Guide to the 3T

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I. Getting Started
   a. Overview of the setup
   b. IFIS and E-Prime
   c. Computer systems
   d. Peripherals
   e. Old IFIS cart

II. fMRI – IFIS system setup
   a. Hardware configuration
   b. Software configuration
   c. Digital Projection & Setup

III. Peripherals
   a. Eye tracker
   b. Sound system
   c. Physiological box
   d. Others

IV. Collecting and Retrieving data
   a. E-Prime files
      i. Copy to Disk
   b. How to copy data
      i. Burn on CD

V. Old IFIS cart
   a. E-Prime
   b. Hardware configuration

VI. Troubleshooting
   a. There is no display from the projector or it is distorted
   b. I’m getting no response from the glove
   c. I’m not gathering eye-tracker data
   d. My paradigm is being triggered prematurely
   e. My external equipment doesn’t work
   f. The computers are turned off

VII. Supplementary Information
   a. Contact information
   b. Hardware diagram
Chapter 1: Getting Started
Overview
On June 15th 2004 a new hardware upgrade took place on the GE 3T scanner. The ultimate goal of updating this equipment was to expand capabilities and services as well as create a solution that was compatible with the equipment currently in use at the Brain Imaging Research Center for those groups that are running (or eventually want to run) subject’s at both sites. Though the installation of this new hardware went relatively smooth, it left the MR center with an entirely new question to answer; how do things work? This document is meant to provide some general and specific information to answer that question, as well as others.

E-Prime and IFIS
For most users the primary paradigm platform for running fMRI experiments is E-Prime and/or IFIS. E-prime is as a graphical experiment generator written for Windows XP. It is a joint design effort between the makers of Psyscope and Psychology Software Tools which consists of a suite of applications to design, generate, run, collect data, edit and analyze the data. IFIS on the other hand is a software application (from MRI Devices) designed to act as a development and launch platform for E-Prime. IFIS includes an integrated set of libraries capable of supporting a wide range of functional imaging experiments for visual, auditory and motor tasks. Additionally, IFIS creates a unique dual computer user interface to make the transition easier for the researcher to collect his/her data.

Computer Systems
As noted above, the new IFIS/E-Prime platforms as designed to run on Windows XP. To run this software we have implemented two fully-functional and custom configured Dell Dimension PC’s. The specifications for these systems are as follows:

- Processor: 3ghz
- Ram: 1gig
- Hard Drive: 80gig
- DVD-ROM: on both
- CD-RW: on Operator1
- Operating System: Windows XP Professional, SP1

Each system is equipped with standard and necessary software. However, we do ask that users do not perform analysis on these systems. A practice computer as well as systems for analysis are available to users.

Peripheral Equipment
Attached to both the IFIS computer setup and additional computers within the scanner room are several peripheral devices. These include a rear projection system, eye-tracker, physiological monitoring box and many other devices. Devices such as the eye-tracker
and physiological monitoring box are run by independent computer systems with a variety of operating systems and configurations. The more important of these items will be discussed in further detail in a later section.

**Old IFIS cart**
Also in the control room is an old version of the new IFIS setup, in the form a wheelbase cart. Though the cart is capable of running E-Prime paradigms, the installed version is very old and will not accommodate newly designed paradigms. It is not recommended that users attempt to use this obsolete system and with current plans this system will be completely removed from operation within a few months.
Chapter 2:

fMRI - IFIS System Setup
Hardware Configuration
Not surprisingly the hardware configuration for the 3T scanner system is rather complex. Here we will try to provide both an overview of what’s going on and how it works as well as a basic setup guide to help things run smoothly.

Attached to, or running through, the aforementioned computer systems are items for visual output, auditory input and output, RF signaling and users responses. Visual output is facilitated through a fiber-optic cable that runs from the control room to the magnet. Auditory input and output is based on a custom designed acoustic transducer and optical microphone. An RF Monitor is used to synchronize the system with the MR Scanner or console trigger. Additionally there are two finger response gloves that have completely phased out the use of standard button boxes. All of these items, as well as other are fully integrated into the 3T system and are available when needed.

In regard to hardware setup there are a few things to keep in mind. Below we have listed three main items to remember when setting up for a scan.

(1) First, make sure that all equipment is turned on before trying to run a paradigm. Many problems can occur when everything is started but one piece of equipment is not yet on.

(2) Second, due to the large quantity of different equipment the use of switch boxes was put in place to provide an easy transition between scans. Switchboxes are located on top of the computer systems below the table where the monitors sit. Before someone begins their scan (using the current IFIS system) it is imperative that both switchboxes are turned to “E-Prime.” This switches all standard equipment to the IFIS system. When using external equipment, a device may be plugged into the right switchbox and turned to “psyscope.”

(3) Third, make sure no additional, unauthorized equipment is plugged in. Sometimes users will accidentally leave their auxiliary equipment connected; when this happens disconnect the auxiliary item and return things to the proper configuration.

Additional information about the hardware configuration of the 3T is provided in the supplementary section of this document; which includes a detailed hardware diagram.

Software Configuration
After making sure all the hardware is correctly setup it is time to turn to the computer systems. The configuration of the computer system was detailed in the first section and will therefore be omitted from this section. We will instead discuss relevant information about the computer setup and then go on to the steps necessary to properly run your paradigm.
The first thing to note about the computer systems is that they are linked together through a local network hub. The reason behind this is not only to permit the use of the IFIS interface, but allow users to transfer files between both systems. To transfer files between systems open Windows Explorer, go to Network neighborhood and choose Entire Network. Doing this will allow you to see all experimental files on both system. Just locate the file you wish to transfer, copy them and paste them into a new folder. The second thing to note is the monitor resolution. On Patient1 the resolution is set to 1024x768 to accommodate the project and on operator1 the resolution is set differently. Users must never change the resolution on Patient1; this will cause a loss of proper video signaling. The third and final item to note is the CD Burning Rom. The CD-RW is physically located inside Operator1, not Patient1. Therefore to burn CD’s you must be logged onto Operator1 and transfer your files from Patient1. This concept will be discussed in more detail in a later section.

Now onto a stepwise description on how to run paradigms:

1. First you must log onto the computer systems. Instructions for doing so are located near the monitors and keyboard; however they will be reiterated here. Your username is your project code in all capitol letters (i.e. SSN-RAF) and your password is the first letter of your project code, the last letter of your project code and 3T (i.e. SF3T). When logging onto the system you must log onto Patient1 first, then Operator1. If you are not using the IFIS interface system it is still recommended that you log onto both systems simply because you may wish to transfer data after you scan.

2. After logging onto the system the second step is to load your paradigm. If your paradigm is already installed on the computer then just locate your E-Prime file using either the IFIS interface (on Operator1) or using Windows Explorer (on Patient1). If you have not yet loaded your paradigm onto the system here is how to do it. While logged on to Patient1 open Windows Explorer and go to the following location: My Computer → All Users → Shared Documents → Shared Experiments → IFIS → Shared. Once in this location create a folder with the exact same name as your E-Prime file. Then copy your files into that folder. If you are just running your paradigm through E-Prime just double-click and load your file, if you are using the IFIS interface restart Operator1 and locate your filename in the drop down menu.

3. Once your paradigm is loaded onto the computer and opened the third and final step is to run your scan. At this point all the peripheral equipment should have been set up properly and your patient should be in the scanner. Also at this point, or most users, there should be something being displayed on the screen in the magnet.
**Digital Projection & Setup**

An integral part of the 3T upgrades was the installation of a new MR Digital Projector manufactured by PST. This projector is based around a high quality projector system using Digital Light Processing technology with an excellent contrast ratio, supports 1024x768 resolution, and provides a much wider field of view (assuming rear projection is used rather than front projection). The digital projector also comes with addition of a projection screen in the back of the magnet bore and a cold-mirror eye piece that attaches to the head coil. This eye piece, which sits only an inch away from the patient’s eyes allows the patient to have a crisp, clean and close view of the screen.

The setup procedure for the digital projection system is relatively easy. First, inside the control room is a control box for the projector, make sure it is on. This runs the video feed, via fiber optic cable to the projector. Second, the projector itself (located behind the magnet) needs to be turned on. Third, the projector screen needs to be put into the magnet bore. The screen is secured with Velcro which is permanently inside the magnet bore. Finally the cold mirror must be placed onto the head coil and positioned for the patient.
Chapter 3: Peripheral Devices
Eye Tracker
One peripheral device integrated with the 3T scanner is an ASL eye-tracking system. The remote eye tracker is designed to accurately measure a person's pupil diameter and point of gaze on a stationary (room fixed) scene space. The measurement is displayed as a cursor or set of cross hairs superimposed on the image from a scene camera showing the subject’s field of view, and is recorded digitally on the eye tracker Interface PC.

In terms of setup, the eye tracker is only turned on when in use. To do so one must first make sure the eye tracker box and eye monitor are on. Next the ASL system must be turned on and the correct cables must be plugged in. Currently we have a switchbox for use with the eye tracker; all it requires is for the correct cable to be plugged in. Once everything is on and correctly connected one should be able to load their batch file, open the “e5-win” icon and begin to collect data.

Sound System
A recent addition to the 3T scanner is a custom designed sound system. Sound is sent via any source (generally a computer sound card) into an acoustic transducer located in the magnet room. From there the transducer converts the sound from digital to acoustic and the waves are sent out through thick tubing to a pair of MR safe headphones. In addition, we also possess an optical, MR safe microphone. A piece of optical tubing is run from the head coil, through the waveguide and is plugged into a silicon converter. Auxiliary devices can be plugged into the converter such as a recording device, speakers or a computer.

Setting up the sound system is no more difficult than working with a home stereo. First attach the speakers & output RCA cable to splitter on Patient1. Next run the transducer cable through the wave-guide and connect to RCA cable under the table. Third, run the optical microphone tubing through waveguide and connect the tubing to the silicon converter. Next plug the microphone and speakers into the outlet. Finally, turn on the transducer and test the setup by playing sound.

Physiological Monitoring Box
Old Equipment
The 3-Tesla scanner also has an integrated physiological monitoring system capable of tracking multiple physiological components. This system generally uses a software application called LabVIEW. Though protocols vary no setting up the monitoring equipment there are basic steps for recording and transferring your data. To prepare to record your data you must first hook up and turn on your desired hardware. Next you must log onto the black computer using the username mri and the password physio"". Then open an interface and click on the DAQ icon to load the software. Finally, under options, choose a location to save your data.

Once data has been recorded it is necessary to transfer the data to another location to retrieve it. Though instructions are located beside the black computer system to facilitate
this, we will summarize them here. First, exit out the of graphical user interface. Next, move to the directory containing your data, tar and gzip your files. Then, open an FTP connection to 128.147.59.29, logon under the name physio and password physio and transfer your files. Finally go to the mac and burn them on CD.

New Equipment
We have recently purchased a new physiological monitoring system from Medrad. This system incorporates up to twenty monitoring options in a convenient portable system. Further information about this equipment is available upon request.

Others
The 3T scanner is equipped with many other components. With proper experimental design and enough notice the 3T can be used to accommodate almost any normal scanning needs
Chapter 4:
Collecting and Retrieving Data
**E-Prime Files**

Many users collect physical response data from their subjects. When using E-Prime this data is usually collected in the form of text files and stored in the same location as your original E-prime scripts. To retrieve your files you must logon to Patient1, open Windows Explorer and go to the following location: My Computer → All Users → Shared Documents → Shared Experiments → IFIS → Shared → $your directory$. Once the files have been located they can be copied onto a floppy disk. To do this, follow this simple procedure. First, insert a floppy disk into Patient1. Next highlight all the file needing to be copied (ctrl and select with the mouse) and drag them to Floppy Drive (A:). Once the files have finished copying the disk may be removed and the data taken.

**Burning Data to a CD**

In some case it may be necessary to burn data from the IFIS computers to a CD instead of a disk. The first step in burning data is to understand the computer systems. As described in the first section only the Operator1 system has a CD burner, but the computers are linked. This means that even though all the data is stored on Patient1, data can still be burnt on Operator1. For those individuals not familiar with the standard operating procedures for Windows XP here is a detailed procedure for burning data.

1. Log onto the Operator1 computer system, close the IFIS interface and open Windows Explorer.

2. Insert a blank CD into the drive on Operator1. When you first insert a blank CD into your CD recorder drive, Windows XP opens a dialog box asking if you want to open a writable CD folder. Just click cancel.

3. Locate the desired files by expanding Network Neighborhood and selecting shared documents on Patient1. This will open up the data section of the Patient1 computer. Look through the directories to locate the desired data files.

4. Once the data files have been located highlight them, right click and choose “Send To” → DVD/CD-RW. This sends the files to a staging area where they are ready to be burnt.

5. Finally, in windows explorer more to the CD-Drive icon, right click and choose “Write files to CD.” After burning has completed close Windows Explorer and remove the CD.
Chapter 5: Old IFIS Cart
E-Prime
Located in the 3T control room is an old version of the current IFIS system in the form of a cart. The IFIS cart, which has the same basic design as the new system, runs Windows 98, a very old version of E-Prime and has a pre-release version of IFIS libraries. For all intensive purposes this cart is obsolete and should be phased out in the near future. However since it is still in use by a small handful of users it will be described in limited detail.

Hardware Configuration
Again, the hardware configuration of the old IFIS cart is similar to the new system, just with older equipment. Paradigms are loaded onto the system and executed in the same manner. It items to keep in mind are regarding connection of the cart system to the peripherals such as the projector.

When using the old system the old movable projects must be used, the cart is incompatible with the rear projection system currently in place. Therefore a fiber optic cable must be plugged into the back of the system, run through the waveguide and connected with the projector. Additionally, when trying to use external devices with the old system a certain configuration is required. All external auxiliary devices must be plugged into the cart through a parallel port and then the cart must be plugged into the right side switchbox on top of the new IFIS computers. Finally, the right switch must be turned to “psyscope” to allow the use of an external device.
Chapter 6: Troubleshooting
This section will cover some frequently asked question and problems that occur when setting up and using the 3T system. These are actual problems that have occurred and have likely solutions. In some cases problem have unusual reasons and unorthodox solutions. So, if a problem does occur, don’t hesitate to ask someone for help; it saves time and frustration.

**There is no display from the projector**
Projector problems usually arise as a result of a signal not being transmitted between the computer system and the projector itself. When examining this type of problem pay attention to certain things:

1. Is the projector turned on?
2. If the projector is on, is video activated (i.e. DVI and analog clone)?
3. If everything is active is light coming from the lens?
4. Is the fiber optical cable hooked up to the projector and computer?
5. Is there an error message?
6. Are only the PST / Psyscope message being displayed?
   a. try changing the “input”
   b. try restarting the projector

For times when the projector is projecting images but the images are somewhat distorted here are some items to pay attention to:

1. Is the computer resolution set to 1024x768?
2. Is the lens in focus?
3. Is the projector screen tilted?
4. Is the fiber optic cable tangled or obstructed?

**I’m getting no response from the glove**
On some occasions users wish to record a physical finger response in the form of the response gloves. Most problems with the response gloves are attributed to a disconnection, but here are some items to pay attention to:

1. Are the glove cables connected?
2. Has a cable been broken?
3. Is the patient using the wrong finger?
4. Is the cable connected in the control room?
5. Is the user’s paradigm set up for glove response?
6. If yes to 4, does the paradigm have the right assignment of numbers to finger?
   (i.e. Thumb response = 0, record YES)
**I’m not gathering eye-tracker data**

One of the major problem spots with the 3T can be the eye tracking system. This is because it has many parts and is highly configurable. Problems with the eye tracker generally come in the form of improper cable connections and computer problems. When the eye tracker doesn’t seem to be collection data first look at the cable connections:

1. Is the right group using the right cable (i.e. Siegel – Pink, Luna – White)?
2. Is the switchbox in the right position?
3. Have the data cables been disconnected from the back of the eye tracker box?
4. Has the parallel cable from the switchbox been disconnected?

If it doesn’t seem to be a cable problem check the computer

1. Try rebooting the computer and all equipment
2. Restart the ASL software

If it doesn’t seem to be a cable or computer problem you can try a few other things:

1. Is the cold mirror still on the head coil?
2. Is there another type of obstruction for the eye tracker beam?
3. Are any additional devices plugged in?

**My paradigm is being triggered prematurely**

A paradigm being triggered prematurely is not just a sign of male old-age, it is usually indicative of random RF pulses. If this occurs there are several questions that can be asked:

1. Are floor panels, grates or extra wave-guides open?
2. Are any external or unusual devices plugged in?
3. Has anyone made changes to the 3T setup recently?
4. Is the user using a nonstandard paradigm (i.e. not E-Prime)?

**My external equipment doesn’t work**

Using external auxiliary devices can be a bastion of problems. One must first ask if this equipment can even be hooked up to the system, and if so how? Here are some basic questions to ask when there are problems:

1. Is the equipment attached to the psyscope switchbox?
2. Are all the cables connected correctly?
3. Did you hook up the device before starting up the system
4. Have you used this equipment before and where there problems?

**The computer are turned off**

Though we specifically ask that no user turns the IFIS computers off at some point the computer systems may be turned off. If this happens follow these steps to restart the systems.

1. Using the drive selector, choose hard drive number 3 for each system
2. Press the power buttons on each system
3. When restarted, log onto the system normally
A note about troubleshooting
Troubleshooting problems like these can be a daunting and intimidating task especially when dealing with such a complex engineering marvel. However, you must keep in mind that the setup in the control room is based on the same principals as a home computer, television or stereo, it’s just larger. When you begin to think about a problem start at the beginning and work your way through. If just follow the basic questions outlined below you will find that these problems are a lot easier than you think.

1. What are the symptoms of this problem?
2. With what device(s) is this problem actually occurring?
3. Could another device be causing this problem?
4. Have any recent changes been made?
5. Have I restarted all the hardware and computer systems?
Contact Information
It is important to be able to contact someone with a problem or a question. Listed below is the contact information for several people who can be of use to you.

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