

# Standard Operating Procedure for IMAGEN

**SOP-06/10/2008 version 2.5 – alterations in red and marked by \***

## WP2: fMRI tasks

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**Please also refer to the *IMAGEN task specifications* (*IMAGEN task specs*) for fMRI related details and information on the output format of the logfiles. This file is also available on the Millarium homepage under *IMAGEN* in the folder *fMRI\_battery*.**

**Please also refer to the *case report form (CRF)* which provides you with an overview of the time flow and relevant test instructions for the complete assessment. This file is also available on the Millarium homepage under documents in the folder *Institute\_Asesment\_Material*.**

## 1. fMRI data collection

### 1.1 Overview of Imaging sessions

<b>SESSION 1: Structural &amp; functional sequences</b>	<b>Dur.</b>
<b>1. Volunteer preparation / equipment adjustment</b>	20:00
<b>2. 3 plane localizer / Parallel imaging calibration</b>	00:22
<b>3. Axial T2 slices</b> ( <i>site specific duration</i> )	~01:19
<b>4. Axial T2 Flair slices</b> ( <i>site specific duration</i> )	~ 02:25
<b>5. Instructions / talk to volunteer</b>	2:00
<b>6. Face task</b>	5:00
<b>7. Instructions / talk to volunteer</b>	2:00
<b>8. Stop-signal task</b>	16:00
<b>9. B0 Map</b>	00:40
<b>10. 3D Sagittal ADNI MPRAGE (Long)</b>	09:17
<b>Duration</b>	<b>~60 min</b>

<b>SESSION 2: Structural &amp; functional sequences</b>	<b>Dur.</b>
<b>1. Volunteer preparation / equipment adjustment</b>	14:00
<b>2. 3 plane localizer / Parallel imaging calibration</b>	00:22
<b>3. B0 Fieldmap</b>	00:40
<b>4. 3D Sagittal ADNI MPRAGE (Short)</b>	02:23
<b>5. Instructions / talk to volunteer</b>	2:00
<b>6. M&amp;M Incentive Delay Task</b>	11:06
<b>7. Instructions / talk to volunteer</b>	02:00
<b>8. Global Cognition Assessment</b>	05:00
<b>9. Instructions / talk to volunteer*</b>	<b>02:00*</b>
<b>10. Breath Hold Task (optional)</b>	<b>05:40</b>
<b>11. DTI</b> ( <i>duration is heart-rate dependent at sites with cardiac gating</i> )	10:00
<b>Duration</b>	<b>~60 min</b>

<b>OPTIONAL SESSION 3: Structural &amp; functional sequences</b>	Dur.
<b>1. 3 plane localizer / Parallel imaging calibration</b>	00:22
<b>2. Despot</b>	18:30
<b>3. 3D Sagittal ADNI MPRAGE (Short)</b>	02:23
<b>Duration</b>	<b>~22 min</b>

**Important notes:**

Please always try to run all of the tasks. In case you need to stop the scanning session earlier please skip the optional sessions / tasks first.

We do not recommend running all sessions in one go as this is too tiring for the participant and has an impact on the data quality. If you have to do this please allow at least for a break between sessions.

If you have scheduled two volunteers and you run both sessions on the same day please use the following scanning order which allows for breaks for the volunteer:

Volunteer 1: first session

Volunteer 2: first session

Volunteer 1: second session

Volunteer 2: second session

### **1.1.1 Face task**

In this task volunteers are asked to passively watch video clips presenting faces with neutral and angry expressions as well as control non-biological motion stimuli (concentric circles).

After scanning a short recognition test is performed outside the scanner with 5 static pictures extracted from the movies. The pictures are presented sequentially, each with the question: "Have you seen this object while you were in the scanner?" The volunteers are NOT informed that a recognition test will be performed after scanning.

### **1.1.2 Stop-signal Task**

The main principle of this task is to respond to regular presented visual go stimuli (go trials) but to withhold the motor response to the go stimulus when it is followed unpredictably by a stop-signal (stop trials). This task yields an estimate of a subject's stop-signal reaction time (SSRT). The SSRT is thought to be directly reflective of the central inhibitory mechanism.

### **1.1.3 MID (M&M Incentive Delay) Task**

This task is a reaction time task - it tests how quickly the subject can react and pull the trigger to hit a target (with left or right index finger) that only appears for a short time on the left or right of the screen. If the subject can hit the target, they will score points. The subject can tell where the target will appear and how many points they can win by the symbol they see on the screen before each trial. A triangle means no points, a circle with a line means 2 points and a circle with three lines means 10 points. Responding too early or too late will result in a loss. The task lasts 11 minutes and is adaptive - the maximum that can be won is <200 points.

The subjects receive 1 M&M (or similar chocolates/sweets) for every 5 points to enhance motivation during the task.

### **1.1.4 Global Cognition Assessment Task**

This task is composed by the following brief tasks:

1. passive viewing of a flashing checkerboard (20 trials),

2. pressing three times the left button with the left index finger according to visual instructions (5 trials),
3. pressing three times the right button with the right index finger according to visual instruction (5 trials),
4. pressing three times the left button with the left index finger according to auditory instruction (5 trials),
5. pressing three times the right button with the right index finger according to auditory instruction (5 trials),
6. reading silently short visual sentences (10 trials),
7. listening to short sentences (10 trials),
8. solving silently visual subtraction problems (10 trials),
9. solving silently auditory subtraction problems (10 trials).

#### **1.1.5 Breath Hold Task (Paced Expiration Breath Hold Task)\***

This task uses visual instructions to pace their breathing in a regular rhythm for 40 seconds (breathing in for 4 seconds and out for 4 seconds), followed by holding their breath *on expiration* for a short periods of 20 seconds. This cycle is then repeated five times, ending on paced breathing to give a total task length of 5 minutes 40 seconds. This task uses the small build up of carbon dioxide to assess vascular responsivity in each participant and which differs between participants. This task is optional but we would like to ask all sites to run it as these data can be used to calibrate the bold response and more accurately measure neural responses from **all** our other tasks.

## 1.2 Software installation

Contact: If problems occur during installation please contact Naresh Subramaniam ([ns434@cam.ac.uk](mailto:ns434@cam.ac.uk)) or Sanja Abbott, ([sa466@cam.ac.uk](mailto:sa466@cam.ac.uk)) from the Behavioural and Clinical Neuroscience Institute in Cambridge.

All files necessary to install the fMRI battery are available on the Millarium homepage in the folder fMRI\_task\_battery:

<https://www.millarium.gabo.de/Forms/Generic/Security/frmLogin.aspx>

Make sure you have read the **readme.txt** file in this folder folder before starting the installation.

Please install the software on the stimulus presentation computer you are using to present the tasks during fMRI as well as on another computer which you would like to use for the practice session.

### 1.2.1 Installation of Microsoft .NET Framework Version 2.0

Task presentation and recording of the behavioural responses is performed using Visual Basic 2005 with .NET Framework Version 2.0. To run the tasks Microsoft .NET Framework Version 2.0 Redistributable Package (x86) has be installed first. The Microsoft .NET Framework version 2.0 (x86) redistributable package installs the .NET Framework runtime and associated files required to run applications developed to target the .NET Framework v2.0.

For more information please refer to the Microsoft homepage:

<http://www.microsoft.com/downloads/details.aspx?familyid=0856EACB-4362-4B0D-8EDD-AAB15C5E04F5&displaylang=en>

To do:

- To install Microsoft .NET Framework Version 2.0 Redistributable Package (x86) double-click on the .NET Framework executable file (.exe)
- Follow the download and installation instructions

## 1.2.2 Installation of fMRI tasks

### To do:

- Download all files to your local computer and unzip the files (e.g. using winscp)
- Open the folder and double-click on **ImagenBatterySetup.msi**. A Setup Wizard opens which guides you through the steps required to install the Imagenbattery on your computer:
  - Click next. Then chose your preferred installation folder C:\Program Files\ImagenBattery is recommended.
  - Click next
  - Confirm the installation of the Imagen battery on your computer by clicking next again.
  - After installation is completed click close to exit the Setup Wizard.
- There is no need to restart your computer after the installation.

### 1.3 Run tasks

Before running the tasks please make sure the screen resolution is set to 600 X 800. We offer a small program developed by **Jeffrey A Dalton** (Centre for Neuroimaging Sciences, IOP, London) with which you can automatically change the screen resolution to 600 X 800.

#### Download tool to change screen resolution automatically:

##### To do:

- Go to the Millarium homepage and copy the folder **screen\_resolution** under fMRI\_task\_battery to your computer (C:\Program Files\ImagenBattery is recommended so that all files related to IMAGEN are in the same folder)
- To start the program click on the .exe File **SetPrimaryResolution.exe**. This will change the screen resolution of your primary monitor to 600x800. (Depending on your individual setup you might want to change the screen resolution of the second monitor. To do that please chose *SetSecondaryResolution.exe*).
- After the scanning session reset the resolution by clicking again on the .exe file.

#### Download .wav File to test earphones:

##### To do:

- Go to the Millarium homepage and copy the folder Test\_earphones to your computer (C:\Program Files\ImagenBattery is recommended so that all files related to IMAGEN are in the same folder)
- Open the folder and double-click on the .wav file Test\_earphones.wav to test the earphones

#### Start the fMRI battery:

##### To do:

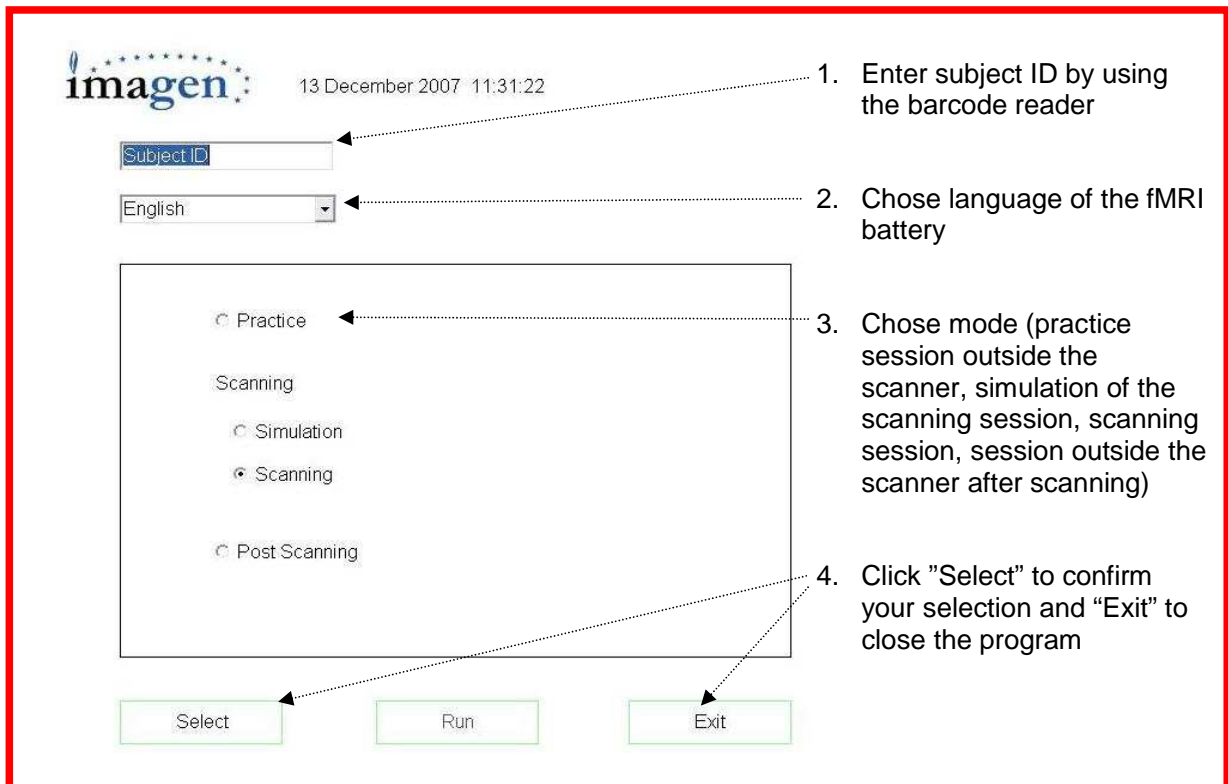
- Open the folder C:\Program Files\ImagenBattery (or the folder where you have installed the fMRI battery).
- Start the fMRI battery by double clicking on the file **Imagenbattery.exe**  
→ *The start window opens.*

### 1.3.1 Start window of the fMRI battery

An example of the English version of the start window is presented in Figure 1.

To do:

- 1.) Enter ID: Use barcode reader to read in the individual barcode (make sure the cursor is in the correct field)
- 2.) Chose language of the fMRI battery (English, French or German)
- 3.) Chose what mode you want to use (practice, scanning etc.)
- 4.) Click select



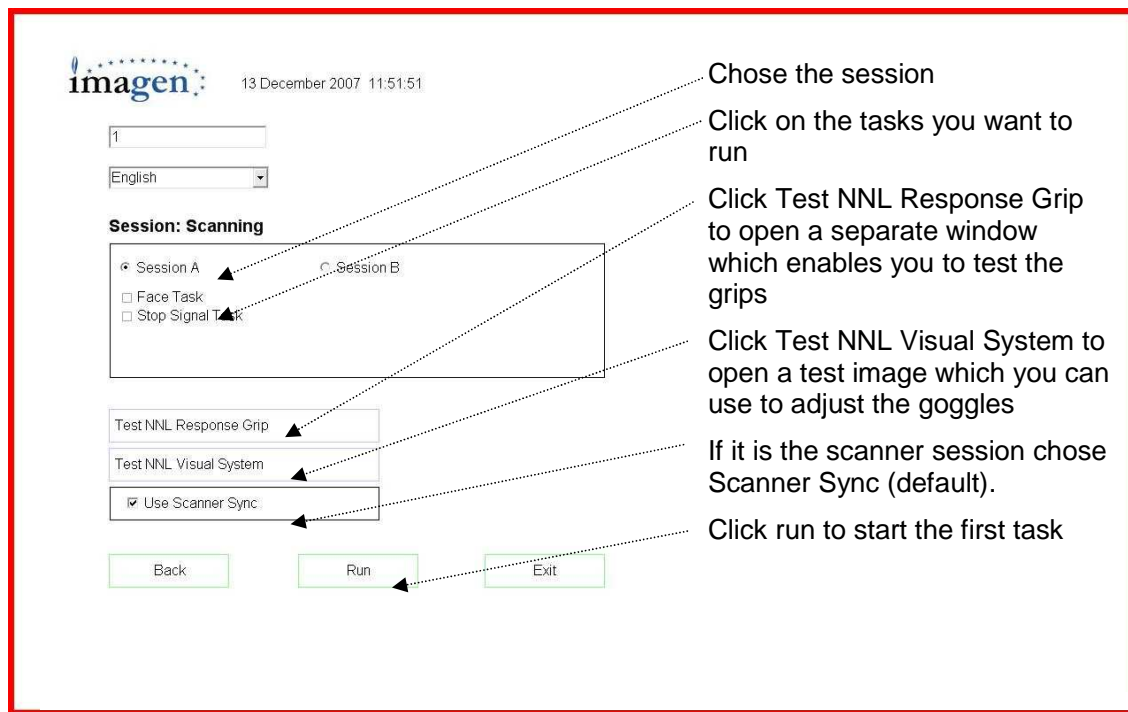
**Figure 1. Start Window of the fMRI battery.**

### 1.3.2 Scanning session window of the fMRI battery

An example of the English version of the scanning session window is presented in Figure 2.

To do:

- 1.) Chose which session you want to run
- 2.) Chose which tasks you want to run. Please note the order is predefined. If you tick the boxes of both tasks they will be presented in that order.
- 4.) Test NNL grips: Press 'Test NNL Response Grip' to check whether the response grips are working. Press each button of the grips separately and check whether the display colours change. If so the response are registered correctly.  
This test has to be performed on the stimulus presentation computer on which the tasks run during fMRI. In case you get no reply make sure the response grips are properly attached to the computer.
- 5.) Test and adjust NNI goggles: Press 'Test NNL Visual System' -> A test picture is presented which you can use to adjust the goggles
- 6.) If it is the scanner session always chose scanner sync (the start of the task is synchronized with the scanner pulse). This is already the default option.
- 7.) Click 'Run' to start the first task
- 8.) A black screen appears and the initial letter of the task which will be presented next appears in the upper right corner;
- 9.) Press enter to start the instructions of the respective task
- 10.) If you press enter again a black screen appears with the word "ready" in the upper right corner. Now the program is ready and waits for the scanner pulse to start the presentation.
- 11.) After each task the following sentence is presented for 5 sec on the screen: 'short break - please relax'. Afterwards a black screen is presented and again the initial letter of the following task appears in the upper right corner; the researcher can start the task by pressing 'enter'
- 10.) After all tasks have been presented the following sentence appear on the screen: 'well done - please wait'



**Figure 2. Scanning session window of the fMRI battery.**

### 1.3.3 Practice and postscanning session

#### **Practice session**

All tasks needs to be explained / practiced outside the scanner on a computer on which the fMRI task battery is installed. For the practice session, the left and right arrows on the computer keyboard are used for tasks that involve button presses. Instruct the volunteer to place their left index finger on the letter 'left arrow' and their right index finger on the 'right arrow' of the computer keyboard. Start the practice version of the task (see 1.3 Run tasks) and give the instruction summarized under 1.3.4 to the volunteers.

#### **Session A:**

**Face Task:** Please present the task instructions outside the scanner. No practice trials are performed for this task.

**Stop-signal task:** Volunteers are familiarized with the task by performing a practice session block of 60 trials outside the scanner. The practice session lasts ~ 2 minutes.

## **Session B:**

Monetary Incentive Delay Task: Volunteers are familiarized with the task by performing a practice session block outside the scanner. The practice session lasts ~3 minutes.

Global Cognition Assessment: Please present the task instructions outside the scanner. No practice trials are performed for this task.

Breath Hold Task (optional): Please run the practice session and make sure the volunteer understands the instructions (that means that they should breathe out and stop breathing when prompted to do so). The practice session lasts ~2 minutes.

## **Postscanning session**

After the scanning session a recognition test is performed as part of the Face task.

Please the volunteer in front of the computer and start the recognition test (choose "Postscanning" and then Face task: Recognition Test - see also 1.3 Run tasks). The volunteer is asked which of the presented faces he has seen during the scanning session.

**The results of this post scanning task need to be saved - therefore please save the logfile on a memory stick and upload it to the local data computer afterwards!**

### **1.3.4 fMRI task instructions in English**

In the following scanning session we will ask you to perform different tasks and games which are so far unfamiliar to you. Therefore we would like to explain these tasks and games first outside the scanner using this standard computer. Additionally you have the opportunity to practice some of the tasks.

Let's start with a few simple tasks which target basic functions of the brain.

#### **Face task**

In this task you will be presented with short video clips showing faces with neutral and angry expressions as well as moving circles. Please watch them carefully and remember to lie as still as possible during this task.

#### **Stop-signal task**

'In the following game which you will play during scanning you have to respond to regular presented arrows but to withhold the motor response to the arrow when it is followed unpredictably by a stop-signal.'

[Please start the practice session of the Stop-signal task and present the following instructions to the volunteer by saying: 'Please read the following instructions carefully.'

In this task you will be presented with a picture of an arrow pointing left, or a picture of an arrow pointing right. You must respond by pressing the button with your left index finger if the arrow is pointing to the left and with your right index finger if the arrow is pointing to the right.

It is important that you react as quickly as possible.

Occasionally, the arrow pointing left or right will be followed by an arrow pointing upwards. If this happens, you must not respond at all, rather you must try and inhibit your reaction.

Of course, you will not always be able to stop yourself from responding when this happens.

Please do not wait to see if the upwards arrow is going to appear, the task is designed to allow for these mistakes.

'Do you have any questions about this task?'

Please remember that being as fast as possible in response to the left and right pointing arrow is as important as trying to inhibit when an upwards arrow (which is the stop signal) follows the left and right pointing arrow. However, stopping will not always be possible as the delay between go and stop stimulus is varied.'

### **Monetary Incentive Delay Task (MID Task with M&Ms)**

This task is a reaction time task - it tests how quickly you can press the button to hit a target, which is a white square appearing only for a short time on the left or right of the screen.

If you manage to press the button as soon as the white square appears, you will score points.

If you respond too early (before the white square appears) or too late (after the white square has disappeared) you will not gain any points.

You can tell where the white square will appear and how many points you will win by the symbol you see on the screen before the white square is shown. A triangular symbol means you will not win any points, a circle with a line means you will win 2 points and a circle with three lines means you will win 10 points.

You should try to win as many points as you can! - but only if you press the button while the square is presented on the screen! For every 5 points you win, you will receive an M&M, - see how many you can win!

### **Global Cognition Assessment**

You will

- See a flickering pattern
- Read or hear short sentences (e.g. We switch on the lights if it is getting dark)
- Read or hear calculations which you have to solve silently (e.g. calculate 12 minus 3)
- Read or hear a prompt to press a button with your left or right index finger three times which you have to follow.

Please remember that you should not talk during the tasks and therefore please do not answer the questions loudly. Do you have any questions about the tasks?

### **Breath Hold Task\***

In this task you will see instructions which tell you when to breathe in or to breathe out at regular intervals. Every so often we will ask you to breathe out fully and then hold your breath for 20 seconds. It is very important that you breathe out, and then stop breathing – do not take another breath in until we tell you.

### **1.3.5 fMRI task instructions in German**

#### **Gesichteraufgabe**

In diese Aufgabe siehst Du kurze Filmsequenzen die Gesichtern mit einem neutralen oder wuetenden Gesichtsausdruck zeigen, sowie sich drehende Kreise.

Bitte schaue Dir die Filme an und denke daran, dabei moeglichst ruhig zu liegen.

#### **Stop-signal Aufgabe**

„In dem nun folgenden Spiel, das Du ebenfalls im Scanner durchfuehren wirst, sollst Du immer wenn ein Pfeil gezeigt wird eine Taste druecken. Wenn aber nach dem Pfeil ein Stopzeichen folgt musst Du versuchen Deine Reaktion zu stoppen und die Taste nicht zu druecken.“

[Bitte starten Sie nun den Uebungsdurchgang der Stop-signal task und zeige die folgenden Instruktionen dem Probanden waehrend Sie folgendes sagen: „Bitte lies die folgende Anleitung sorgfaelltig durch.“

In der nun folgenden Aufgabe wirst Du Bilder sehen auf denen Pfeile abgebildet sind die entweder nach rechts oder links zeigen. Bitte druecke die rechte Taste wenn der Pfeil nach rechts zeigt und die linke Taste wenn der Pfeil nach links zeigt.

Es ist wichtig dass Du die Taste immer so schnell wie moeglich drueckst!

Manchmal wird nach dem nach rechts oder links zeigenden Pfeil ein Pfeil erscheinen der nach oben zeigt. Wenn das passiert sollst Du keine Taste druecken sondern musst versuchen Deine Reaktion zu stoppen.

Natuerlich wird es Dir nicht immer gelingen Deine Reaktion zu stoppen wenn das passiert. Bitte warte nicht auf den nach oben zeigenden Pfeil, da die Aufgabe dafuer gemacht ist, dass solche Fehler passieren.

„Hast Du Fragen zu dieser Aufgabe? Bitte denk daran dass es genauso wichtig ist so schnell wie moeglich auf den nach links bzw. nach rechts zeigenden Pfeil zu reagieren als auch zu versuchen Deine Reaktion zu stoppen wenn anschliessend der aufwaertsgerichtete Pfeil praesentiert wird. Jedoch wird es nicht immer moeglich sein zu stoppen, da der Abstand zwischen dem nach rechts bzw. nach links zeigenden Pfeil und dem nach oben zeigenden Pfeil (also dem Stopsignal) veraendert wird.“

### **Monetary Incentive Delay Task (MID Task mit M&Ms)**

Diese Aufgabe ist eine Reaktionszeitaufgabe – damit testen wir, wie schnell Du eine Taste drücken kannst, wenn ein weißes Quadrat nur für kurze Zeit rechts oder links auf dem Bildschirm erscheint.

Wenn Du es schaffst, die Taste rechtzeitig zu drücken, wenn das weiße Quadrat erscheint, gewinnst Du Punkte. Wenn Du zu früh drückst (bevor das weiße Quadrat erscheint) oder zu spät (nachdem das weiße Quadrat verschwunden ist) gewinnst Du nichts.

Ein Symbol vor jedem Durchgang zeigt Dir an, wo das weiße Quadrat erscheinen wird und wieviele Punkte Du gewinnen kannst. Ein dreieckiges Symbol bedeutet, Du kannst keine Punkte gewinnen, ein Kreis mit einer Linie bedeutet, Du kannst 2 Punkte gewinnen, und ein Kreis mit drei Linien bedeutet, Du kannst 10 Punkte gewinnen.

Du solltest dabei versuchen, so viele Punkte wie möglich zu gewinnen! – Das geht aber nur, wenn Du die Taste drückst, während das weiße Quadrat auf dem Bildschirm erscheint. Am Ende der Aufgabe erhältst Du jeweils 1 M&M pro 5 gewonnener Punkte. Mal sehen wieviele Du gewinnst.

### **Aufgabe zur Einschätzung der allgemeinen Wahrnehmungsfähigkeit**

“In den nun folgenden Untersuchungen im Scanner wirst Du einige Aufgaben und Spiele durchführen müssen, die für Dich bisher unbekannt sein werden. Daher möchten wir diese Aufgaben und Spiele mit Dir vorher kurz an einem normalen Rechner üben.

Beginnen wir mit einer kleinen Anzahl einfacher Aufgaben, die Grundfunktionen des Gehirns abrufen. Du wirst

- ein flackerndes Muster sehen, das die Form eines Schmetterlings hat
- jeweils einen kurzen Satz lesen oder hören (z.B. ‚Wenn es dunkel wird, schaltet man das Licht ein‘)
- Rechenaufgaben hören oder lesen, die Du im Kopf lösen sollen (z.B. ‚Rechne 12 minus 3‘)
- eine Aufforderung zum Tastendruck lesen oder hören (z.B. ‚Drücke dreimal die linke Taste‘), der Du bitte nachkommen sollst.

Bitte denk daran, daß Du nicht sprechen darfst, also die Fragen nicht laut beantworten darfst. Hast Du Fragen zu dieser Aufgabe?

### **Atemhalte-Aufgabe\***

In dieser Aufgabe wirst Du Anweisungen sehen, die Dir mitteilen, wann Du in regelmäßigen Abständen ein- und ausatmen sollst. Ab und zu werden wir Dich auffordern, vollständig auszuatmen und fuer 20 Sekunden mit dem Weiteratmen aufzuhören. Es ist sehr wichtig, dass Du ausatmest und dann aufhörst zu atmen. Atme nicht wieder ein, bis Du dazu aufgefordert wirst.

## **1.3.6 fMRI task instructions in French**

### **Test des visages**

Dans ce test, tu vas voir des clips vidéo de courte durée. Ces clips pourront montrer aussi bien des visages (avec des expressions de neutralité ou de colère) que des cercles mobiles. S'il te plait, regarde les attentivement et souviens toi de rester aussi immobile que possible durant le test.

### **Test du signal d'arrêt**

Au cours du jeu suivant, que tu feras aussi dans l'IRM, tu verras des flèches à intervalles de temps réguliers, mais tu devras empêcher ta réponse motrice si elles sont suivies d'un signal d'arrêt.

[Veuillez commencer la session d'entraînement au test du signal d'arrêt et présenter les instructions au volontaire en disant: 's'il te plait, lit attentivement les instructions suivantes']

Durant ce test, tu verras des images d' une flèche pointant à gauche, ou d'une flèche pointant à droite. Tu devras répondre en appuyant avec ton index, sur le bouton gauche si la flèche pointe à gauche, ou sur le bouton droit si la flèche pointe à droite. Il faut répondre le plus vite possible.

Parfois, la flèche pointant vers la droite ou vers la gauche sera suivie d'une flèche pointant vers le haut. Si cela se produit, tu ne devras pas du tout répondre, il faudra au contraire essayer d'arrêter ta réponse, c'est à dire l' inhiber. Bien sûr, tu ne pourras pas toujours y arriver. N'attends pas de voir si la flèche pointant vers le haut va apparaitre; la tâche est prévue pour tenir compte de ces erreurs.

“As tu des questions sur ce test? Rappelle toi qu'il est aussi important de répondre aussi vite que possible, que d'essayer d'arrêter quant un signal d'arrêt apparait après une flèche

droite ou gauche. Mais l'arrêt ne sera pas toujours possible, car les intervalles de temps entre la flèche droite ou gauche et les flèches d'arrêt, seront variables."

### **Tâche de récompensé différée (MID)**

Cette tâche évalue les temps de réaction. Elle mesure à quelle vitesse tu appuies sur le bouton pour atteindre une cible représentée par un carré blanc. Cette cible sera présentée à gauche ou à droite de l'écran pendant un court laps de temps.

Si tu atteins la cible dès qu'elle apparaîtra, tu gagneras des points. Avant chaque essai, tu pourras savoir où va apparaître la cible et combien de points tu pourrais gagner en regardant le symbole qui apparaîtra sur l'écran juste avant de voir la cible.

Un triangle indique que tu ne gagneras aucun point, un cercle avec une ligne indique que tu gagneras 2 points et un cercle avec 3 lignes indique que tu gagneras 10 points.

Tu dois essayer de gagner le plus de points possible! Mais seulement si tu touches la cible! Tu recevras une petite friandise au choix pour chaque tranche de 20 points que tu obtiendras. Voyons combien tu peux en gagner!

### **Evaluation cognitive globale**

Au cours de la prochaine session d'IRM, tu auras à faire des tests et des jeux nouveaux pour toi. C'est pourquoi nous te proposons d'abord une séance d'entraînement à ces tests sur un ordinateur en dehors de l'IRM. Nous allons commencer par quelques tests sollicitant des fonctions cérébrales simples.

Tu:

- verras une forme clignotante évoquant un papillon,
- liras ou entendra des phrases courtes (par exemple: "nous allumons la lumière lorsqu'il commence à faire sombre"),
- liras ou entendras des instructions de calcul mental simple (par exemple : "calcule 12 moins 3"),
- liras ou entendras un signal te demandant d'appuyer sur un bouton (avec ton index droit ou gauche, soit trois fois)

Rappelles toi qu'il ne faut surtout pas parler durant ces tests, ni répondre aux instructions en parlant.

As tu des questions sur ces tests?

### **Tâche d'apnée\***

Lors de ce test tu verras des instructions qui t'indiqueront quand inspirer ou expirer à intervalles réguliers. De temps en temps nous te demanderons de vider complètement tes poumons et de retenir ta respiration pendant 20 secondes. C'est très important que tu vides tes poumons et que tu arrêtes de respirer – Ne reprends pas ta respiration avant qu'on te le dise.

### **1.3.7 MRI scanning instructions in English**

In the following scanning session you will be presented with the tasks and games which you have practised before on a computer outside the scanner.

Do you have any questions about these tasks?

We will provide you now with a short overview of the next steps during the scanning session to familiarize you with the scanning procedure.

Before starting the tasks which you have practised before we will conduct a quick scan to identify your head position. The scanner will be adjusted accordingly and all subsequent measures refer to this position. During these first scans you will get an idea of the noise you have to expect during scanning. Additionally, you have the possibility to adapt to the scanner environment.

For the whole investigation it is essential that you are lying still and relaxed but that you also concentrate on the task presented. Movements in general and head motion in particular may lead to loss of data. Therefore it is very important that you lie comfortable on the table. If we ask you in the following to lie down on the table please let us know whether you are lying in a comfortable position or what changes are necessary to make it as comfortable as possible. During scanning you will be provided with headphones to reduce noise produced by the scanner as well as to allow us to speak to you between scans. Please make sure the headphones are sitting tight but comfortable as you are not able to change its position during scanning.

We will further provide you with modified eyeglasses (resembling a microscope) in which a kind of camera is integrated. We use these eyeglasses to present to you pictures and words. Please adapt the visual acuity for each eye so that the test picture is as focused as possible. Please make sure that you are able to see the picture through the eyepiece and that the device does not pinch you.

To allow you to respond during task presentation we will provide you with special a response device for each hand. Please hold them loose in your hands without cramping. The response device is constructed in a way that makes sure you don't lose them during the course of the scanning session.

To avoid that you are freezing during the scanning session we will offer you a blanket. Please consider to use the blanket as it is difficult concentrating on the task when you are freezing.

Between different tasks we will contact you in the scanner over the headphones using a microphone. If you are feeling unwell and you wish to get out of the scanner immediately

please squeeze the emergency ball which will be placed on your waist by the investigator. *Please note that we will stop scanning immediately to get you out of the scanner. However the data cannot be used for analyses.*

To be able to analyse the acquired imaging data it is important to improve data quality. You can help to improve data quality by lying as still as possible during the whole investigation and most importantly that you don't move your head. This includes that you do not speak during scanning if possible but you may talk to us in between scans or if we talk to you.

During breaks between scans you can adjust your body position on the table if *necessary but please make sure you do not move your head. If this is not possible please let us know and we will do another quick scan to localize your new head position.*

The whole procedure lasts 60 minutes in total. Therefore we would kindly ask you to go the toilet before we start with the investigation.

Please don't hesitate to ask if you have any further questions with respect to the scanning procedure.

### **1.3.8 MRI scanning instructions in German**

In den nun folgenden Untersuchungen im Scanner wirst Du die Aufgaben und Spiele durchführen, die Du eben kurz an einem normalen Rechner geübt hast.

Hast Du Fragen zu diesen Aufgaben?

Wir werden Dir nun einen kurzen Ueberblick ueber die nun folgenden Schritte im Scanner geben um Dich mit dem Ablauf der Untersuchung vertraut zu machen.

Vor der Durchführung der eigentlichen Aufgaben, die Du bereits geübt hast, werden wir eine kurze Positionsmessung durchführen. Damit messen wir, wo sich Dein Kopf genau im Scanner befindet. Für diese Position planen wir dann die folgenden Messungen. Anschließend wird das Gerät genau auf Deinen Kopf eingestellt (kalibriert). Während der ersten Messungen wirst Du einen Eindruck über die Art und Stärke der Geräusche im Scanner erhalten. Du kannst Dich also schon einmal an die neue Umgebung gewöhnen.

Für die eigentlichen Untersuchungen im Scanner ist es entscheidend, daß Du während jeder Aufgabe ruhig und entspannt liegst und Dich voll auf die Aufgabe konzentrierst. Bewegungen irgendwelcher Art - insbesondere Kopfbewegungen - können zum Verlust der Daten führen. Daher ist es zunächst wichtig, bequem zu liegen. Wenn wir Dich im folgenden bitten werden, auf der Liege Platz zu nehmen, sage uns bitte, wenn Dich etwas stören sollte, und versuchen, eine für Dich angenehme Position einzunehmen.

Während der Untersuchung wirst Du einen Kopfhörer tragen, damit Du die Lautstärke im Gerät gedämpft wahrnimmst und wir mit Dir reden können. Überprüfen bitte, ob der Kopfhörer optimal anliegt und nirgendwo drückt, da Du seine Position während der Messung nur schwer ändern kannst.

Um Dir Bilder zum Anschauen und Text zum Lesen präsentieren zu koennen, werden wir Dir eine Brille zur Verfügung stellen, die äußerlich einem Mikroskop ähnelt und in die eine Art Kamera eingebaut ist. Wir werden die Schärfe für jedes Auge so einstellen, daß Du in der Lage sein wirst, das Testbild scharf zu sehen. Sorgen ferner dafür, daß Du das Bild durch das Okular gut erkennen kannst, das Gerät jedoch nicht drückt.

Damit Du alle Aufgaben auch im Scanner erfüllen kannst, werden wir Dir spezielle Antworttasten in die Hand geben. Halte diese bitte während der Untersuchung locker in den Händen. Verkrampfe die Hände aber bitte nicht! Die Antwortgeräte sind so konstruiert, daß Du sie nicht verlieren kannst.

Um zu vermeiden, daß Du während der Untersuchung frierst, werden wir Dir eine Decke anbieten. Bitte ziehe die Benutzung der Decke in Betracht, da Du Dich wenn Du frierst, nicht auf die Aufgabe konzentrieren kannst.

Solltest Du Dich während der Untersuchung unwohl fühlen, gib uns bitte Bescheid. Zwischen den einzelnen Teiluntersuchungen werden wir über die Kopfhörer und ein Mikrophon im Scanner mit Dir Kontakt aufnehmen. Solltest Du Dich wider Erwarten schnell so unwohl fühlen, daß Du unmittelbar aus dem Scanner geholt werden wollen, so betätige bitte den Notball, der Dir vom Versuchsleiter oder der Versuchsleiterin auf den Bauch gelegt werden wird.

Um die erhobenen Daten auswerten zu können, ist es wichtig, daß wir eine hohe Datenqualität erreichen. Du kannst uns helfen, die Qualität der Daten entscheidend zu erhöhen, indem Du während der einzelnen Untersuchungen ganz ruhig im Scanner liegst und Deinen Kopf nicht bewegst. Dazu gehört auch, daß Du nicht sprechen sollst und Deine Arme und Beine ruhig und entspannt am Körper liegen laesst. Wenn es Dir möglich ist, solltest Du dies nur zwischen den einzelnen Untersuchungen tun, wenn wir mit Dir reden. Während dieser Zeit kannst Du auch gern eine bequemere Position auf der Liege einnehmen. Bitte teile uns dies aber mit, damit wir eine neue Positionsmessung durchführen können.

Da die Untersuchung insgesamt ca. eine Stunde dauern wird, möchten wir Dich bitten, vor Beginn noch einmal die Toilette aufzusuchen.

Hast Du noch Fragen hinsichtlich des Versuchsablaufs?“

### **1.3.9 MRI scanning instructions in French**

Au cours de la session d'imagerie, les tests que tu as déjà effectué en dehors de l'appareil te seront présentés.

As tu des questions supplémentaires?

Avant de commencer les tests auxquels tu t'es déjà entraîné, nous referons quelques images IRM pour identifier la position de tête. Durant ces premières minutes, l'appareil fera un bruit qui sera analogue à celui qu'il fera au cours du test.

Durant toute la session d'IRM, il est important que tu sois confortablement installé, pour rester concentré sur le test. Les mouvements, et en particulier ceux de ta tête peuvent rendre les images inutilisables. Alors, n'hésites pas à dire si quelque chose te gêne, et nous essaierons d'améliorer ton confort.

Dans l'appareil d'IRM, les tests te seront projetés par des lunettes spéciales comportant un écran. Nous te présenterons ainsi des images et des mots. Tu devras adapter la position de ces lunettes à ton visage, et régler toi-même la netteté de l'image pour chacun de tes yeux.

Tu auras aussi une poignée dans chaque main pour répondre.

Quand tu seras installé, nous te donnerons une couverture pour t'éviter d'avoir froid.

Nous te parlerons entre les tests avec des hauts-parleurs intégrés dans l'appareil d'IRM. Si tu désirais nous parler ou sortir, tu n'aurais qu'à appuyer sur un petit bouton qui sera placé sur ta ceinture par l'opérateur. Nous pourrons alors venir te voir tout de suite.

Comme pour toute photo, les images seraient floues et donc inutilisables en cas de mouvement de la tête. Il faudra donc éviter de parler pendant les sessions, mais tu pourras nous parler entre les sessions. Durant ces pauses, tu pourras ajuster ta position sur le lit de l'appareil, mais en évitant de bouger la tête. Si cela n'était pas possible, appelle nous et dis le nous, et nous ferons quelques nouvelles images pour mesurer le changement de position de ta tête.

Cette session d'IRM dure 60 minutes. Alors, nous te demanderons d'aller aux toilettes auparavant si nécessaire.

N'hésites pas à demander si tu as d'autres questions.

## 1.4 Time flow of the scanning session

1. Switch on the NNL Sync Box and the Response-Grip optic-electric adapter (see NNL SOPs on Millarium for more information).
2. Go to **C:\Program Files\ImagenBattery\screen\_resolution**. Change the screen resolution to 600x800 by clicking on the .exe File **SetPrimaryResolution.exe**. This will change the screen resolution of your primary monitor to 600x800. (Depending on your individual setup you might want to change the screen resolution of the second monitor. To do that please chose SetSecondaryResolution.exe).  
After finishing the scanning session you can reset the resolution by clicking again on the .exe file.
3. Check whether the earphones are working by playing the file **Test\_earphones.wav** provided in the folder **C:\Program Files\ImagenBattery\test\_earphones.wav**
4. Start fMRI battery by double-clicking on the IMAGENbattery.exe file again in the folder C:\Program Files\ImagenBattery
5. Use barcode reader to enter the subject pseudocode in the ID field and chose the respective language
6. Chose scanning under scanning session and press select.
7. Chose the respective session (A or B) and the tasks you would like to run by ticking the boxes next to them.
8. The next screen opens. Click on the button “NNL Response Grip” to test the response device. Please press all buttons, one after the other, to check whether the display colour changes.
9. Select “Test NNL visual system”. A test picture is displayed and the goggles can be adjusted.
10. Position subject in scanner with:
  - Earplugs and headphones
  - NNL Functional equipment (goggles and handsets): Adjust goggles for the volunteer (use again the test picture) and let them press the buttons of the response grips and check again whether they are working
  - Place pillow under subject’s knees

- Provide blanket if needed

11. Make sure use scanner sync is ticket (default) and double-check that you have selected the correct session. Make sure you have selected all tasks of that session and click run. Then black screen appears with the initial letter of the task chosen presented at the upper right corner of the screen.

Tell the Radiographer which task/series to download

- Session 1: 1. Face task / 2. Stop-signal task

- Session 2: 1. MID Task/ 2. Global Cognition Assessment/ 3. **Breath Hold Task - optional**

12. Talk to the volunteer:

- Ask the volunteer whether he is ok and ready to start with the first scans.
- Remind the subject to lie as still as possible
- Remind the volunteer that she or he can always press the alarm button if she or he feels very uncomfortable and feels the urgent need of immediately being removed out of the scanner. Note, that the interviewer talks to the volunteer between the tasks.
- If the volunteer affirms the inform the subject that scanning starts and that there will be some scanner noise (3 to 4 minutes) and that he/she will talk again to the volunteer after these scans

13. Radiographer starts the first structural scans (see overview MR sequences)

14. After the structural scans the researcher talks to the volunteer and ask him or her whether he/she is ok. Then inform him/her which task is next.

15. Researcher informs subject that instructions are about to be shown and there will be some scanner noise (from the prep scan), but to stay focused on the instructions

16. Researcher starts the instructions and Radiographer performs prep scan (data dummy acquisition (DDAs))

17. Radiographer tells Researcher when prep scan is finished and ready to scan

18. Researcher checks that the subject is ready to start the task

19. Researcher hits “Return” on the task console keyboard (a black screen appears with the word “ready” in the upper right corner)

20. Radiographer presses “Scan” on the scanner

***Repeat steps 13 to 20 for all the tasks of this session.***

## **2. Data backup**

*For each subject a folder named according to the ID (Barcode) is generated under C:\Program Files\ImagenBattery\Data*

Within each subject folder the logfiles (.csv files) are saved in the folder "Scanning".

### To do:

- Please copy the subject folder onto a memory stick after each fMRI session and save it on the local data computer (LDC).

For more information on where to save data on the LDC and how to transfer them to Neurospin in Paris please refer to the SOPs of Jean-Baptiste Poline.

### 3. Troubleshooting

*No button responses are detected*

Possible cause	Solution
<ul style="list-style-type: none"><li>- Button box is not properly connected to the stimulus presentation computer</li><li>- Optic fibre cable is flexed / broken</li><li>- Button box is broken</li></ul>	<ul style="list-style-type: none"><li>- Check power supply and connection between button box and stimulus presentation computer</li><li>- Contact Nordic Neurolab (Stefan Zysset: <a href="mailto:Stefan@nordicneurolab.com">Stefan@nordicneurolab.com</a>)</li></ul>

*Scanning has to be aborted during a functional task*

Possible cause	Solution
<ul style="list-style-type: none"><li>- Subject is feeling unwell</li><li>- Scanner problems</li></ul>	<ul style="list-style-type: none"><li>- Talk to the volunteer; make a break;</li></ul> <p><i>To discuss: Restart the task?</i></p> <p><i>Problems: - Practice effects/ limited scanning time -&gt; Case-to-case decision?!</i></p>

*Software crashes / error message*

Possible cause	Solution
<ul style="list-style-type: none"><li>- Software problem</li></ul>	<ul style="list-style-type: none"><li>- Restart computer / restart software</li><li>- Contact Naresh Subramaniam (software developer in Cambridge) (<a href="mailto:ns434@cam.ac.uk">ns434@cam.ac.uk</a>)</li></ul>