_logfile.txt* to *Z:\fMRI Project ExampleExp*)





Make scanner/operator room ready for next researcher

15 If you're done scanning for the day, make sure to check/do the following:

- Check whether the MRScreening forms are complete and signed and put them in the mailbox;
- Make sure the table in the scanner room is elevated;
- On the scan computer, close your current examination;
- Put down new paper on the scanner table and two earplugs;
- Tidy up scanner room (e..g., leftover tape, old earplugs, etc) and operating room;
- Lock the door to the scanner room and hang the key in the cabinet;
- Make sure you've archived/put away all the documents used during your experiment (e.g., informed consets, screening forms, etc.);
- Log out from any website/service on the 'scan-assistant computer', such as Facebook, email, etc.;

Close off (only if you're the last researcher that day)

16 If you were the last researcher scanning for the day (check Calpendo), make sure to check/do the following:

- Check whether the MRScreening forms are complete and signed and put them in the mailbox;
- Make sure the table in the scanner room is elevated;
- Unplug the headcoil;
- Tidy up the scanner room (throw away leftover tape, earplugs, etc.)
- Lock the door to the scanner room and hang the key in the cabinet;
- Turn of the monitor in the scanner room (button is next to the stimulus computer);
- Turn off the stimulus computer and the 'scan-assistant computer' (to the right of the scan computer);
- Restart the scan computer (Start → Restart) and turn off the monitor;
- Turn off the cubicle computers (if used);
- Close the door to the operating room after you leave;
- Turn off all the lights and put on the alarm;