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York NeuroImaging Centre
THE UNIVERSITY of York

Workflow

Guidelines for Users

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1. Registration

Welcome to the York Neuroimaging Centre (YNiC). This document is intended as a brief introduction to the centre, the facilities available and centre personnel. It exists as a means for assisting all users to get the most out of their time spent at the centre.

Due to the potentially hazardous nature of the work being undertaken at YNiC, all new users are required to complete and sign an induction training form to confirm that they have read and understood the relevant information prior to the commencement of any work within the centre.

The centre staff are available to answer any queries regarding the use of the facilities or the centre itself; please feel free to contact them as needed. Further particulars of their contact details and individual responsibilities are included below.

Please note that the centre is a clinical facility and receives patients, their relatives and external visitors on a very regular basis. Therefore, professional conduct from those working within the department is required at all times.

Door fobs can be acquired from reception. You are required to pay a £10 deposit, which will be refundable when you leave YNiC. Door fobs will only be issued at the same time as an IT account is created and will require that the induction training form (available from https://www.ynic.york.ac.uk/forms/InductionTrainingForm.pdf) has been signed off.

IT Account

The IT systems at YNiC are separate from the University IT systems. They differ from the University systems, and some other systems you may be used to, in some important ways. All new users at YNiC are provided with a computer account at YNiC. If you already have a university account your YNiC login name will be the same as the university login name. However these two accounts are separate and so have different passwords. If you change a password on one system, it will not automatically change on the other. The computers you will be using at YNiC are neither wholly stand alone machines nor “dumb” terminals, but you can use any machine and see the same data and system set up.

In order to obtain a YNiC IT account, you must fill in an account application form which is available from https://www.ynic.york.ac.uk/forms/YNiCUserApp.pdf. Once this form is submitted, it will take up to 48 hours for your account to be created. When

your account has been set up, you will recieve some essential information regarding the use of YNiC.

2. Project Application

Project Proposal

All applicants must complete the YNiC Project Proposal Form (which can be found at https://www.ynic.york.ac.uk/information/application) and send it electronically to the Centre Manager <centre.manager@ynic.york.ac.uk>. You will then be invited to make a project presentation, at which point you will have the opportunity to meet relevant members of the team and discuss your ideas and requirements. Depending on the outcome of these discussions you will be advised on how best to pursue your formal Research Ethics and Governance application.

Project Presentation

Once you have submitted a project proposal, you will be asked to come and make a project presentation at YNiC. The objective of this presentation is to provide YNiC with an early indication of the project requirements and how best to support them. There is also the opportunity to benefit from the experience of the wider user community to optimise your study. Some investigators, with little background in neuroimaging, may feel unable to pursue their project without input from more experienced neuroimagers. This presentation also provides the forum to meet potential collaborators.

After presentations have been made investigators, or investigators with their collaborators, will be expected to develop an action plan so that a full application to the Research Governance Committee (RGC) can be submitted. It is the responsibility of the investigator to complete the application, but guidance on this procedure and the centre's resources will be provided by your SLO.

The presentation, or the discussion generated by the presentation, should cover the following points. Some investigators may not be able to provide specific information concerning all these issues. It is hoped, however, that discussions prompted by the presentation will assist the applicant in finalizing these details.

1. What is the background to the study?
2. Why is the study important?
3. What is/are the hypothesis(es)?
4. Why is neuroimaging an appropriate methodology to address the hypothesis?
5. What task and stimuli will be used?
6. What is the study design?

7. How will the data be analysed?
8. What is the timescale of the study?
9. How many participants will be scanned?

Project Funding

If a project at YNiC is to be the subject of a grant application, costing information (especially that relating to pFACT) must be sought from the Director of YNiC, Professor Gary Green <gary.green@ynic.york.ac.uk>.

RGC Application and Decision

Guidelines on preparing a full RGC application can be found at https://www.ynic.york.ac.uk/information/application.

Following the meeting of the RGC your application will receive notification of the body's decision. Under some circumstances a revised application may be requested or, more rarely, a meeting between you and the RGC may be called to discuss the details of your proposal in more detail. Once your project is approved you will be asked to sign a hardcopy of your application form. The RGC will also allocate a certain amount of scanning time for your project and provide you with some guidance specific to your study, along with general guidelines regarding participant handling during your study.

3. Pre Scanning Steps

Finalising Stimuli

You should know how to use triggers and group codes. In MEG/MRI the data is usually recorded continuously. Therefore you need to know when a stimulus was presented and what was actually presented. Triggers in your stimulus presentation software tell you, and the scanner, when a specific stimulus was presented. Whereas group codes, which are optional, are used to provide extra information about which group of triggers the stimulus is affiliated to. The use of triggers allow you to relate the the timing of physiological responses in the brain to the onset of your stimuli. Different trigger/group code values can be assigned to different stimuli conditions for comparing condition in data analysis. Triggers/group codes are used as the basis for averaging your data later on. You should check that your triggers/group codes are working properly before the pilot scan.

You should use appropriate stimulus delivery software. As described above, trigger codes and group codes need to be integrated with your stimulus presentation software. At YNiC, the following software allows you to integrate the necessary triggers with your trials:

- E-Prime
  - Visual
- Presentation
  - Visual
  - Auditory
- Python in-house tools
  - pywavplay for simple auditory paradigms

Unfortunately, it is not the case that one stimulus presentation package suits all experimental paradigms. In general, we advise Presentation over over E-Prime; in particular, E-Prime is not well suited for auditory paradigms in imaging studies. However, should you only be using auditory stimuli in MEG, then the Python in-house tools are most suitable. If you are unsure about the most appropriate stimulus presentation software for you, you may want to raise your concerns at your Project Presentation.

You must book the scan rooms every time you want to use them. There may be times when you need to use MEG/MRI even when you are not scanning a participant e.g. using stimulus delivery software/hardware for checking triggers, setting up fMRI

scanning paradigm etc. In these cases you must book MEG/MRI. Until your project is in the “Scan” state, all bookings must be made by contacting your SLO.

Preparing to Scan

It is advised that you book a pilot scan. A pilot scan is a practice scan that is supervised by the SLO for your project. The PI for the project should be present at the pilot scan. A pilot scan gives you the opportunity to check that your experiment will run smoothly and make any final changes that will improve your experimental paradigm. You may or may not want to use a participant. You may or may not include the data from the pilot scan in your final analyses. The pilot scan will give you a chance to check the timing of your experiment. This is important because you need to book the appropriate amount of time on the scanners for your experiment.

One/both of these forms need to be filled in before/during the pilot scan:

- https://www.ynic.york.ac.uk/forms/MEGsetup.doc
- https://www.ynic.york.ac.uk/forms/MRIsetup.doc

By the end of the supervised pilot acquisition, you need to have completed two copies of either the MEG Experimental Setup form, or the MRI Experimental Setup form (as appropriate). One form needs to be kept by one member of the project, the other will be kept in MEG / MRI.

You will notice that on these Experimental Setup forms there is a list of 'Approved Persons'. Anyone who is going to be running the experiment needs to have attended at least one 'supervised scan'. The supervised scan can either be a pilot scan where the SLO is present, or a scan that is attended by the approved Principal Investigator. This supervised scan is necessary to ensure that each approved person knows how to run their experimental stimuli. It also helps to ensure that any operator has the necessary information to perform the scan for any project, and that the operator knows the person who is running the experiment has received the appropriate training.

You should be aware that the YNiC operators (both MEG and MRI) are not responsible for the running of your stimulus program(s). The running of the experiment is the responsibility of the investigator(s) present. By the end of your pilot scan a final copy of your stimuli should be saved onto a USB stick (or equivalent) and in your group project folder. You need to be able to load this onto the stimulus computer and run the script yourself for each acquisition. It is your responsibility, not the operators, to run stimulus presentation scripts. Please be advised not to expect stimulus

presentation scripts left on the stimulus delivery computers to be in the same state as you left them; either the stimuli may have been unintentionally modified by another User, or the computer itself may have been re-imaged.

To aid all Investigators, we have a checklist of advised practices. These following points should hopefully provide all the information for a trouble free imaging experience. By following these suggested practices, we feel that any Approved Person on any project would be capable of running an experiment with any operator.

Pre-scan checklist

You can advertise for participant volunteers in the YNiC volunteer pool. To advertise to the YNiC volunteer pool, you can use the `YNiC Database` program installed on all YNiC Open Plan machines. In this program, there is a `Email Pool` button which will allow you to send a request to participants. Please be aware that use of this service is monitored by YNiC staff.

You should know how to book scan time. In order to make bookings, you can either use the `YNiC Database` program on the machines within YNiC or use the web-based project tracking system. This can be found at https://www.ynic.york.ac.uk/pts and requires your normal YNiC username and password.

You should know how to register participants in the YNiC database. To register a participant into the YNiC database, you will have to get the participant to fill in this form; https://www.ynic.york.ac.uk/forms/ParticipantRegistration.doc and ensure that it is with reception 48 hours before the participant is due to be scanned. A participant only needs to be registered once, so you will only have to do this if it is the participant's first scan. Please note that under no circumstances should completed participant forms be sent via email.

Preparing a participant for scanning

It is important that your participants have received some level of preparation before they enter the scan suite. The Participant Preparation: RGC Requirements are the procedures that the RGC requires you to adhere to when scanning participants at YNiC. The Participant Preparation: YNiC Advice is a set of advised procedures which have proved over time to improve scan efficiency.

Participant Preparation Checklist: RGC Requirements

You should provide all relevant information to your participants prior to the scan. This is done by forwarding documentation to them *at least 24 hours* before

the scan (YNiC Full Consent forms, MEG/MRI participant leaflets etc). An example email to send to participants is available here; https://www.ynic.york.ac.uk/forms/DraftParticipantEmail.doc. If your participant has not taken part in a neuroimaging experiment at YNiC before you should attach to this email the Full Consent Forms, the Participant Registration form, and the MRI and MEG Participant Leaflets. The Participant Registration form needs to be returned to YNiC at least 48 Hours before the scan (please remember that completed participant forms must not be sent via email). The Consent Forms should be filled in by the participant in advance, if they are a new participant, and brought with them on the day of the scan. If the participant has already taken part in an imaging study at YNiC their consent forms are kept in a locked filing cabinet in the Administration office. Ask a member of YNiC staff for access to filed consent forms. The MEG/MRI Participant Leaflets are simply for informational purposes.

You need to review the study-specific consent form with your participant. In addition to the YNiC consent forms, the RGC requires that you have a study-specific consent form. It is advised that your participant completes all forms at least 24 hours prior to the scan. On the day of the scan you should discuss all forms with your participant in the Interview Room before they enter the scan suite.

You need to review the YNiC Health and Safety and Consent forms with your participant. The YNiC Full Consent Forms, and are available here; https://www.ynic.york.ac.uk/forms/FullConsentForms.pdf. Forms must be reviewed for all participants even if they have participated regularly. This review should be completed with the participant in the Interview Room, before the participant gets changed. It is imperative that these are not completed in Reception or Open Plan; the Consent Forms contain sensitive information that must be discussed in a private environment. Although completion of the consent forms is ultimately the responsibility of the scanner operator, it is highly desirable that the experimenter has reviewed the forms before the participant enters the scan suite. By reviewing the forms in advance, should there be any questions about the scan, or reasons why the scan cannot commence, then these issues can be dealt without losing precious time in the scan-suite. This makes the best use of everyone's time.

You should explain to participants the importance of de-metalling. For both MRI and MEG scanning, participants must remove all ferromagnetic items. Should participants fail to do this there will be scan artefacts that may render the data useless. Moreover the participant could potentially be in danger. Typical items that need to be removed are highlighted in the Consent Form. To ensure participants have fully demetalled, they are routinely asked to change into medical gowns. Note, some make-up

contains ferromagnetic items, therefore you may wish to inform participants in advance that make-up also needs to be removed before scanning.

You should know the procedures for getting participants changed. Participants must get changed into medical gowns in the changing rooms, and must be in suitably attired when in reception. Even if a participant is willing to change in the scan-suite, or anywhere else, they should be instructed to change in the changing rooms. There are dressing gowns that participants may wear in between the changing room and the scan-suite. Similarly, female participants should be informed that they may wear a cotton t-shirt, or equivalent, underneath the medical gowns.

You are responsible for your participant's behaviour in YNiC. When you bring a participant, or anyone else, into YNiC you are responsible for their behaviour. YNiC is a clinical, as well as a research, facility. As such, your participant or guest must act in a manner appropriate for a clinical facility. In particular, please respect the fact the reception is a public space.

Participant Preparation Checklist: YNiC Advice

You should know how to book the interview room. The Interview Room may be booked by filling in your name and project number on the door.

You should prepare your participant for the experimental paradigm if necessary. Prior to the experimental scan, you can use the Interview Room to prepare the participant for your experimental paradigm. It is strongly advised that you do this in the Interview Room, rather the scan suite, so that you maximise your time and productivity in the scanner. Preparation may be in the form of either an information sheet, or practice trials on the Interview Room stimulus PC. The Interview Room may be booked by filling in the timetable on the Interview Room door.

You should know how much time in advance of the scan participants should arrive at YNiC (this is a minimum of 10 minutes). During the pilot scan it will be agreed how much in advance of the scan your subject needs to arrive. This will be different for each study depending on how much training participants need for the specific paradigm. The minimum time to complete the Consent forms and allow time for the participants to change is 10 minutes.

4. Scanning

In the Scan Room

When recording neuroimaging data, it is important to put your participant at ease. For the participants to feel at ease during their imaging experience it is essential that they enter the scan suite feeling comfortable and informed. You have an inherent responsibility when running a neuroimaging study to ensure that your participants are suitably briefed and prepared; particularly if it is the participant's first scan. Some participants find the imaging suites an intimidating environment. However, as the Investigator, it is also very much in your interest to ensure that the participant is at ease.

When recording neuroimaging data, you are recording all the activity in your participants' brain i.e. not just the selective responses to your stimuli. If the participant enters the scan suite feeling apprehensive and nervous, and spends the whole of their scan worrying, it is likely that your results will contain a good representation of the response to apprehension, which may swamp the responses to your paradigm. Also, if your experiment has a behavioral or attentional component, then apprehension may impair the participant's performance, resulting in a weaker response. The combined effect of a poorly prepared participant may be that they have both more noise in their neural responses and also less signal. So, it goes without saying that this will do the signal-to-noise ratio of your results no favours at all!

Lastly, investigators should be reminded that the YNiC Consent forms inform participants that they may leave the scan suite at any point, without having to give the investigator or operator a reason. Therefore, once again, it is also in your interests to ensure the participant is fully prepared for their scan.

Participant Scanning Checklist: RGC Requirements

Re-familiarise yourself with the data confidentiality issues related to acquiring MRI / MEG data. There are important confidentiality issues when acquiring MRI / MEG data. These are especially pertinent when you know your participant. In the RGC approval for your study, you will have been given information regarding the confidentiality issues of scaning. If you have done little scanning, or it is a while since you scanned, it is advisable to re-acquaint yourselves with this advice.

Data Protection. It is required that you familiarise yourself with the YNiC Data Protection policy and the rules contained within for handling data and especially for taking it offsite. The Data Protection Policy is referenced within the YNiC Rules of

Computer Use and you will be required to sign up to these when you are given your IT account. The Data Protection Policy is available at https://www.ynic.york.ac.uk/guides. Should you have any questions, please contact the YNiC Data Controller at <data@ynic.york.ac.uk>

Participants should be introduced to the MEG/MRI operator, rather than just directed towards the scan suites. Once your participant is prepared for the scan, it is best practice to accompany them to the scan suite. As you will be present for the scan anyway, this should not present any difficulties. If the scan is a structural scan, it is not necessary for you to be present at the scan, however, it is advised that you should still accompany the participant to the scan suite.

At the end of scan, investigators should accompany participants back to changing rooms. Once they are changed, make sure that the participant has no further questions.

Finally, please place the completed YNiC Consent Forms in the Return Post-Box in the YNiC Reception area. The forms will then be filed away for future use.

Participant Scanning Checklist: YNiC Advice

The following is a point of practice in the scan suite that is a recommendation to help the scan process go smoothly for your participants, for you and for the operator. The best data is generally recorded when everything runs smoothly, and as the investigator, you are typically the person who dictates how smoothly the scan proceeds.

You are advised to discuss your experimental setup with the operator before you start to scan. In doing this, you will be able to establish your respective roles during the scan. As the investigator, you are responsible for the running of your stimuli in the scan suite. During your pilot scan, you will have agreed a modus operandi for your study. This will have been recorded on the respective Experimental Set Up form for your study (https://www.ynic.york.ac.uk/forms/MRIsetup.doc or https://www.ynic.york.ac.uk/forms/MEGsetup.doc). As a result of this, when you enter the scan suite, the operator will have set up the stimulus presentation hardware settings that you require for your study. As the Investigator, you should be familiar with these, and check with the operator that the set up is correct. During the recording phase, the operator will also start and stop the MEG or MRI data acquisition. However, the running of stimuli is up to you. Therefore, for a smooth acquisition, there needs to be good communication between the investigator and the operator to dove-tail stimulus presentation and data acquisition. A little coordination between the investigator and the operator be-

fore acquisition can make a big difference to the recording process! So, be pro-active, familiar with your experimental set up, and work out the best way to work together with your operator.

Post Scan Checklist

If your scan protocol involves a behavioral component, and these responses are recorded on the stimulus computer (i.e. there are button presses etc. which are saved into a logfile), ensure that you remove them from the stimulus PC at the end of the acquisition. We suggest you put them onto a USB device and transfer them to your Project Group directory. If you do not take this behavioral data with you after the scan, then it may not be on the stimulus PC when you return for your next scan. This is particularly important for fMRI studies when button presses and reaction times are nearly always recorded on to the stimulus PC. In MEG, it is more common to save response in the data than on the stim PC, so in MEG this is less of an issue.

In MEG, you also need to record in your logbook the distances moved by each participant in each run. This is important information, because if a participant makes any big movements during acquisition, you may have to reject that dataset.

5. Analysis

Project Analysis Steps

Analysis

The primary analysis support at YNiC is via the doc wiki:

- https://www.ynic.york.ac.uk/wiki/

This details how to go about analysing your data, be it MEG data:

- https://www.ynic.york.ac.uk/wiki/docs/MEGFrontPage

or MRI data:

- https://www.ynic.york.ac.uk/wiki/docs/MRIFrontPage

There are also a number of pages that give supplementary information to hone the IT aspect of your analyses, helping to make your number crunching more efficient and less painful:

- https://www.ynic.york.ac.uk/wiki/docs/ITFrontPage

Note that on the IT Front Page there are three links under the YNiC Specific Information section for New Users. If you are not already familiar with these you should familiarise yourself with this information. In particular, now that you are starting analysis, it will be necessary for you to be familiar with the information about using the cluster at YNiC as when you begin to analyse either MEG or MRI data, you will almost certainly at some point need to use the cluster.

Other useful information relating to analysis within YNiC may also be found in the Miscellaneous, TechnicalInfo and other pages linked from the front of the doc wiki.

Should you need further help in interpretation of your analyses, then you are encouraged to present your issues at a YNiC Thursday evening seminar.[1]. Details of who to contact can be found under the Support heading at https://www.ynic.york.ac.uk/wiki/docs/Miscellaneous.

[1]Naturally, if you are being supervised as part of an academic course, you should seek your supervisor's wisdom before doing this.

Tutorials

If this is your first look at MEG or MRI analysis, you may want to work through one of our tutorials.

Tutorials for MEG data analysis can be found in the NAF Documentation. This is available at: https://vcs.ynic.york.ac.uk/docs/naf

For MRI analysis, there is an FSL tutorial tailored for use at YNiC on the Documentation wiki at https://www.ynic.york.ac.uk/wiki/docs/MRI/FSLTutorial

Writing Up

As you might expect, the writing up stage of your study is mostly up to yourselves! However, https://www.ynic.york.ac.uk/wiki/docs/TechnicalInfo will hopefully provide much of the necessary technical information to aid your methods section. Please let a member of YNiC staff know if there are any obvious omissions.

6. Leaving

When your studies at YNiC are complete, and it is time for you to leave YNiC, we ask that you complete a number of practical tasks relating to your YNiC IT account. These are necessary so that your data may be stored efficiently after you have left, and also so that we can maximise the performance of YNiC's computational facilities.

- Any files which are no longer required or which you do not wish to be archived should be removed. This will prevent YNiC from archiving unnecessary and unwanted data.
- Any files in your personal space which your research group may need access to must be moved to the relevant group space. YNiC IT staff will not transfer data from your personal space to a group space once you have left the centre.

Should you return to YNiC in the future and wish to have the contents of an old home directory restored, you will need to provide the IT staff with at least two weeks notice in order for them to recover the data from the archival tapes. Until that time, you will be provided with a new, empty home directory.

On your final day at the centre, you should hand in your door fob to reception which will allow you to recover your deposit.