EEGer4™

Neurofeedback Software

Operator's Manual
Version 4.3.0

Initial issue 30 July 2012
OM43001 16 August 2012 for standardized naming
OM43002 09 September 2012 to add Study Manager instructions
OM43003 13 November 2012 to change impedance mode display
OM43004   7 December 2012 to add custom session plans and changes for FDA 510K
OM43005 30 January 2013 to change indications for use
OM43006 21 March 2013 to change Tech Support menu and correct minor typos
OM43007 04 May 2013 to document 430c changes (expert popup, tc config,etc.)
OM43008 01 December 2013 for 430m
OM43009 20 March 2014 for 430R
OM43010 23 April 2014 for 430s
OM43011 13 June 2014 for 430t

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General Information and Cautions

Indications for Use

This device is to be used for general relaxation training when used with supported amplifier/encoders .

General Warnings

- US Federal Law restricts this device to sale by or on the order of health care practitioners.

- Operators of this device are expected to be health care practitioners trained in neurofeedback or technicians trained in neurofeedback supervised by health care practitioners.

Precautions to Observe

- When using an EEG sensor, the result of the sensor's slight susceptibility to strong Radio Frequency Interference (RFI) could be to artificially increase the microvolt reading and, in almost every case, to obviously corrupt the raw waveform. By paying regular attention to the display on the PC screen of the raw EEG waveform, it should be possible to readily identify whether or not obvious extraneous artifacts are present or to confirm that the signal is "clean". If you observe random or increased signal readings unrelated to user activity, move the amplifier/encoder and client away from any radiating device.

- You can also test for susceptibility of the active sensors by clipping the three electrodes together and observing the display for non-zero readings or variations. If you are unable to resolve the conditions, contact Technical Support.

- Do not mix electrode types. Electrode connections using mixed combinations of metals can lead to incorrect reporting of EEG data.

- Do not forget to clean and sanitize electrodes between use. Follow the electrode manufacturer's recommendations.

- Ensure that proper connection of the electrodes to the client is made. This is most easily checked by measuring the impedance of the electrodes to the head using some measurement device.

- Follow all the instructions in the instruction manual for the amplifier/encoder to be used.

Other Warnings and Contraindications

Warnings

It has been noted that EEG biofeedback (neurofeedback) may engender a "rebound effect" in some clients, i.e., biofeedback training for relaxation may result, sometime later, in an elevated level of arousal, heightened sensory awareness and increased vigilance. This is usually transitory and fades after a short time.

Contraindications

EEGer is contraindicated in clients with the following conditions:

Individuals who are unwilling or unable to understand the general principles and goals of the feedback used. This includes individuals with excessive behavioral problems or low IQ.

Individuals who experience anxiety or other unpleasant experiences in connection with EEG biofeedback training.

Certain individuals may be unable to learn to control their EEG through biofeedback. Therapy should be discontinued if periodic monitoring of therapeutic progress indicates that the client is not learning despite adequate review of instructions for feedback.

Among those individuals who experience a "rebound effect", some may find it mildly uncomfortable. In some of these cases it may be necessary to alter the level of relaxation being trained or discontinue biofeedback training altogether.

Possible Adverse Reactions

There have been some anecdotal reports of dizziness, drowsiness, fatigue, excitability and/or anxiety associated with an EEG biofeedback session.. These symptoms are usually mild and pass within a short time. If they persist, the supervising health care professional should change the training parameters or discontinue biofeedback training altogether.

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What's New in EEGer4 4.3

EEGer4 version 4.3 is a highly modified and updated version of the older EEGer 4.2 neurofeedback software. As part of the development process, there has been an extended test process carried out to verify operation of all components of the software.

Significant changes in EEGer4 are:
- Titles were restructured to be more explanatory and rearranged into more logical arrangements.
- Optional support for 4 channels of EEG
- Up to 3 displays of peripheral data on client feedback displays
- Major revisions to zscore integration
- Extended controls/feedback modes to support ANI zscore computations
- Correction of known bugs in EEGer 4.2.2p
- A new optional feedback display (Iris) to support multiple reward/zscore values
- Revised documentation (compliant with IEEE Std 2010-2012
        IEEE Recommended Practice for Neurofeedback Systems)
- Inclusion of utility programs in base release
- Multiple customizable session plans and ability to assign to existing clients
- Updated storage formats for additional data
    Note: EEGer4 can read all earlier EEGer files but older software cannot read EEGer4 files
- Additional advanced feedback modes

As part of the EEGer4 updates, provision for future modes and capabilities were made.

Support for EEGer4 is provided by EEG Education & Research Inc.

Introduction

EEGer4 is a software suite designed to provide visual and aural feedback based on electroencephalograph (EEG) brainwave signals. Neurofeedback is used to teach the brain to modulate excitatory and inhibitory patterns of specific neuronal assemblies and pathways based upon the details of the sensor placement and the feedback algorithms used, thereby increasing flexibility and self-regulation of relaxation and activation patterns.

Here is how the feedback process typically works:

The feedback loop begins with the client. Sensors 'pasted' to the client's head pick up microvolt-level EEG signals which are amplified and converted to digital voltages by the A/D subsystem at a nominal rate (usually 256 Hz).

The samples are converted to equivalent peak-peak voltages. All filters in the software are Infinite Impulse Response (IIR) filters. The raw samples are lowpass-filtered to remove 60 Hz ambient noise and threshold-limited to remove muscle (EMG) artifacts. The resulting lowpass signal is fed to a number of 'streams' of processing which are very similar.

In each stream, the lowpass signal is bandpass-filtered into various frequency bands (of the clinician's choice) using IIR digital filters. The filter output is fed to an exponentially-weighted moving average filter which produces a short-term average (peak-to-peak) voltage for further use. The time constant of the averaging filter is selectable but is usually 0.5 seconds. The moving average goes two places: directly to the client (game) computer/display and to a comparator. The comparator produces a threshold-exceeded signal whenever the clinician-adjusted threshold voltage is less than the current moving average of the stream.

All the threshold-exceeded signals are processed by the reward decision logic which declares a 'reward' when streams defined as "Inhibit" are all below threshold and streams defined as "Reward" are all above threshold. Rewards are also limited at some rate so that each sound can be separately heard. The reward command is sent to the client computer/display.

The client computer logic plays a prerecorded sound file (usually a short beep) whenever a reward is commanded, giving aural feedback to the client that all therapist-specified (amplitude) conditions were being met. The client computer also draws simple graphics images giving a continuous (25 Hz) display of the ratio of amplitude to threshold for each stream of data.

The client's EEG response to the aural/visual signals is then sensed and fed back into the loop.
This entire process is shown in Diagram 1.
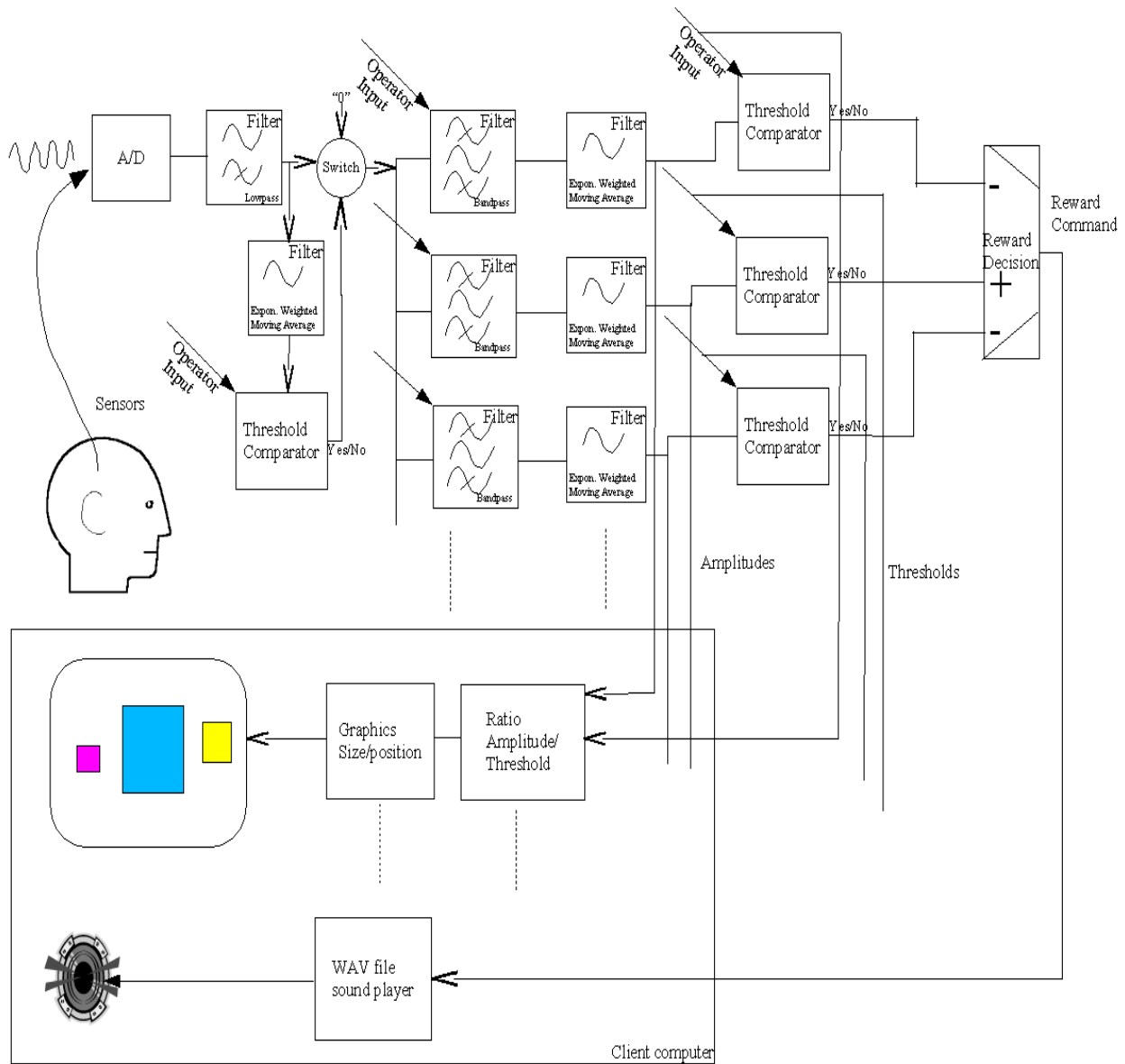
Diagram 1.

General Concepts

A neurofeedback system is comprised of four components: electrodes (sensors), amplifier/encoders, software, and the computers used.

There are several manuals for EEGer4 users. The Operator's Manual (this one) contains information on all the controls and displays provided by EEGer4. The Technical Manual contains details about the interconnection of data for all the processing, the filter and (supported) device characteristics, and structures of various data outputs.

Overall Operation
Typical overall operation consists of
    a) Selecting a client from the list of clients
    b) (Possibly) reviewing the planned session
    c) Beginning a session
    d) Selecting a feedback display (game)
    e) Making adjustments during the session
    f) Post-session, reviewing the results.

EEGer4 has been designed to facilitate this process and automate full data recording.

Protocol
A "protocol" is the name used to describe the sequence of actions to be used for a neurofeedback session (frequencies, times, site locations, etc.). EEGer provides "Session Plans" as a way of documenting and preselecting the desired protocol.

Protocol Class
There are three different "protocol classes" provided by EEGer as a method of organizing similar data. **AT** class is for Alpha-Theta training data, **SMR** is for Beta-SMR training data, and **EXP** is a Beta-SMR-like class where screening and baseline data can be separated from actual training data.

Layouts
Layouts define what data is presented on a session screen. The layout definitions specify how many traces of information are displayed and the order of the display. Different protocol classes can have differing layouts available. A typical (SMR) protocol class usually has layout selections like these:

For example, the "5-trace" layout has (from top to bottom) two raw/lowpass input data traces, one inhibit trace, one reward trace, and another inhibit trace. The "6-trace,inhibit" layout has two raw traces, two inhibit traces, one reward trace, and another inhibit trace.

Details of the content possibilities for each layout are detailed in the Technical Manual.

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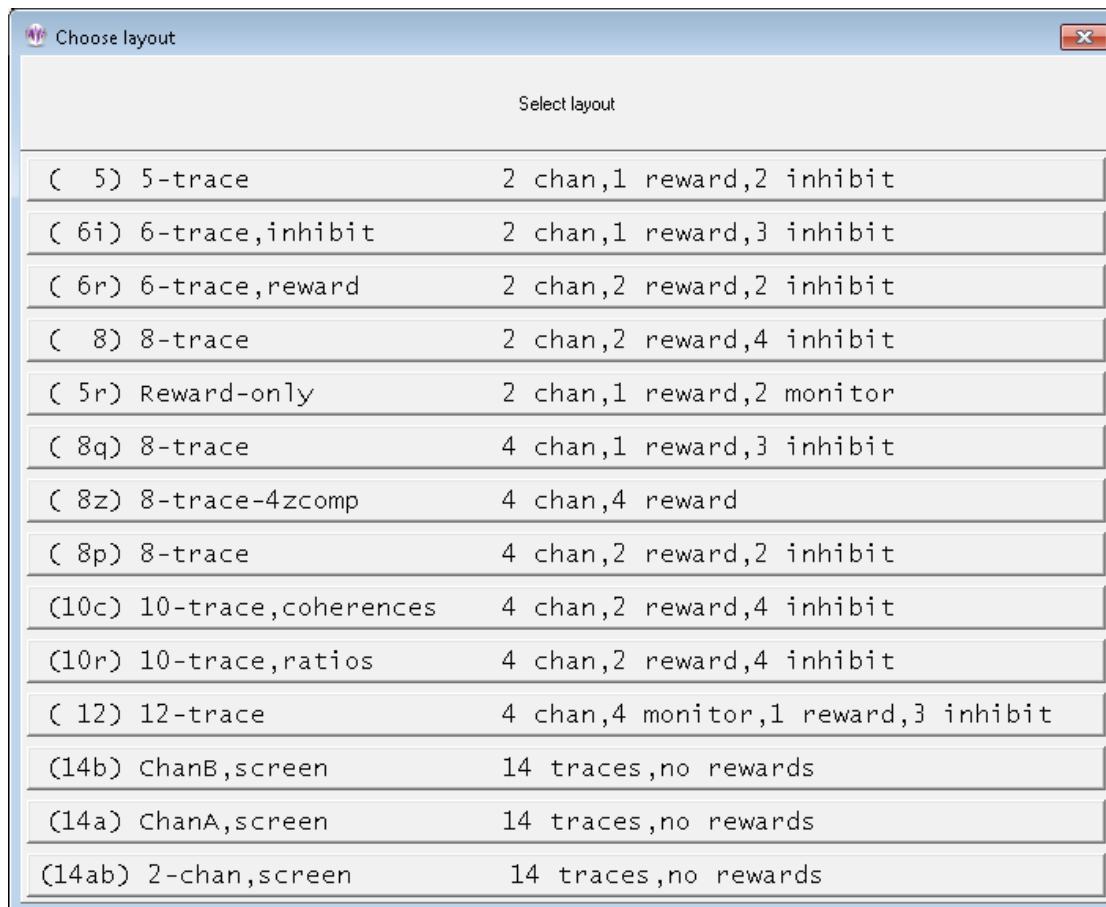
Session plans

Each client has an individual session plan (protocol) for each layout for each protocol class.
Session plan setup is fully described in its own section later in this document.

Feedback and reward modes

Within each layout, a number of feedback modes are defined. Operators can select from any feedback mode within a layout but not select a feedback mode not already defined within a layout. The selection can change during session (pre-)planning or during a session itself.
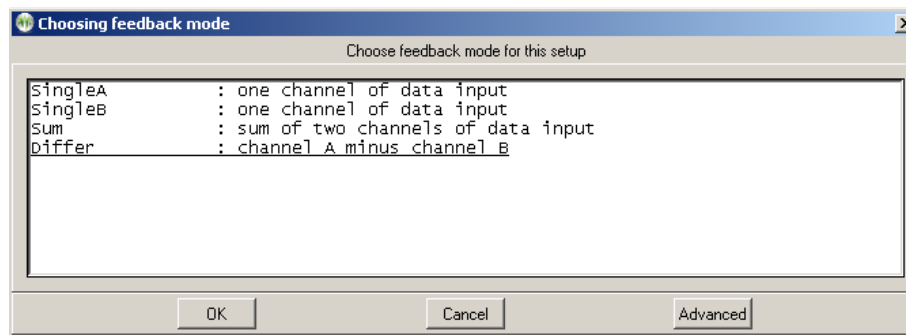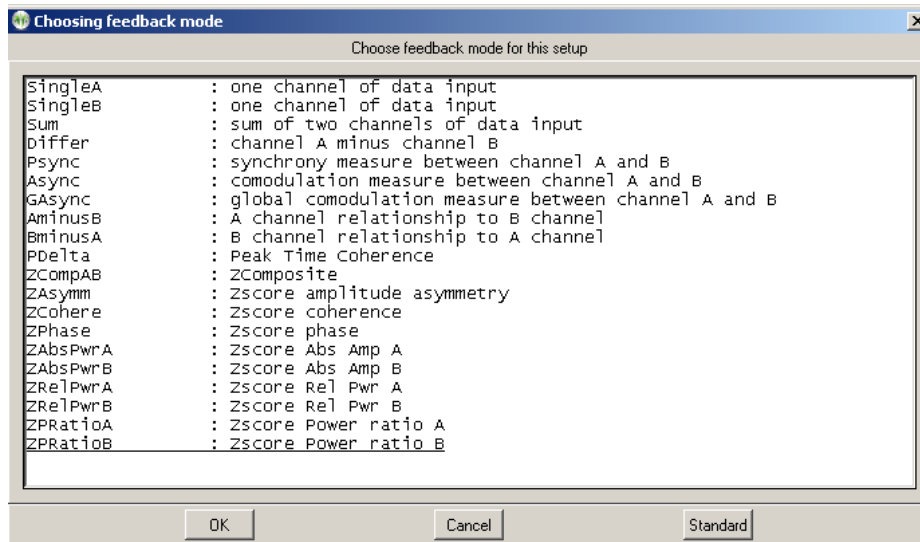
Many of the feedback modes have a selection of reward modes available. The specific reward mode can be selected during session planning and changed during an actual session. Reward modes available of course depend on the specific feedback mode in use but the following is a typical list:
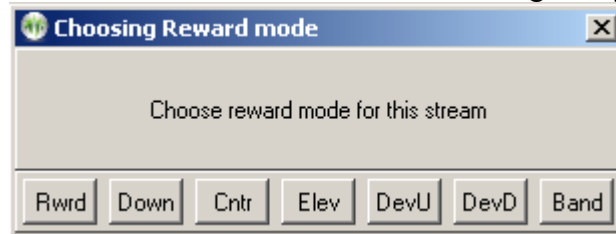
Additional modes (zscore)
Zscore modes and operation are described in Appendix 12. Zscore is an optional capability provided by purchase and installation of the zscore software from Applied Neuroscience, Inc. (ANI).

Tailoring Games
Each feedback display ("game") has a number of options that may be used with it. EEGer provides a large set of options that can be "tailored" for each game on either a semi-permanent basis or for one single session. Examples of this are the sound used for reward occurrences, reward rates, graphics used, colors, etc.

Sound Capabilities
Each EEGer game has a complex set of sound feedback capabilities that can optionally be used. These are described in Appendix 9.

Editor
EEGer has a built-in (simple) text editor that operates during sessions (live or replayed) and during the post-session reviews. Data is saved separately for each client.

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Remote (supervised) Clients

EEGer has a special remote-use mode for remotely-supervised (home) users. The mode includes features that allow/disallow protocol changes and set time frames and quantity limits for remote users. Also, methods are provided that allow the clinician to update/extend/alter the protocol plan for a remote client.

Testing the system

A confidence test of the system is performed as follows:
1. Start EEGer and observe no errors reported on screen.
2. Click on the button labeled "Select Client"
3. Locate and select "SMR eegdemo" (highlight and click open or double-click)
4. Notice that the remaining buttons are now available (and the "Select Client" button is now labeled "Change Client Selection")
5. Click on "Choose Layout" is the current layout is not the desired one (for now, select 5-trace)
6. Click on "Plan Session" to verify the current session plan. Click on OK at the bottom to exit the session planning.
7. Click on "Replay a Session"
8. When the list of files is displayed, select the "normal eeg" selection (select and click OK or just double-click).
9. If using a Thought Technology amplifier/encoder, turn it on.
10. Select a game to use (in this case, select Highway).
11. Verify that there are no error messages on the bottom line of the brainwave display. Error messages (in yellow or red) mean some problem or issue needs to be resolved.
12. Verify that there is NOT a flashing yellow or red message at the lower right side of the display. Such a message means the amplifier/encoder has not been seen by the computer.
13. Press F9. If an "Insufficient data" message flashes, wait a little while and press F9 again.
14. Press F11
15. Press F5. Notice that the PAUSE message in the lower left changes to RUN
16. Press F11 once more and listen for reward beeps.

Clinician Software Menus

The EEGer main screen as shown at startup (no client selected). Notice the RED warning message ("Demonstration Only -...") meaning a successful live session cannot be performed. YELLOW messages are information about upcoming limitations (expiration dates, session counts, etc.) . **F1** can be pressed at any time to show the help file. Also, **Alt-T** can be pressed at the main screen to bring up a tech support menu for aiding in technical support.

There are two rows of selections. The top row consists of Windows-style menus for program-wide actions. The second row is a row of buttons for client-specific actions. Until a client is selected, only the leftmost button (**Select Client**) is active.
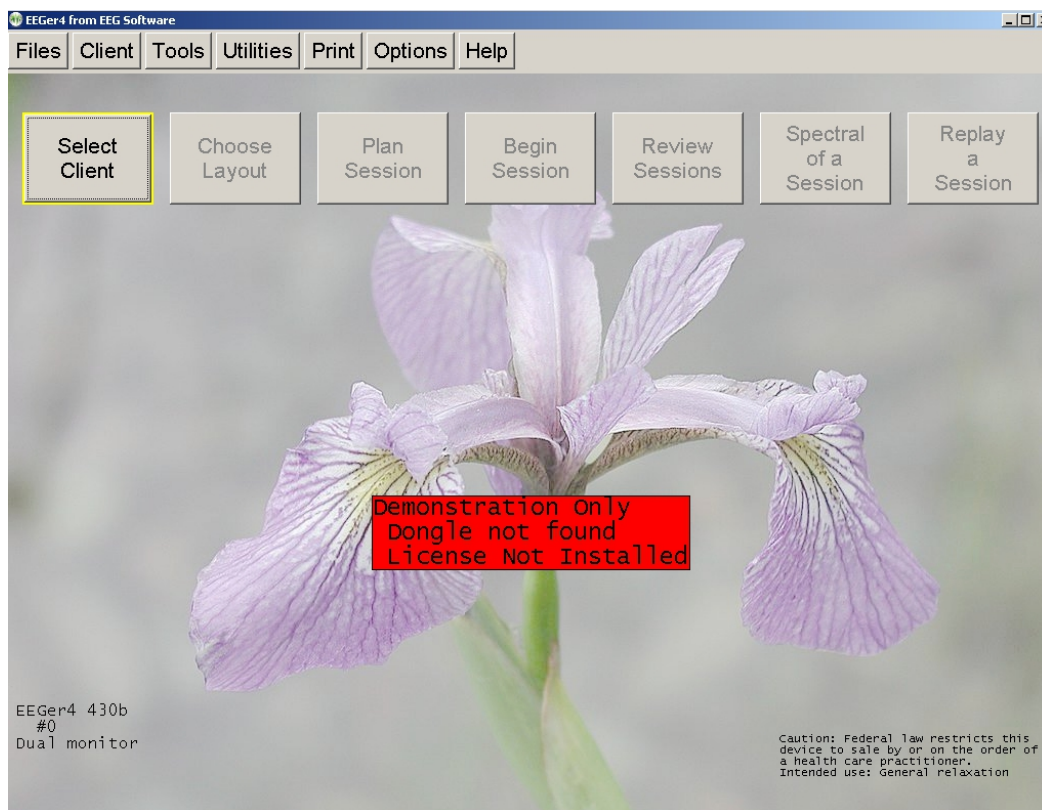
Details of each of the menus listed below are described in greater detail in each corresponding section.

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Files
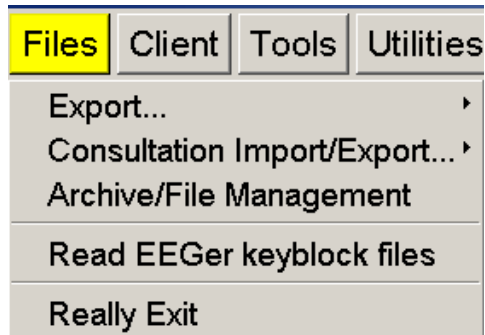
Client
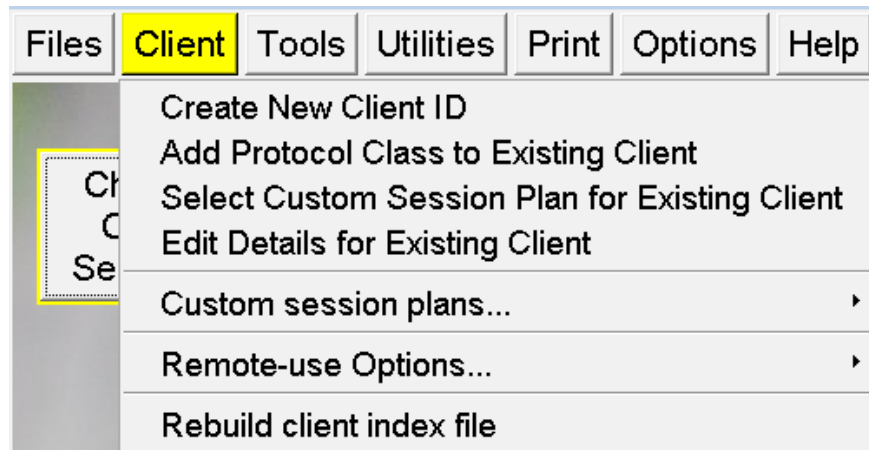
Tools
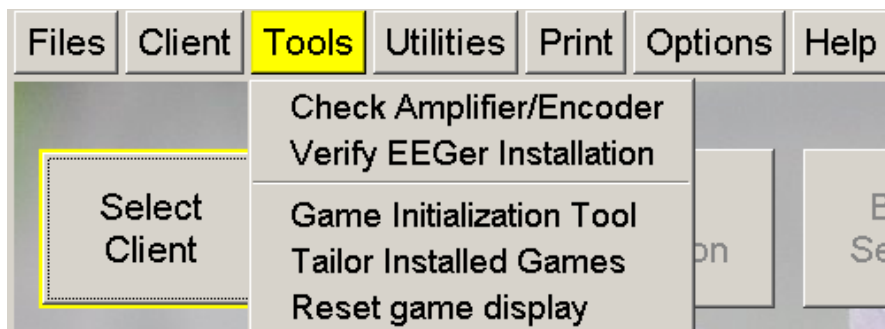
Utilities

The **Utilities** menu item brings up a list of currently installed utility programs that supplement the internal EEGer operations. The example shown below is only the default list of utilities. As other EEGer utilities are installed, they will appear on this menu.
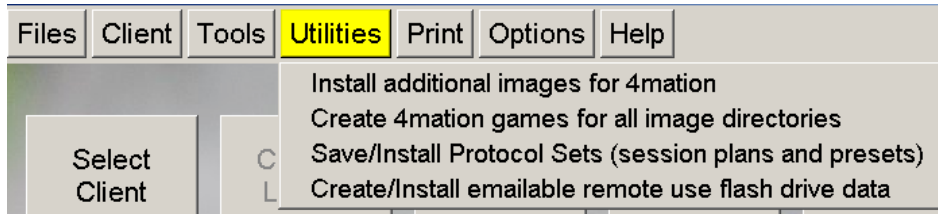
Print

The **Print** menu item brings up the print manager screen to allow preview/printing/deletion of various graphical/textual outputs of EEGer.

Options
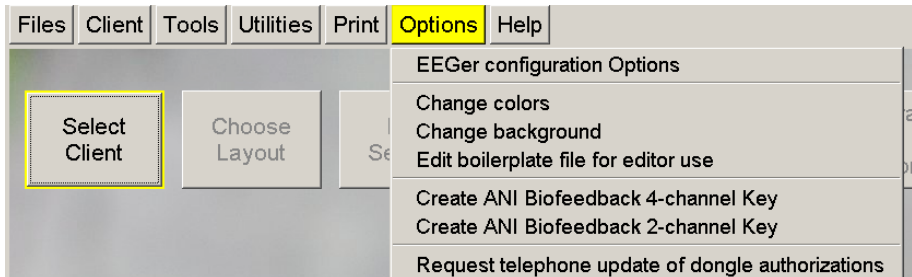
Help
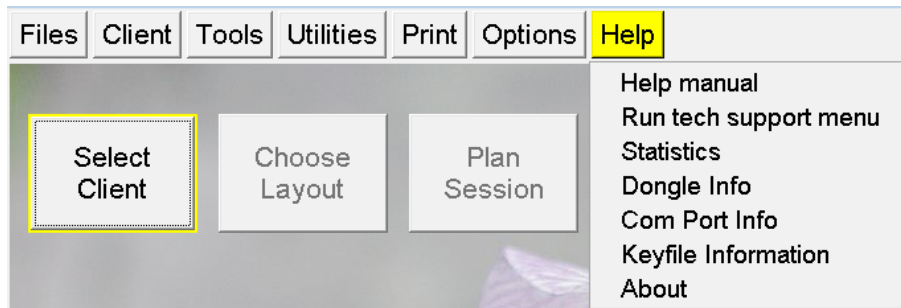
Files Menu

Export...
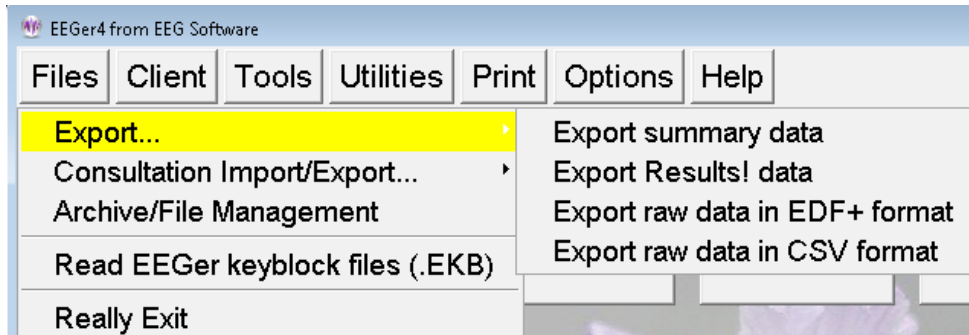
If **"Export summary data"** or **"Export raw data in CSV format"** is selected, a client selection screen will pop up to allow specifying a client.
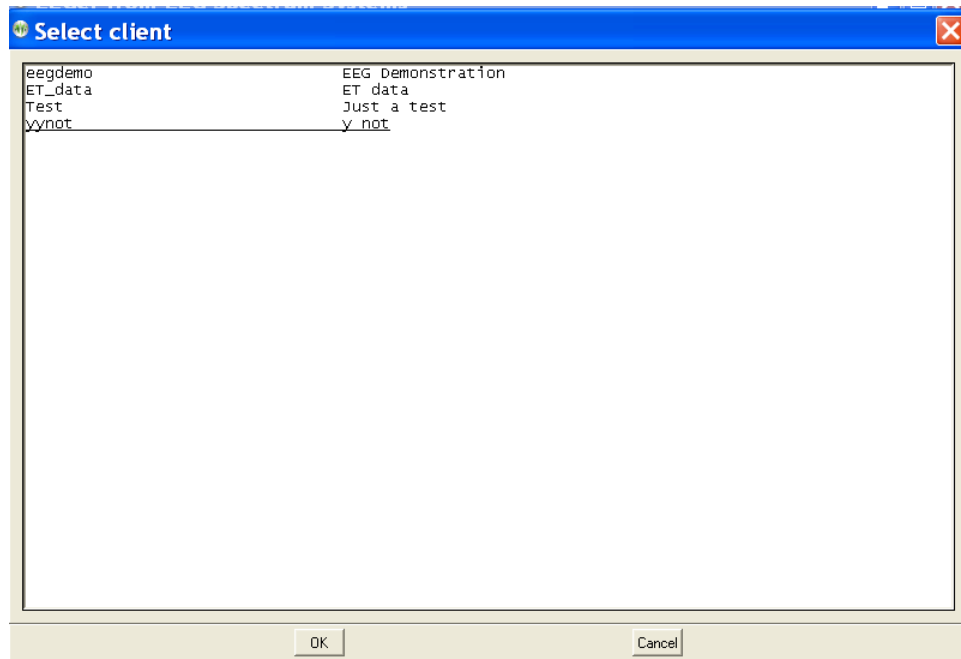
After selecting the client, a window will appear allowing the selection of multiple files for the specified client.
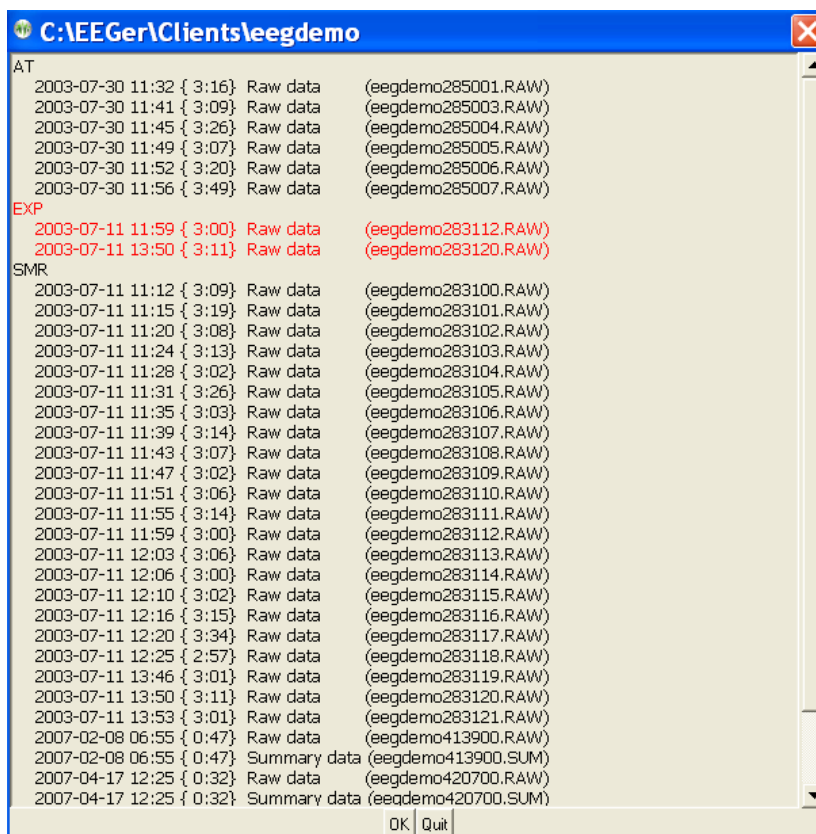
When the **OK** button is pressed, each of the selected files will be exported to the Export directory (default C:\EEGer\Export). Each file will have the same (basic) filename as the summary file (identified by codename and a date-number unique code) but have a .CSV (comma-separated-variable) extension. These .CSV files are suitable for direct import/opening by LibreOffice Calc, Microsoft Excel or other similar programs. Exported raw files have the letters "_raw" as part of the filename.

The .CSV files have one row of headers and one row for each second of data. Each row has as many columns as are defined in the headers. The structure comes from the layout/trace-count of the data as recorded.

If the **Export Results! Data** option is selected, the client selection window and session selection is made exactly like the **Export Summary Data** process (above) except that the output files go to the Results! directory specified in the setup configuration. The format of the .CSV files is specific to the Results! Program.

If the **Export raw data in EDF+ format** option is selected, the client selection window and session selection is made exactly like the **Export Summary Data** process (above). The output files are in EDF+ format. Filenames are related to the original raw file but have additional letters denoting which set of data is contained in the file. Please contact Technical Support for more information on the content and uses of the EDF+ data.

Consultation Import/Export...

If the **Consultation Import/Export** "Export Consultation data" is selected,
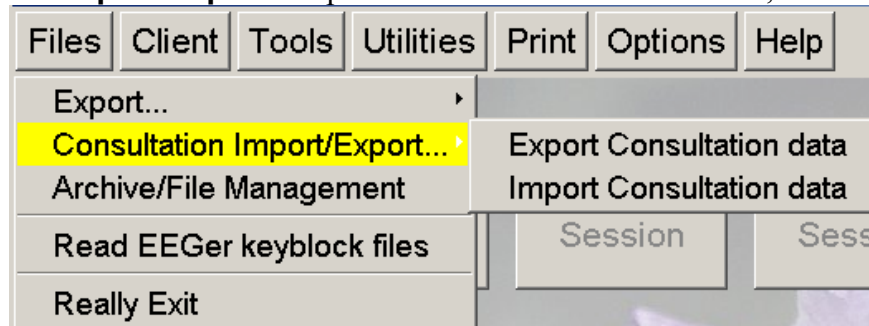
the process is similar to the "Export summary data" process (in the menus and selection of files). The consultation export places a special file (.ECE) on the desktop (or designated location set in configuration) which can be transferred to another clinician. This file contains all the information needed for another clinician to import and review the client (summary and possible raw) data.
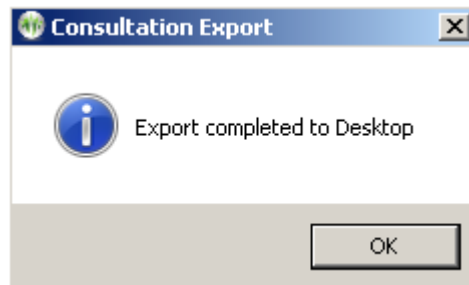
If the **Consultation Import/Export** "Import Consultation data" option is selected, a file locator dialog will be started to locate and import the .ECE file and create a 'client' from the data in the file.

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Windows XP:
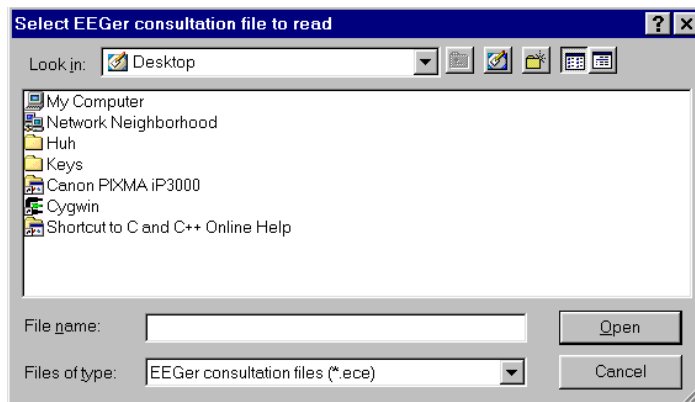
or Windows 7:
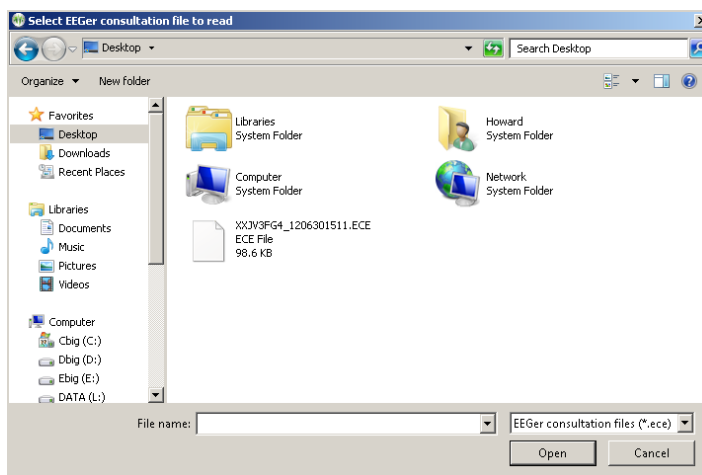
When the .ECE file as been selected (double-click or select and Open), a file contents screen will appear:
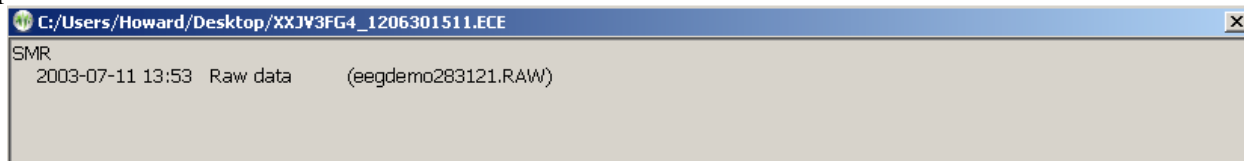
This allows import of only selected files from a .ECE file. The user clicks on files (or entire protocol classes) and only the red-marked files are imported when the OK button is clicked.
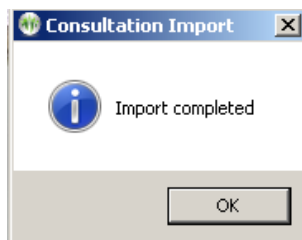
Archive/File Management...

The **Archive/File Management** selection brings up the following menu:
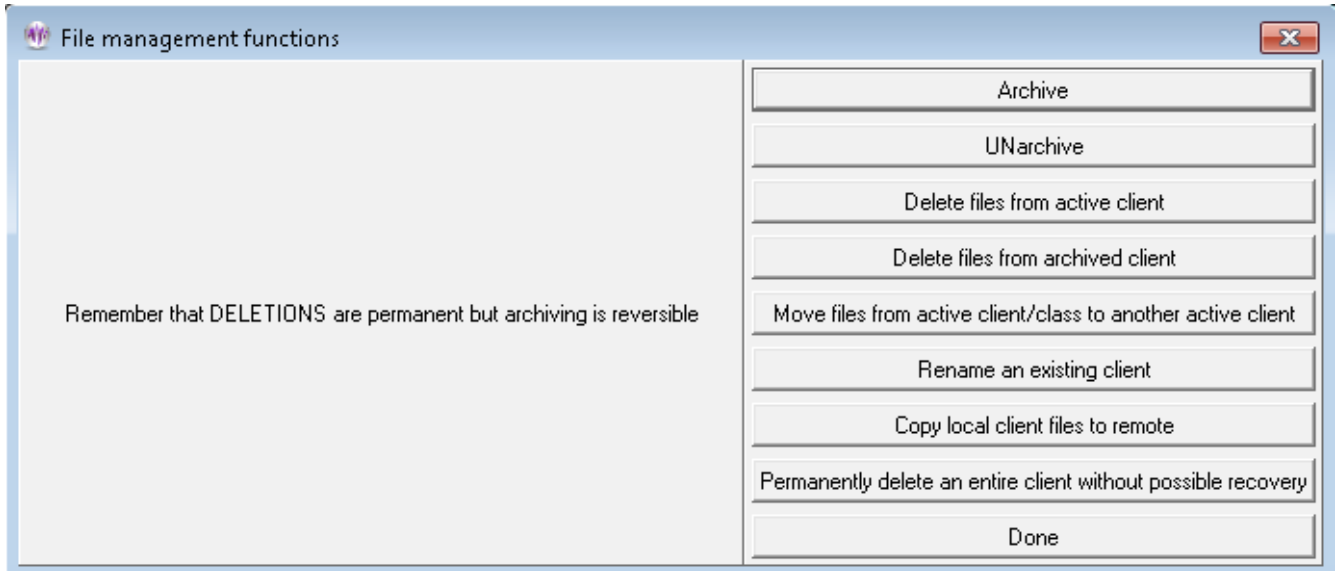
Selecting **Archive** (for example) brings up the client selection screen:
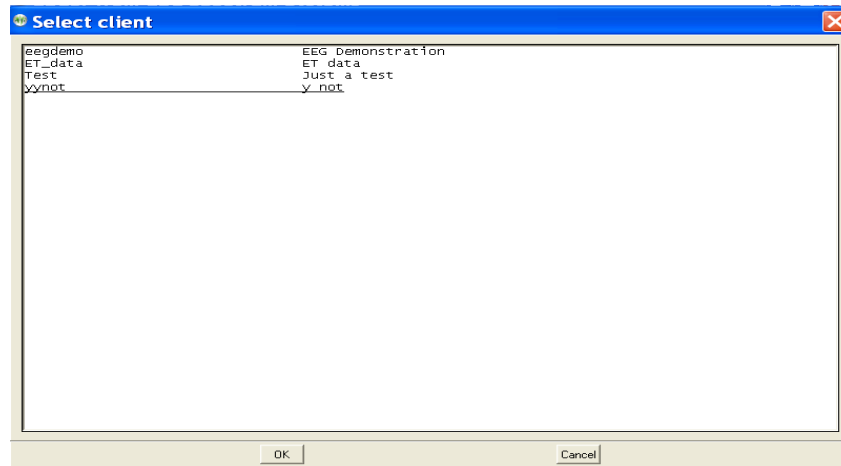
After selecting a client, the client data is examined and a selection screen is displayed.
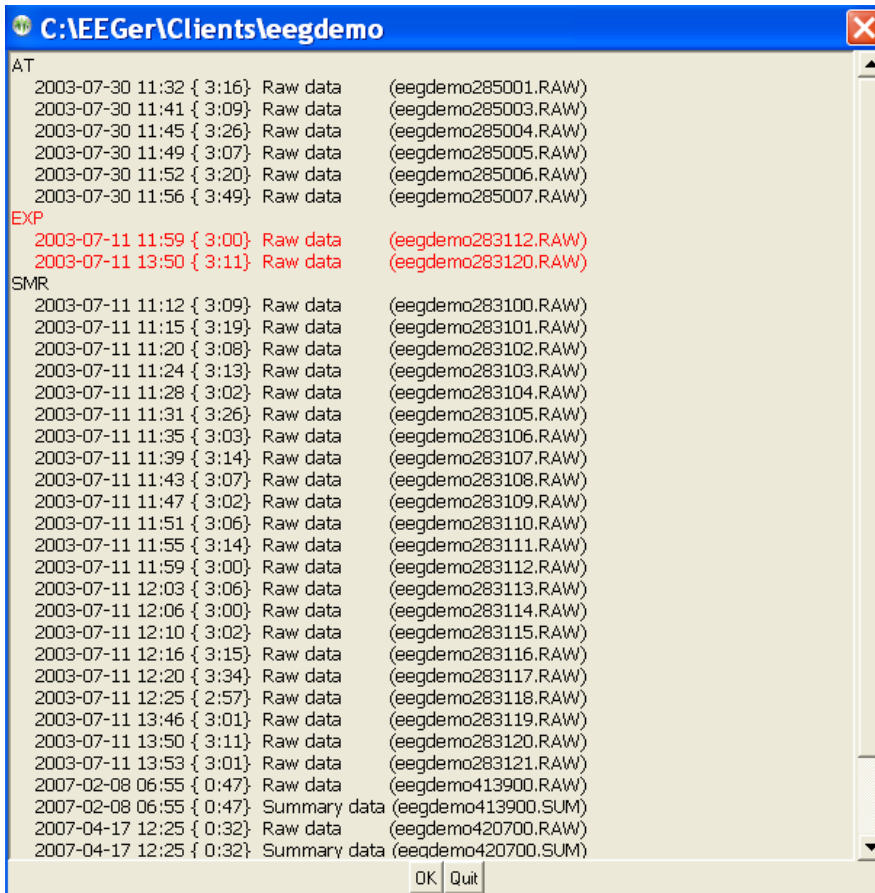
Shown here is the entire EXP protocol class selected. The date/time of each session is displayed.

Clicking on **OK** causes the data to be archived. This means the data is compressed into the appropriate client-specific .ZIP file and removed from the active client section. **If the protocol class item was selected (red), the entire protocol class subdirectory is removed. You need to do this to all protocol classes to remove the client completely from the client list.**

When data is **UNarchive**d, the directory and subsidiary files are restored to the current client path but the data is left in the archive file.

The archive/unarchive process is circular. You can archive an entire client, move the archive file to another computer, unarchive it, and have the complete client history, data, and setups available just as if it was always on the new computer.

Individual files can be deleted from either current clients or archived clients by selecting **Delete files from active client** or **Delete files from archived client** as applicable. The process of file selection is common to all the archive functions.

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If the **Move files** option is selected, a source client selection screen is shown:
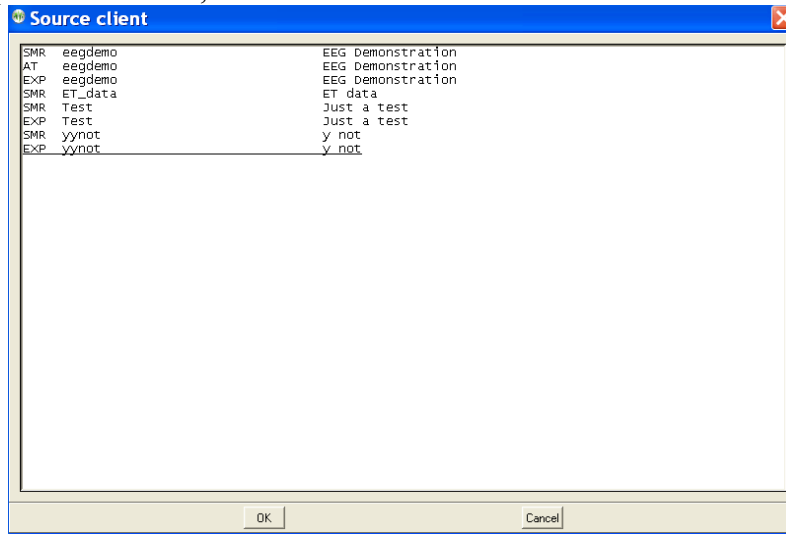
After a client is selected, a selection screen is shown (just like the **Archive** function above) to allow selecting which files are to be moved.

After picking the files, a destination client selection screen is shown.
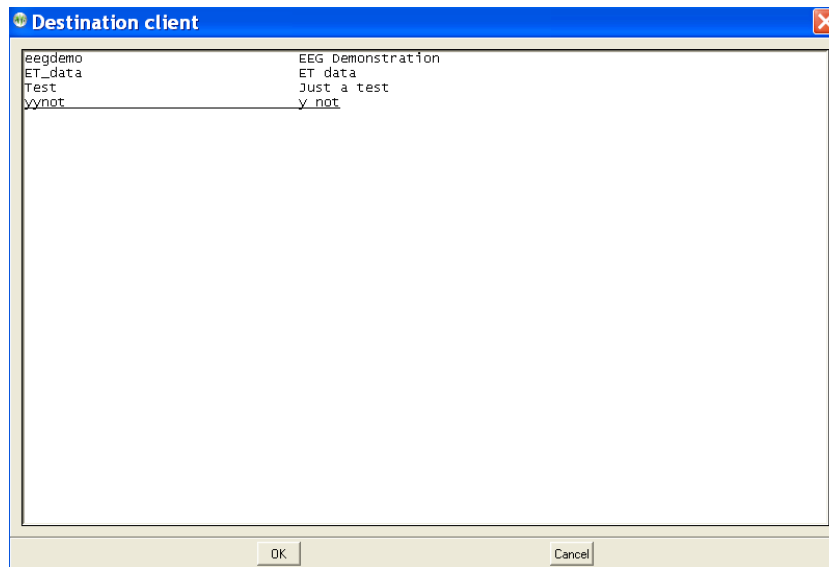
Now a protocol class for the destination client must be chosen.
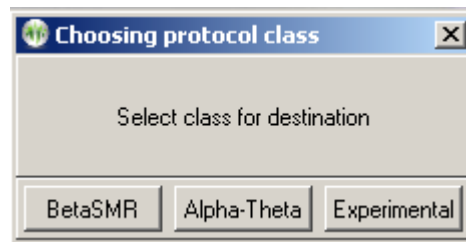
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Of course, you cannot move from the same client/protocol class onto itself.
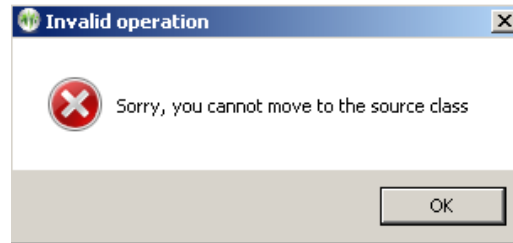
You can move files from one protocol class to another within the same client.

When moving files, the following screen shows the options for the move:
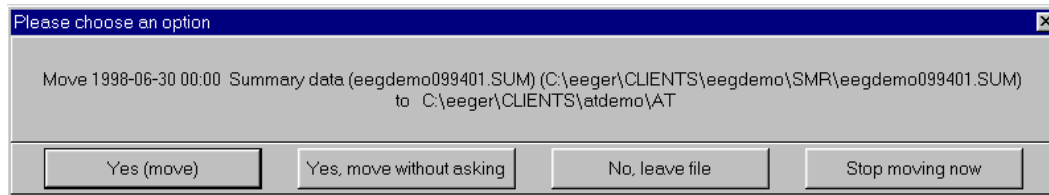
During the move, the source client codenames and fullnames will be replaced by the destination client codename and full name.

If the **Rename** client option is selected, the client selection screen is displayed:
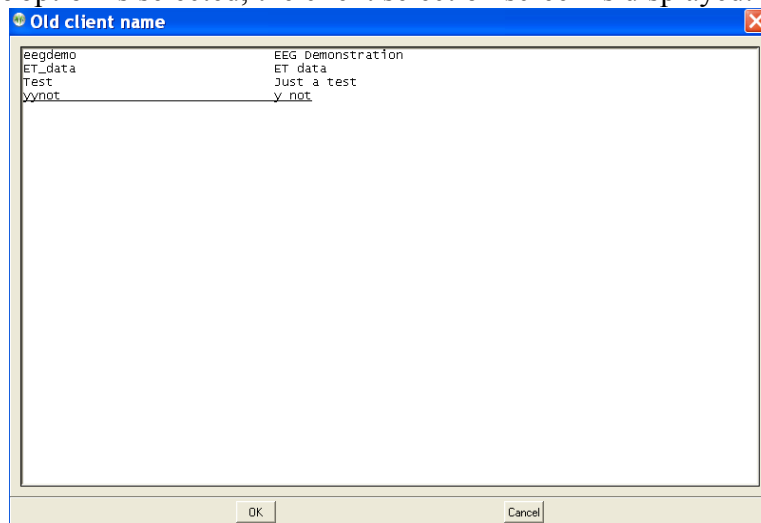
Once a client is selected, a <u>new</u> client name must be entered that does not conflict with any existing client.

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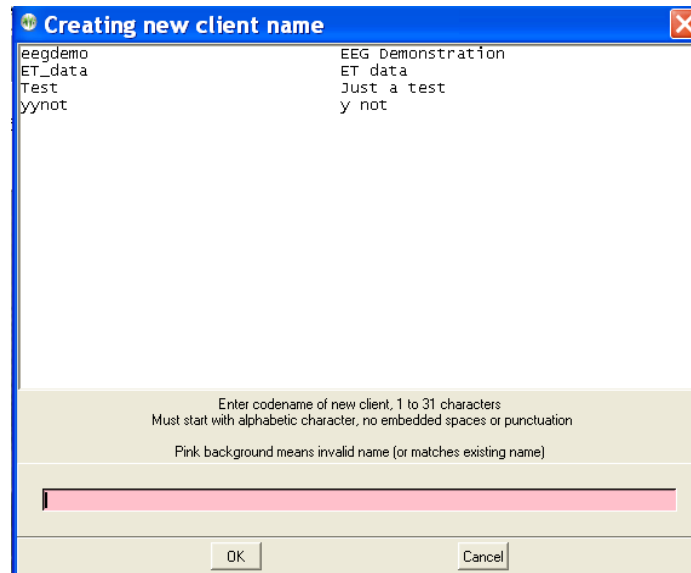
Once the full name, birthdate, and biological sex are entered (since you are creating a "new" client), all the "old" client files will be renamed to the new names including internal references.

The **Copy client files to remote** option exists to handle the case where a remote path for the client data was not available but the clinician went ahead and ran a local session. This option copies local sessions to a remote path specified AND EXISTING in the EEGer options data path configuration. Local sessions are not deleted and copied sessions never overwrite remote sessions (since they are date/sequence numbered).

Permanently deleting an active client can be done by selecting the "**Permanently delete** ..." option. The next step is to confirm you really want to delete a client forever. **THERE IS NO RECOVERY ON DELETED CLIENTS!** Perhaps archiving the entire client would be a better option (which also removes it from the active list but makes it available for restoration).
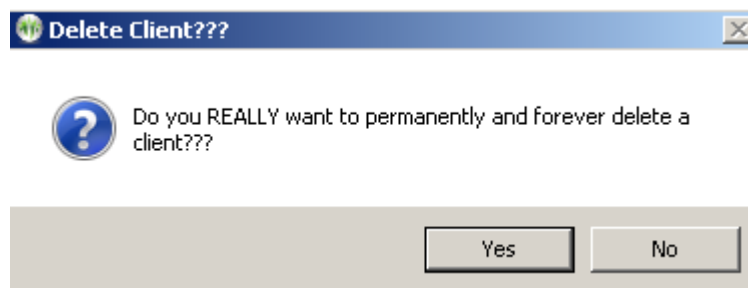
The client to delete is then selected
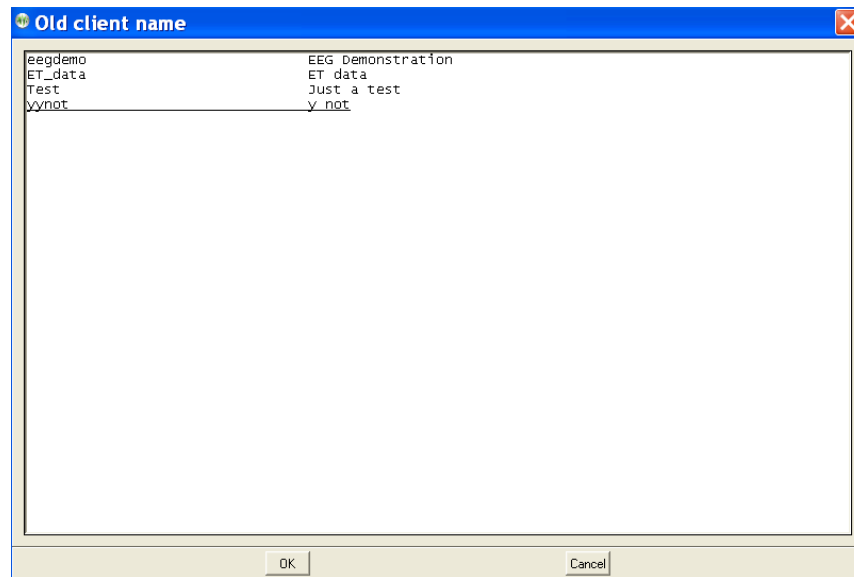
followed by another confirmation menu.
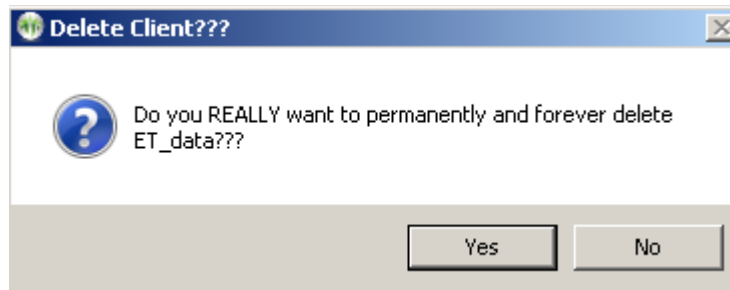
Deleting a client this way COMPLETELY and PERMANENTLY deletes the client and all information.

Client Menu

The **Client** menu option brings up a list of client-related actions. Clinician and remote-use systems have different remote-use submenus.
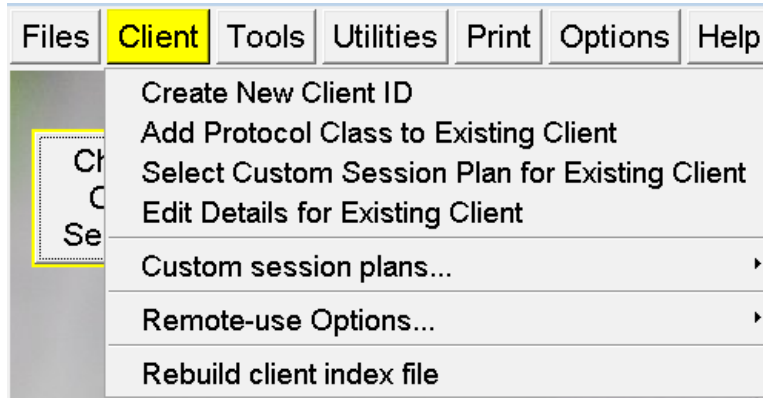
Create New Client ID

Suppose we want to create a "new" client. The same client name/code can be used for any and all protocol classes (Alpha-Theta, BetaSMR, etc.).

After selecting **Create New Client ID**, we get the screen below:
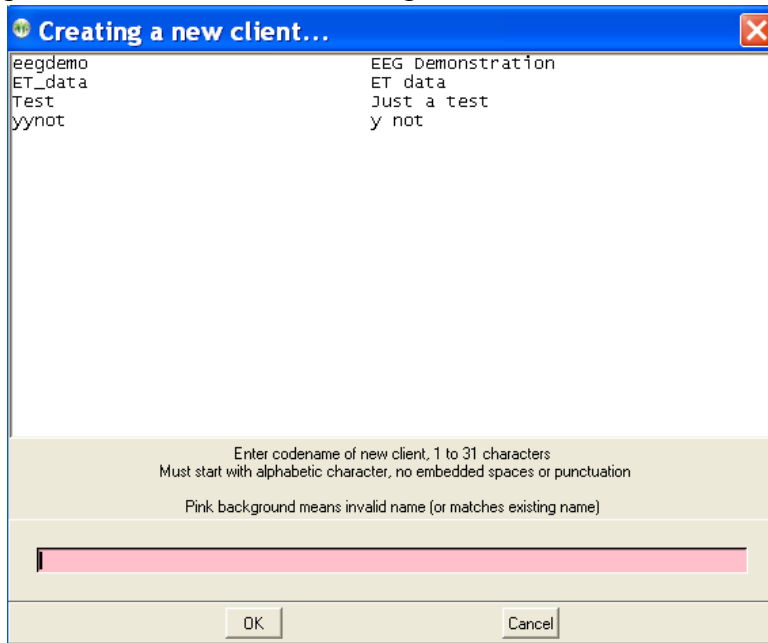
Here are shown existing client codes (and corresponding full names). Client codes are 1 to 31

characters with no embedded spaces or special characters (except a hyphen or underscore). The desired client codename is entered into the (initially pink) box. You cannot create a client code name in incorrect format (the pink background will let you know it is incorrect/not allowed).
When you have created a code name, the following window will pop up to allow entry of a full name:
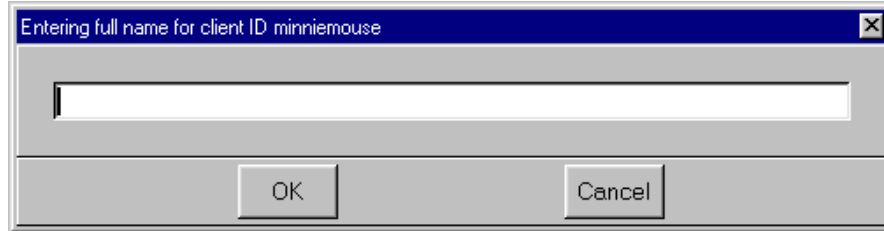
Here you can enter up to 64 characters (with spaces if desired) as the full name of the client.

Next, you must enter the birthdate of the client (in MM/DD/YYYY format).

Next you must enter a selection for biological sex:
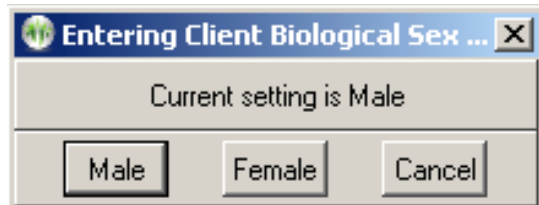
You must then select the first Protocol Class for the client.

       4.3.0
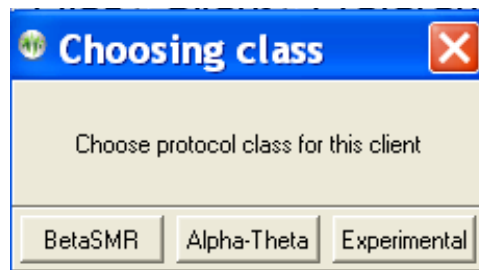
Add Protocol Class to Existing Client

To use a client for a session, a "protocol class" (like SMR, AT, EXP) must be created for the client. One class was created when the client was initially created. To add additional protocol classes, select **Client** from the top menu and choose **Add Protocol Class for Existing Client**.

This menu will pop up to allow selecting the desired client from a list of existing codenames previously created.
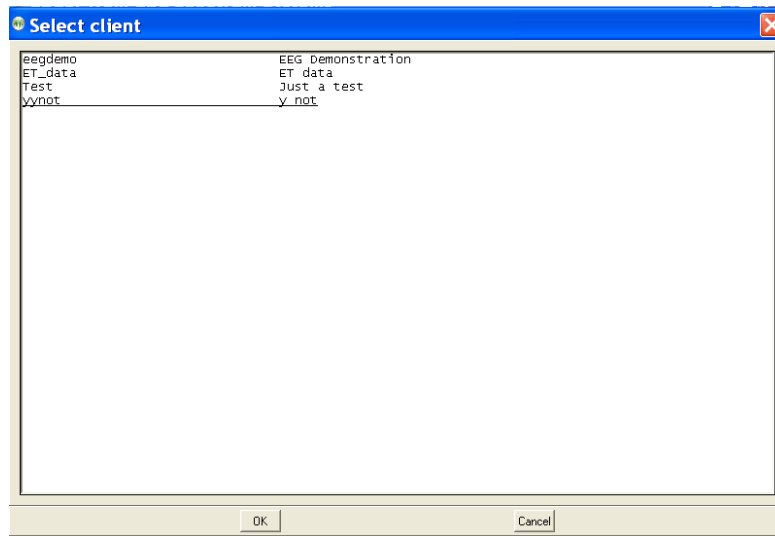
After choosing the client (select and click **OK** or double click on client line), you must choose the protocol class. The protocol class can now be selected from the following menu:
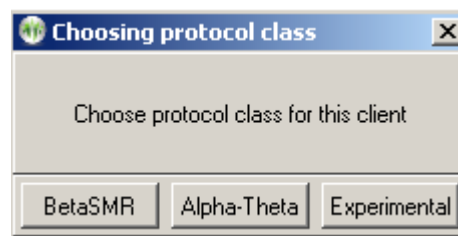
The "**Experimental**" protocol class allows you to create separate BetaSMR protocol options from normal BetaSMR usage. Note that the data, histories, and reports are separate for each protocol class (although they may be combined using the Archive/Move option). After the protocol class is chosen, the appropriate subdirectory, defaults, etc. are created on the hard drive in the path selected in Preferences.

An option is then given to allow a custom default session plan to be specified.
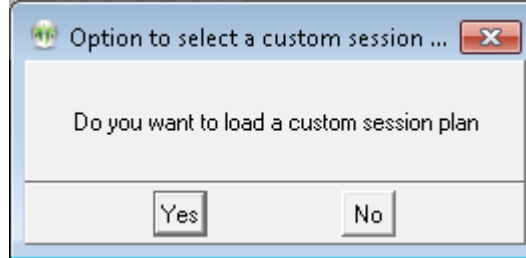
If **Yes** is selected, options are given as described in the following paragraph.

Select Custom Session Plan for Existing Client

This option allows overwriting a client session plan with a customized default plan. First, a client must be selected and a protocol class chosen. Then the appropriate layout must be selected from a list of layouts for the protocol class. If there are NO customized session plans, the default session plan for the selected protocol class overwrites the client/protocol class/layout plan. If there are customized plans (as described in **Custom session plans** below), a menu similar to this is shown:
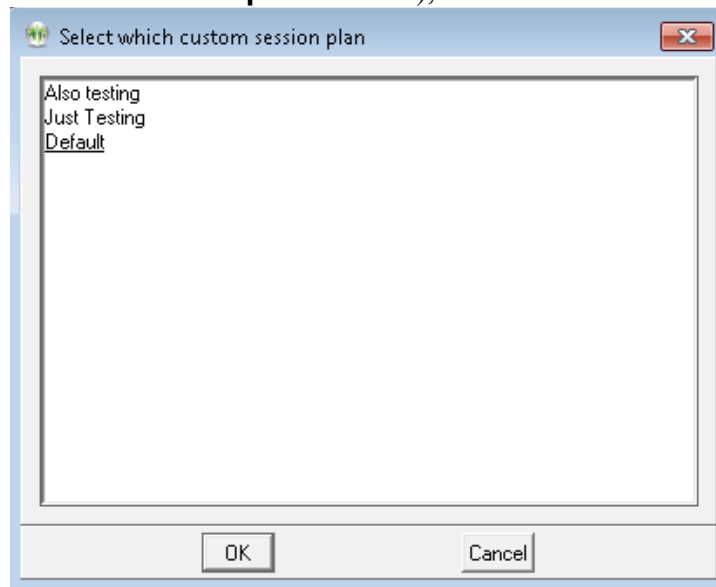
A custom plan can be chosen (by selecting and clicking on OK or by double-clicking on the item). The chosen plan overwrites the client/protocol class/layout plan for the selected client.

Edit Details for Existing Client

"**Edit Details for Existing Client**" allows editing of a client full name, birth date, and biological sex using the same screens as those used in the initial creation.

Custom session plans

The custom session plans and default filter setups for each protocol class can be edited for each different protocol class.
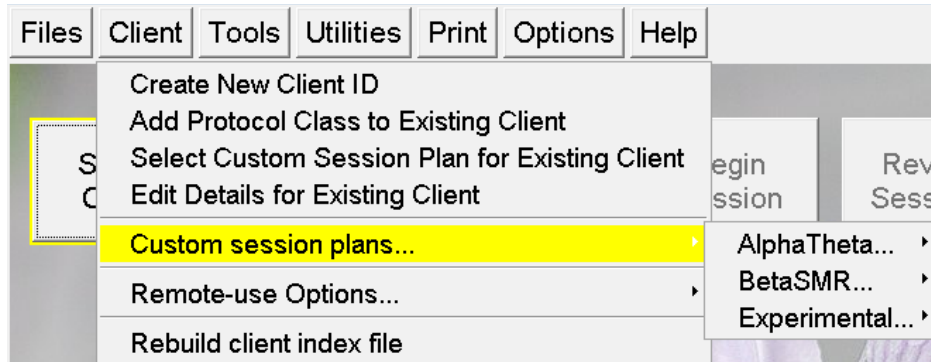
Session Plans

Choosing **Edit custom** (protocol class) **protocol class session plans**
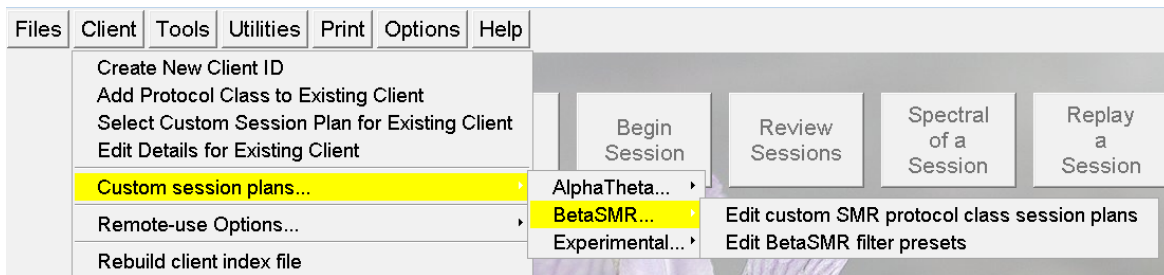
brings up a layout selection menu like this:
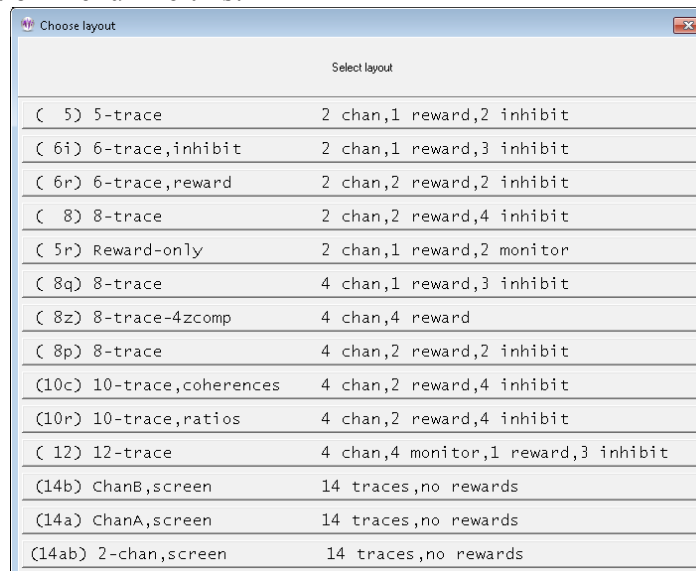
Layouts control the session plan and real-time brainwave screen display and processing actions. The "5-trace" layout has two raw traces, an inhibit trace, a reward trace, and another inhibit trace. The "6-trace,inhibit" layout adds a second (low) inhibit processing display/control. This layout specifies that any of the three inhibit streams can inhibit rewards. The "6-trace,reward" layout adds a second reward stream. In this mode, BOTH reward streams must be in a reward state for a score to be given. The "8-trace" mode has two sets of reward+2 inhibits, each driven by a different input stream. Again, BOTH rewards must be in a reward state for a score to be given. There are separate session plans for each layout. There may be additional layouts beyond the four specified above based on certain processing conditions. Layouts are documented in the Technical Manual.

If there are no custom plans (only the default), the session plan edit screen will be shown. If there are custom session plans, a menu will be shown like this:
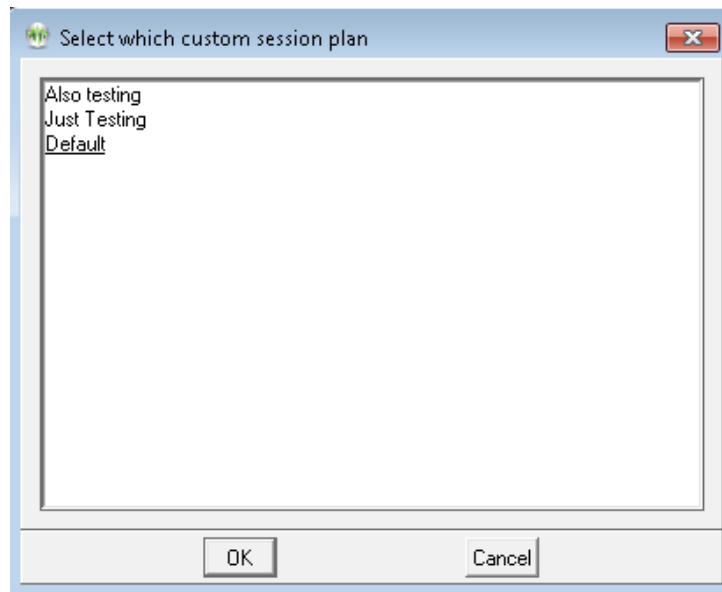
Selecting a plan and clicking OK (or double-clicking) will bring up the session plan edit screen.
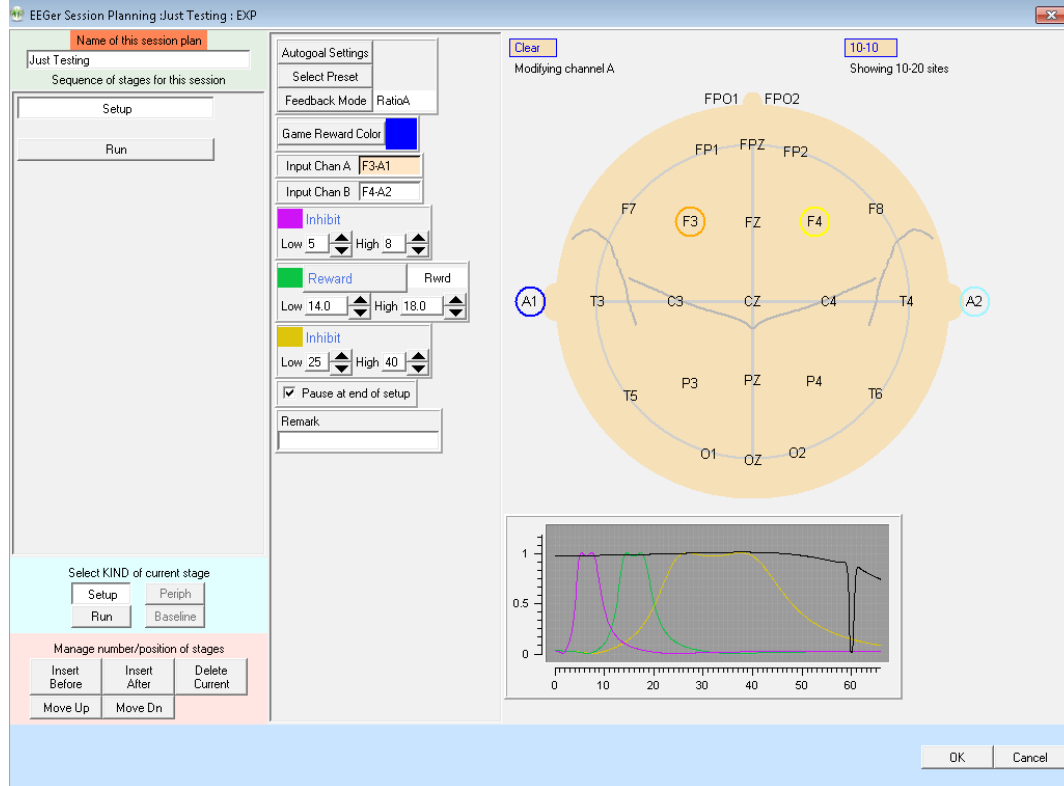
This is almost the same session plan editing screen that is explained later under **Plan Session**. The only difference is the field at the upper left titled "Name of this session plan". This "name" is how the clinician can identify a plan to be chosen. There are some limits on characters to be used (which will automatically not be allowed by the software). This "Name" becomes part of the stored plan name so changing the value implicitly creates a new customized plan.

There are two special cases: a blank name means the 'default' plan; the name "delete" (without the quotes) means to delete the originally chosen plan. It is not possible to delete the default plan. The default session plans are only used when client/protocol classes are **first** selected The default plan is copied to the specific client/protocol directory if no existing session plan exists. The client's plan can then be modified without affecting the default plan. Each client has a personal plan for each protocol class and each layout.

Preset filter setups

You can also select **Edit** (protocol class) **filter setups**.
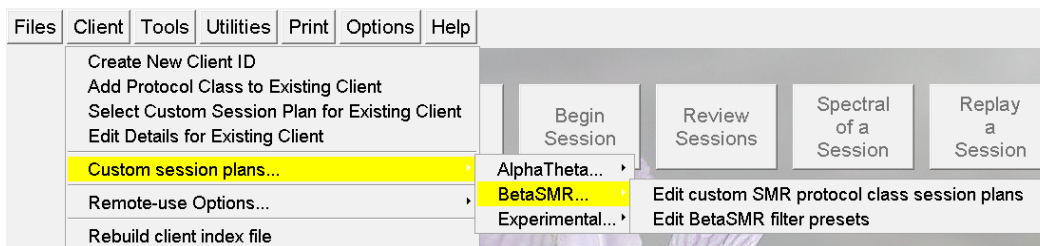
After choosing a layout from a menu as shown for the custom session plan, a screen pops up with existing presets for this protocol class/layout:
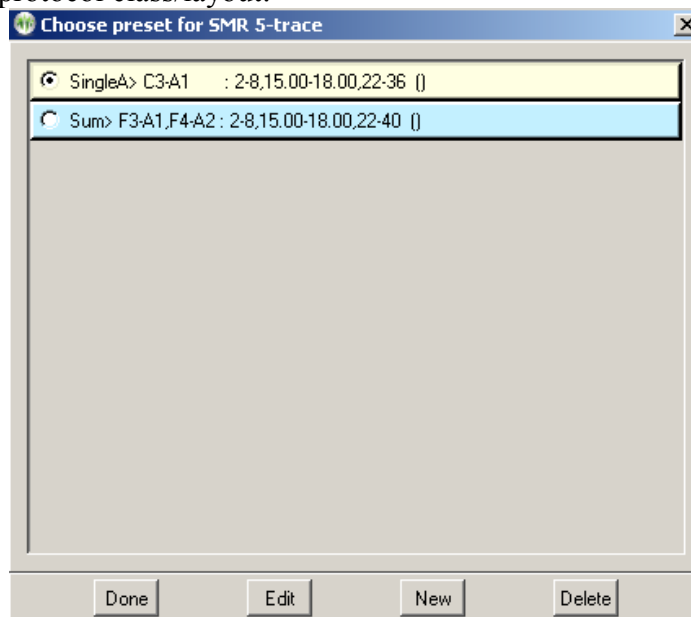
Selecting an entry and clicking on Edit brings up a session planning screen for editing. Clicking on New brings up a selection menu where a default processing mode must be chosen before continuing on to a session planning screen. Only modes available in the current layout are listed.
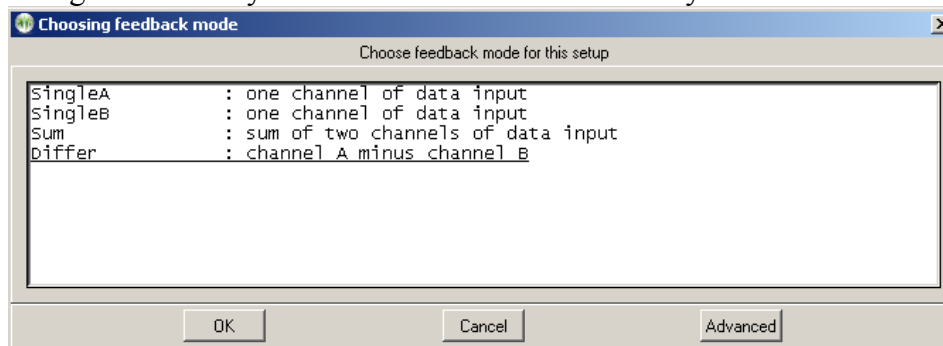
There may be additional advanced modes available:
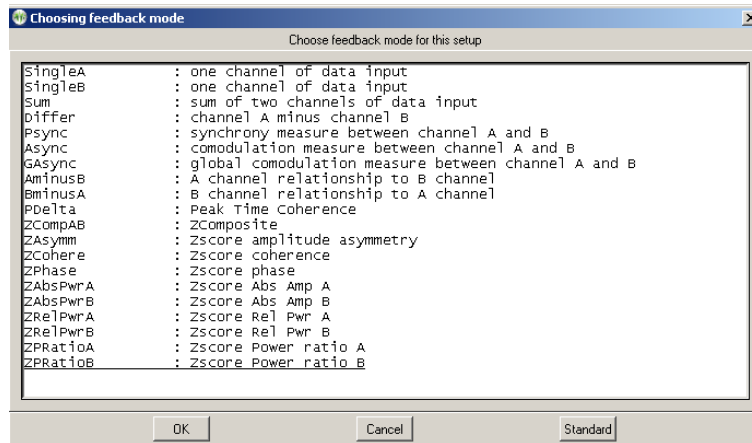
The session planning screen (limited to one stage; notice the stage is labeled "Preset") allows creation of a set of filter frequencies, sites, and modes which are selectable from a normal session planning screen.
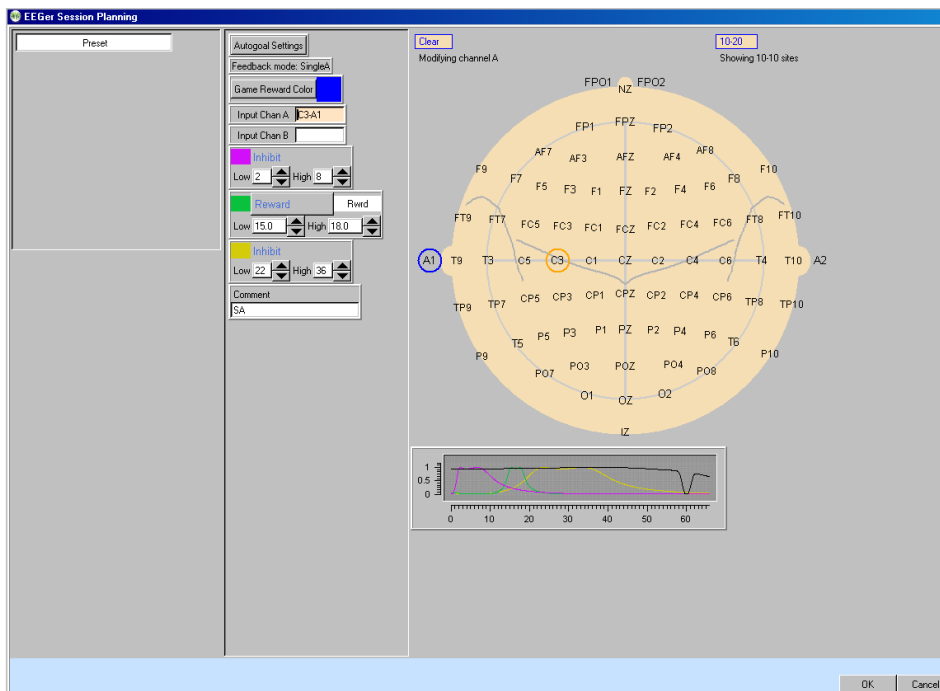
Notice the **Comment** field. Here you can enter a short description of the purpose of the preset as a reminder. (This will be shown on the preset selection menu.)

Remote-Use Client Actions

Remote-use is a method by which clinicians can allow clients to train at home and still exercise control over the number of sessions and treatment period. In EEGer, the clinician provides a session plan which is used for a session. The session plan and limitations are contained on a removable device which the end user must have to run a session (along with an EEGer dongle and license!). Remote users in EEGer require a removable storage device with storage capacity in the range of 30 megabytes to 33 gigabytes. Typically, a USB flash memory of some kind is used. EACH remote user must have his/her own storage device (although multiple protocol classes can coexist for a single client).

Clinician menus for remote use
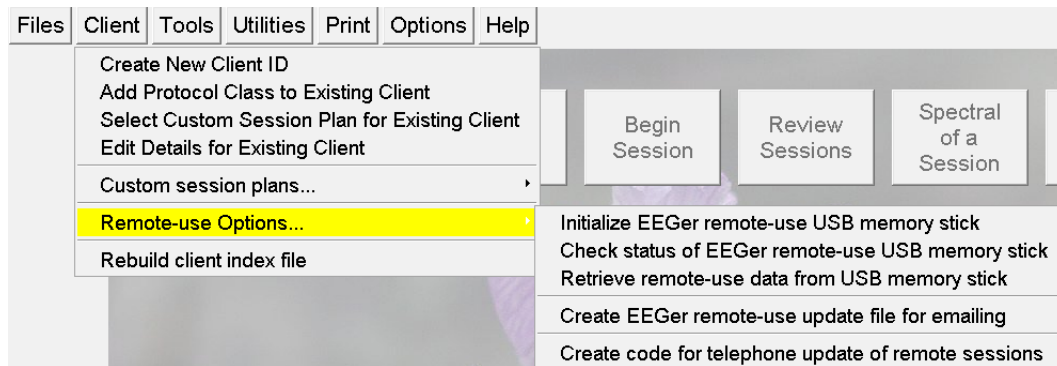
Initialize EEGer remote-use USB memory stick

Selecting **Initialize EEGer remote-use USB memory stick** brings up a client selection window.

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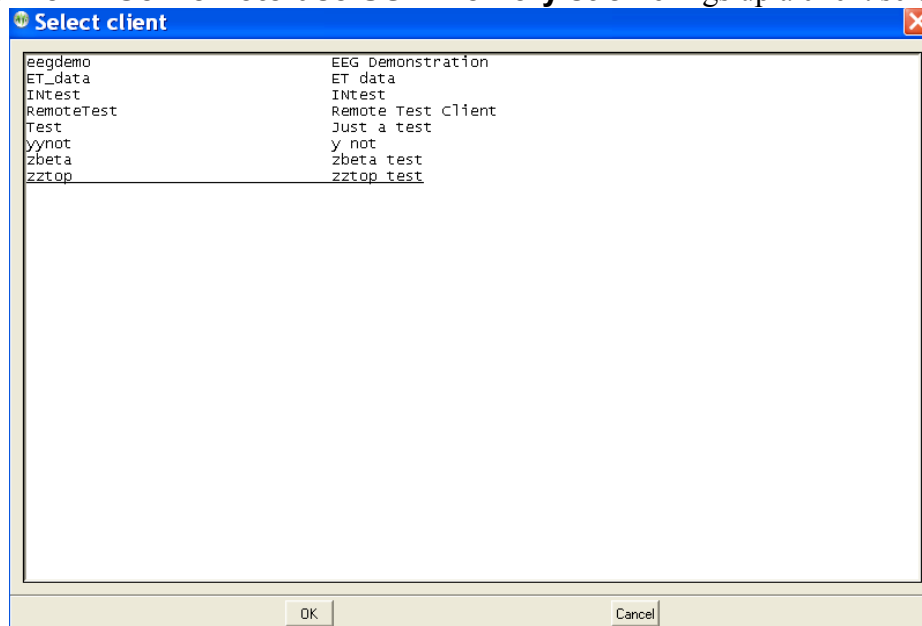
After a client is selected, the computer is searched for a suitable storage device. The following menu then pops up to allow the clinician to specify the storage device:
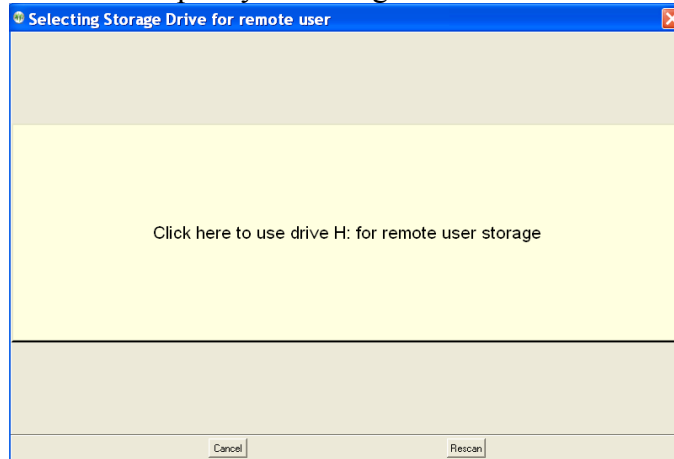
Notice that the H: drive (in this example) contains a suitable device. Also, notice the rescan button which performs another scan (in case you forgot to plug in the USB storage device). A drive is selected by clicking on it.

Then the drive is examined for its contents. If it contains a valid EEGer storage device structure and client, a test is made for any data stored on it. In normal use the client would bring the device back to the clinician at intervals (for more sessions or a time extension). At this time, the option of copying the data back from the storage device to the clinician machine is given:
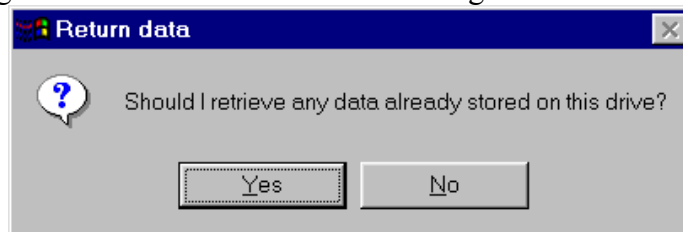
If there is NOT a valid structure/data on the storage device or after retrieving the data, a cautionary menu pops up:
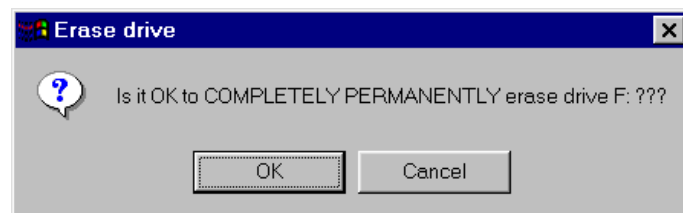
CAUTION: this process really DOES completely and permanently erase the contents of the drive. If you say Cancel, you get a message like this:

```
┌─────────────────────────────────────────┐
│ ⊞ Error creating Remote-user fil...  [X] │
├─────────────────────────────────────────┤
│                                           │
│     ⊗    result was :Not OK to erase      │
│                                           │
│           ┌──────────────┐                │
│           │      OK      │                │
│           └──────────────┘                │
└─────────────────────────────────────────┘
```
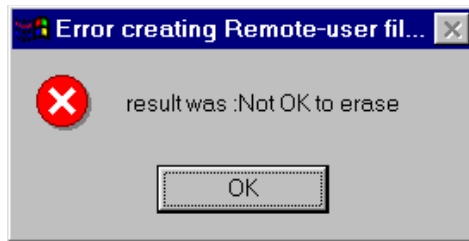
and the process terminates without erasing the storage device.
The device is now initialized with the basic client data. The clinician selects which protocol classes to permit the remote user to use.

```
┌─────────────────────────────────────────────────────┐
│ Choosing class                                   [X] │
├─────────────────────────────────────────────────────┤
│                                                       │
│            Select protocol class for this client      │
│                                                       │
│  ┌─────────┐ ┌───────────┐ ┌─────────────┐ ┌───────┐ │
│  │ BetaSMR │ │Alpha-Theta│ │ Experimental│ │ Abort │ │
│  └─────────┘ └───────────┘ └─────────────┘ └───────┘ │
└─────────────────────────────────────────────────────┘
```
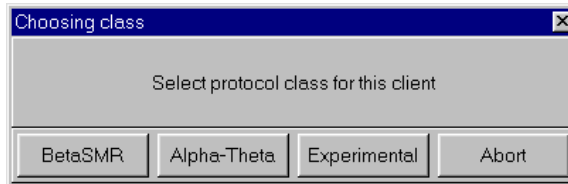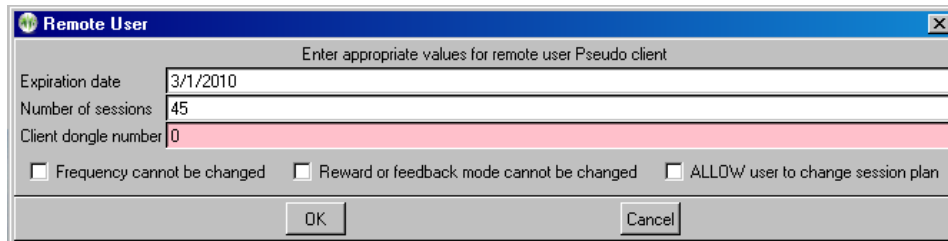
After a protocol class is selected, the layout must be selected:

```
┌───────────────────────────────────────────────────────────────┐
│ Ⓦ Choose layout                                            [X] │
├───────────────────────────────────────────────────────────────┤
│                          Select layout                          │
│                                                                 │
│  ┌───────────────────────────────────────────────────────────┐ │
│  │  (  5) 5-trace              2 chan,1 reward,2 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 6i) 6-trace,inhibit      2 chan,1 reward,3 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 6r) 6-trace,reward       2 chan,2 reward,2 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (  8) 8-trace              2 chan,2 reward,4 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 5r) Reward-only          2 chan,1 reward,2 monitor       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 8q) 8-trace              4 chan,1 reward,3 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 8z) 8-trace-4zcomp       4 chan,4 reward                 │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 8p) 8-trace              4 chan,2 reward,2 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (10c) 10-trace,coherences  4 chan,2 reward,4 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (10r) 10-trace,ratios      4 chan,2 reward,4 inhibit       │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  ( 12) 12-trace             4 chan,4 monitor,1 reward,3 inhibit │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (14b) ChanB,screen         14 traces,no rewards            │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (14a) ChanA,screen         14 traces,no rewards            │ │
│  ├───────────────────────────────────────────────────────────┤ │
│  │  (14ab) 2-chan,screen        14 traces,no rewards           │ │
│  └───────────────────────────────────────────────────────────┘ │
└───────────────────────────────────────────────────────────────┘
```

 4.3.0

Each protocol class enable file embeds the <u>CURRENT</u> session plan for the selected client, class, and layout. Once the layout has been chosen, the limitations must be selected:

An expiration date is REQUIRED and defaults to 45 days from the current date. The client dongle number must be known (but is remembered once you enter it). Checking the "Frequency cannot be changed" or "Reward or feedback mode cannot be changed" checkbox means that the remote client <u>cannot</u> alter the session-plan setup values during a session. If the "ALLOW user to change session plan" option is checked, the remote user will be <u>allowed</u> to alter the session plan at the remote computer (and have it used).

The process of selecting a protocol class and layout can be repeated for different protocol classes. Of course, only the LAST selection for a protocol class is saved. When done, press the Done button on the class selection menu and you will get the following message:

Check Status of EEGer remote-use memory stick
Selecting this option brings up a request to select the appropriate remote use drive.
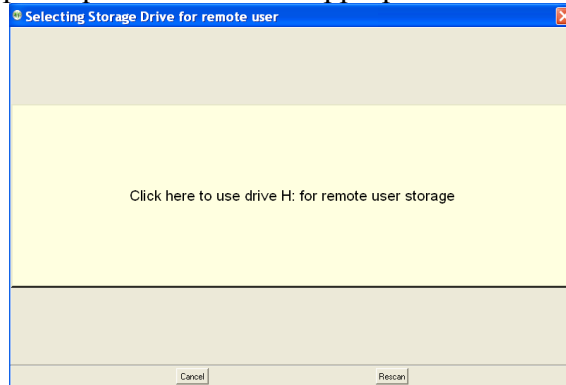
After selecting the drive, the status of the drive will be displayed in a message box like this:
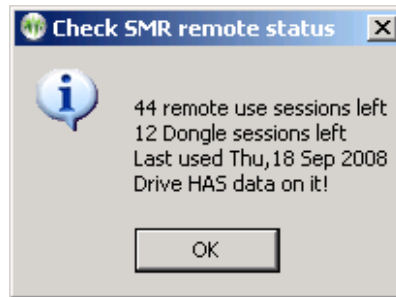
Retrieve EEGer remote-use data from USB memory stick

Selecting the **"Retrieve EEGer remote use data from USB memory stick"** option will allow selection of the remote device and retrieval of any data on the device just as is automatically done when a new remote device initialization is done (as described above).

Create EEGer remote-use update file for emailing

This remote use option is a method of building the session plan/expiration date/session count files so they could be mailed/emailed to a remote client if they cannot get to the clinician's office.

Copyright © 2013 EEG Software
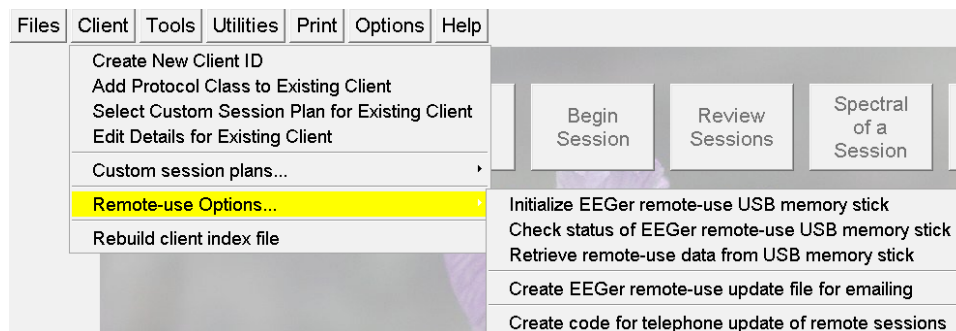
Selecting this option is very similar to the Initialize option except that no storage device is involved. After selecting a client, the process goes immediately to the protocol class selection screen (and layout screen) and the same limitation screen. Upon completion, the following message will be seen:
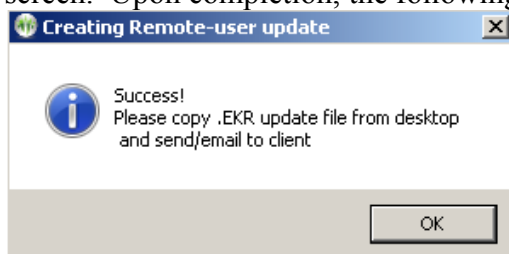
The clinician will discover a file named *remotedonglenumber_yymmddhhmm*.EKR (where *remotedonglenumber* is the user's dongle number and the *yy...* number makes for uniqueness) on the computer desktop. The filename thus does NOT contain any client-identifying data although the internal contents of the .EKR file does (client name and birthdate). Please observe HIPAA rules. This file is designed to be transferable over email and is read and verified by EEGer itself.

Create code for telephone update of remote sessions

The clinician enters the code from the remote client in the top box. When the entered code is valid (no transposed digits, etc.), the "Validate" button will become active. Pressing that button decodes the data from the user showing how many remote sessions are remaining and the remote session expiration date. Also, the dongle number, number of dongle authorizations (sessions), and the client software version is displayed. Assuming the data was really valid, the clinician can now enter additional remote sessions and/or and extended expiration date. Clicking on "Generate client code" causes a reply code to be generated (the above sample shows "nocode" right now). The 26-character code must be read back to the remote client for entry into the client's request screen.

If the client response was "Failure", please verify the codes again. It may be necessary for the client to re-initiate the request option and generate a new code (which must then be entered in the top box and the validate button pressed again). You can see if new sessions were added or the date extended.

Remote-use client menu
The client menu on a remote-use system looks like this:
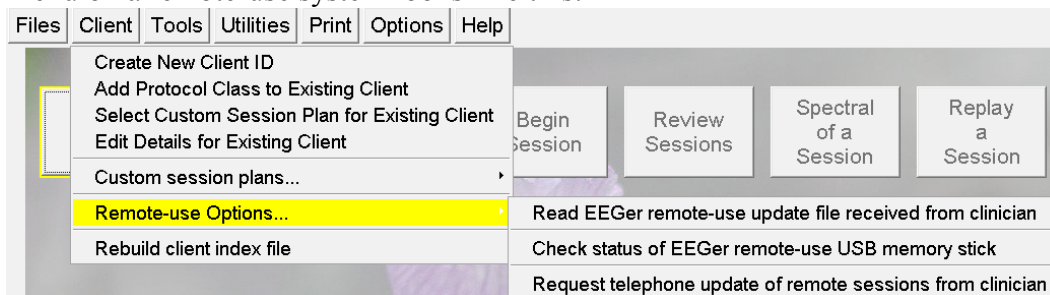
The options are these:

Read EEGer remote-use update file received from clinician

"Read EEGer remote-use update file received from clinician" reads the contents of an update file from a clinician which controls number of remote sessions, expiration date, and session plan. This is a .EKR file which must be read by an EEGer system with a dongle <u>and</u> the client's USB memory stick. Selecting this option brings up a client selection sequence, a file locator window where the remote user must select the received .EKR file

If you get the message below, it is because you must FIRST select the client from remote client USB memory stick.
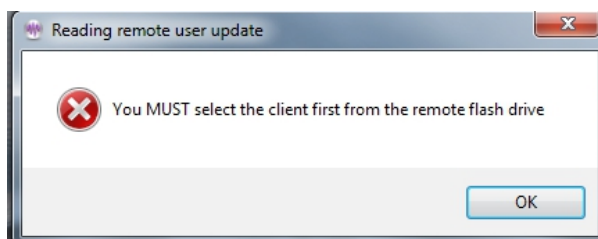
The file locator window (In Windows 7) looks like this:
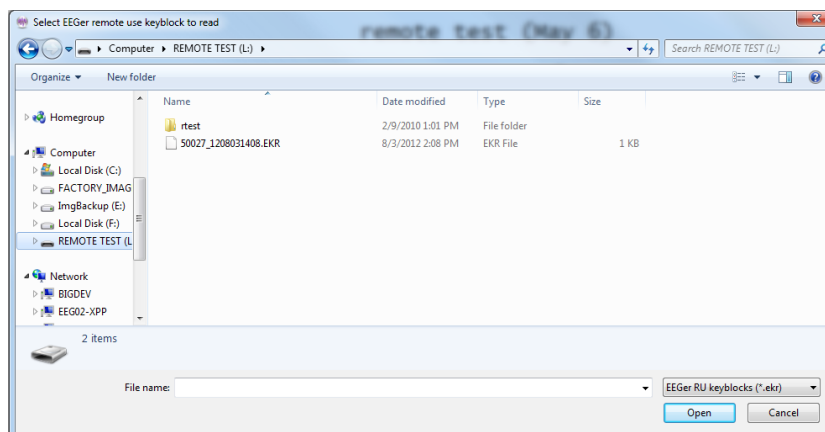
Select and click on Open (or just double-click) to begin the read process.

Success looks like below.   Errors give unique numeric reasons. Common ones are:
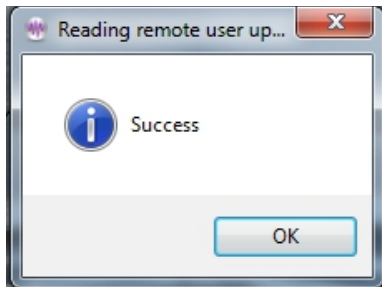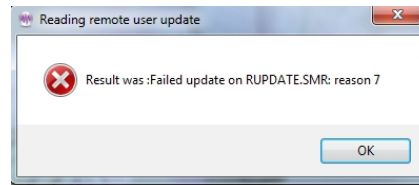
Update already used
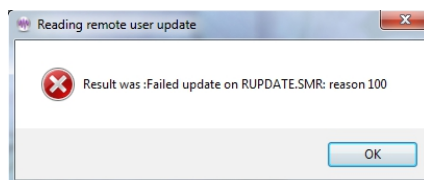
Mismatched dongle number
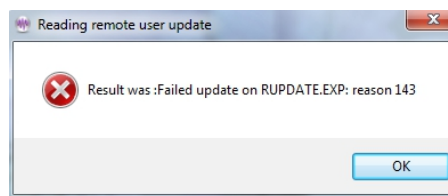
Mismatched client ID

Check status of EEGer remote use USB memory stick

"Check status of EEGer remote use USB memory stick" retrieves data from the remote client USB drive and displays the values. They cannot be changed by the remote user.

Request telephone update of remote sessions from clinician
"Request telephone update of remote sessions from clinician" starts a dialog whereby the remote user can get telephone codes to add additional remote sessions and/or extend the remote session expiration date.

The following screen is used for telephone session updates.

This process uses a time-sensitive code which is ONLY maintained DURING the display of the code values. Closing/re-initiating the process gives/requires different code values.
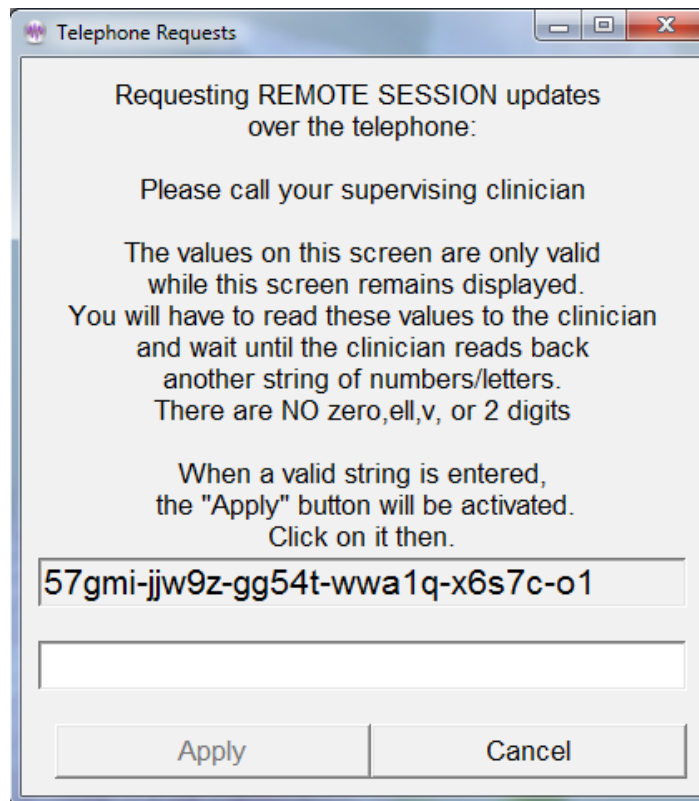
The top set of numbers is read off to the supervising clinician. The supervising clinician enters the character string into a screen on the clinician's computer and creates a corresponding string of 26 characters that are read back and entered by the remote user into the bottom entry box. When a valid string is entered, the "Apply" button will become active. Clicking on it will further validate the data and apply changes. Either a "Successful" or "Failure" message box will appear. Failures are due to incorrect code values.

Rebuild client index file

"**Rebuild client index file**" is an option to force rebuilding of the client index file. This index is automatically maintained by EEGer but alterations to the client folder outside of EEGer (like manually deleting a client subfolder!) may change the index so it does not match the client data.

Tools Menu
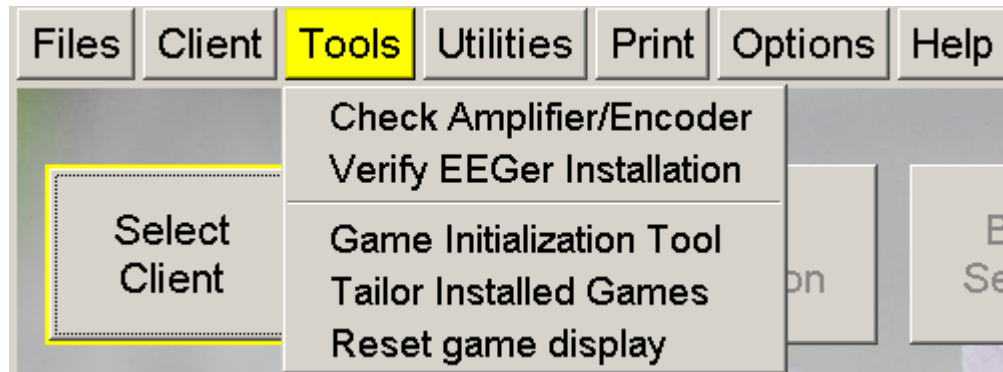
- **Check Amplifier/Encoder"** runs the **EIOtest** program. This can be used to validate device operation (or check battery voltages). Further instructions on the **EIOtest** program are contained in Appendix 10.

- **"Verify EEGer Installation"** examines the required files used for EEGer to confirm that none of them have become corrupted (or missing).

- **"Retrieve Installed Game List"** queries the EEGer Game Set to retrieve the list of currently installed games. Note: this must be performed at least once to retrieve any user-installed games. This option only exists in 2-computer configurations.

   or

- **"Game Initialization Tool"** generates a list of installed games and possible options. Note: this must be performed at least once to retrieve any user-installed games. This option only exists in single-computer configurations. The **Game Initialization Tool** is described in Appendix 11.

- **"Tailor Installed Games"** allows the user to order the game list, to set special options, and to create multiple game variations with different options (described below).

- **"Reset game computer"** just sends a menu reset to the game computer. You can see the game screen flicker when it understands this command. In single computer mode, the menu option reads **"Reset game display"**.

Tailor Installed Games

Tailoring the game list allows user flexibility in defining games and options for use. Retrieving a game list resets those games and variations whose basic definitions have changed on the game computer (different sound files, etc.). Selecting the **Tailor installed games** option brings up a selection screen for games to tailor:
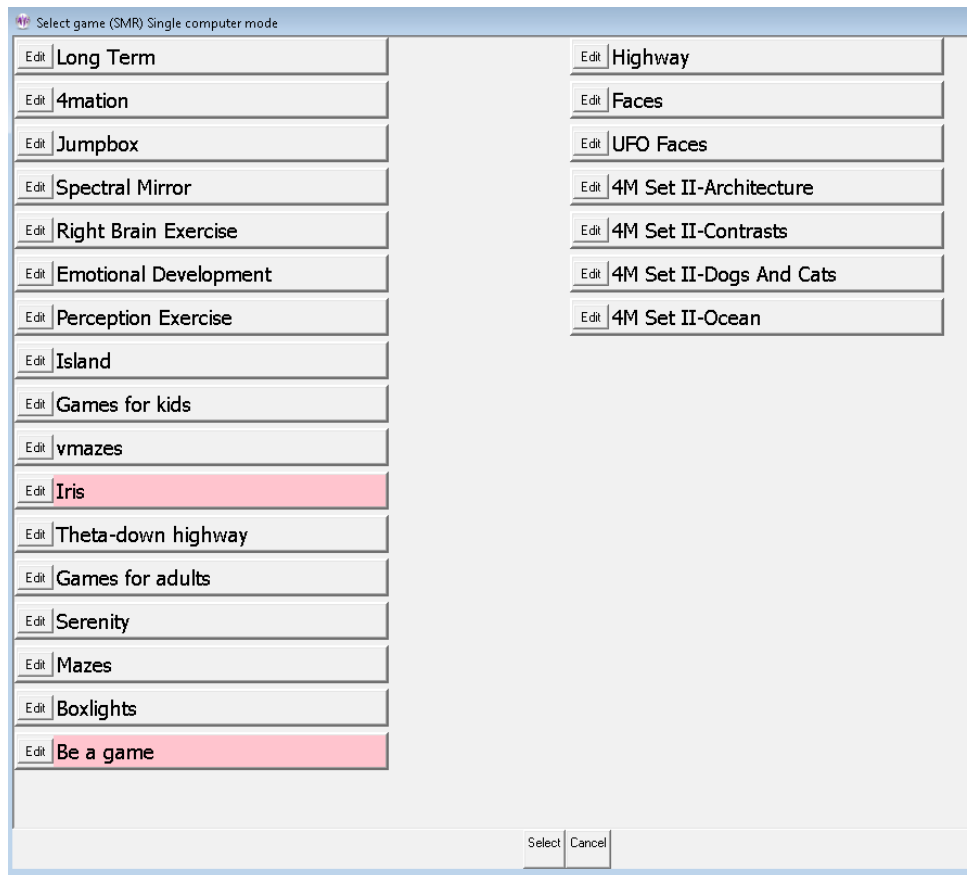
Buttons shown in pink are games that are NOT licensed. They may be only be used in Replay mode for test purposes.

The buttons at the bottom allow the game titles to be moved up or down, to be deleted (from the selection list until the next 'retrieve games'), or to be edited. Selecting the **Edit** button gives something like this:

The "What You want to call this tailored game" field is what the "title" of the game will be on the clinician game selection menu. Options can be changed/specified by clicking anywhere on the applicable line. The buttons at the bottom allow modification of this selection or creation of a new selection (hopefully with a new legend and new options) to appear on the game selection menu.

The "Save all games" button on the main tailoring screen saves a new game selection menu for later use in Begin Session or Replay modes.

Utilities Menu

The **Utilities** menu item brings up a list of currently installed utility programs that supplement the internal EEGer operations. The example shown below is only the default list of utilities. As other EEGer utilities are installed, they will appear on this menu.

- "**Save/Install Protocol Sets**" displays only if the Protocol Transfer Utility is installed. See instructions for use in the appropriate appendix.

- "**Install additional images for 4mation**" displays only if the Image Installer utility is installed. See instructions for use in the appropriate appendix.

- "**Create 4mation games for all image directories**" displays only if the Add4 utility is installed. This program adds all the possible 4mation image display sets as choices on the clinician game selection screen.

- "**Create/Install emailable remote use flash drive data**" displays only if the Remote Flash Utility is installed. This program allows saving/restoring the contents of a remote-user flash drive under certain conditions as described in Appendix 20.

Print Menu

The **Print** menu item brings up the print manager screen to allow preview/printing/deletion of various graphical/textual outputs of EEGer.
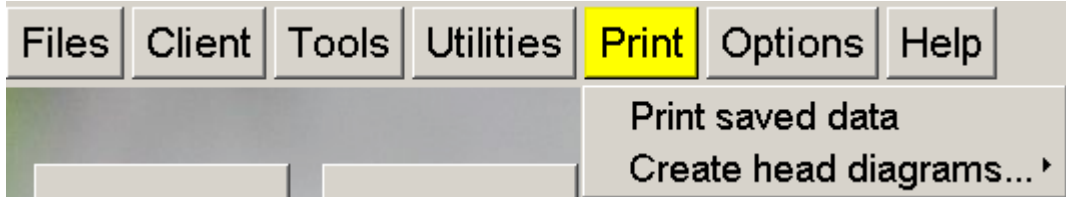
The print manager screen:
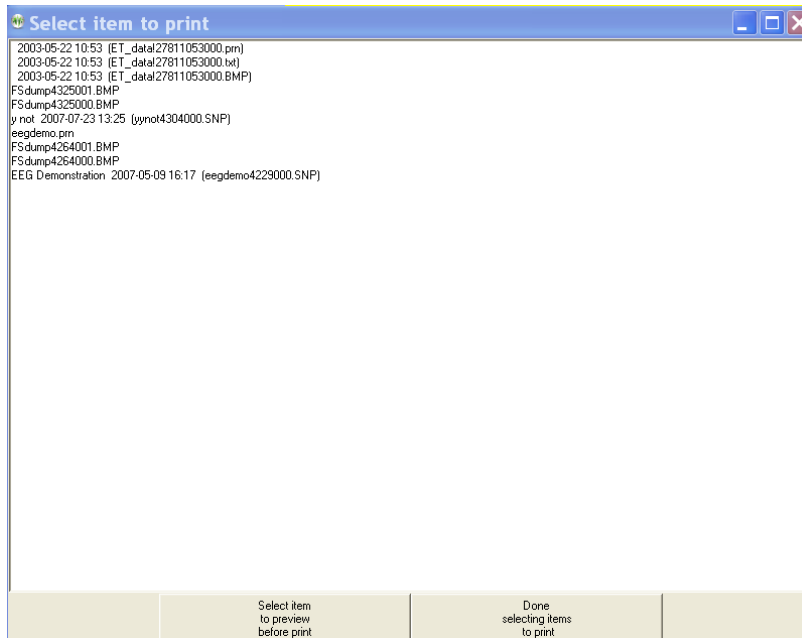
Double-clicking on one of the print menu items brings up a (preview) display screen with several button options (as shown in the sample below).
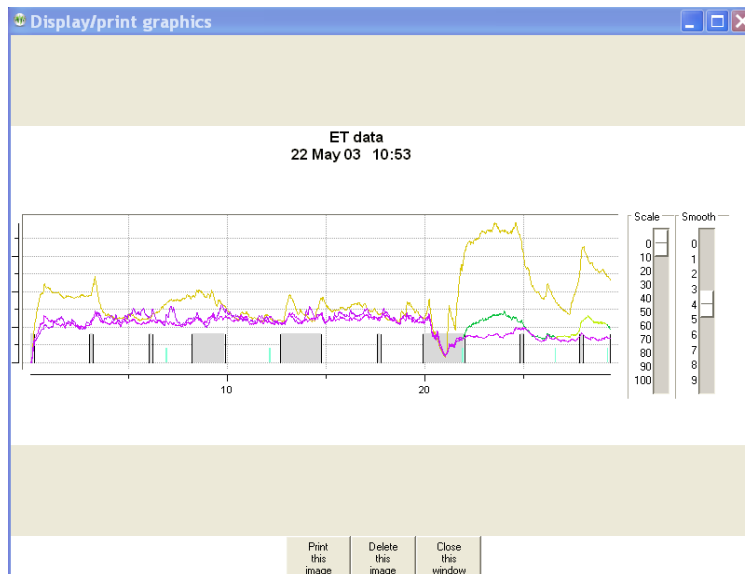
The **Print** button sends the printout to the current default Windows printer. The **Delete** button deletes the current file and returns to the print menu. The **Done** button just returns to the print menu (leaving the file still there).   There may be more than one output file for the summary outputs (one for the graphics and one for the tabular data).

The **Create head diagrams** option under **Print** allows the saving of standardized 10-20 and (modified) 10-10 electrode placement diagrams in the print directory.
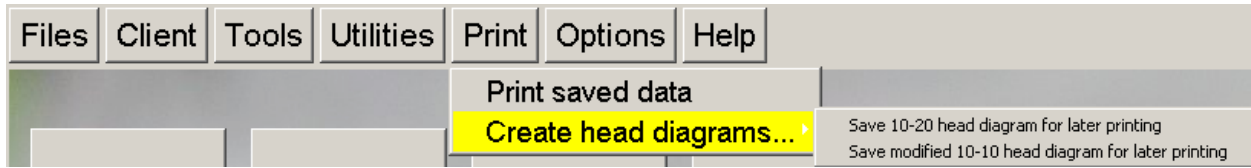
They are printed using the same **Print saved data** method previously described.
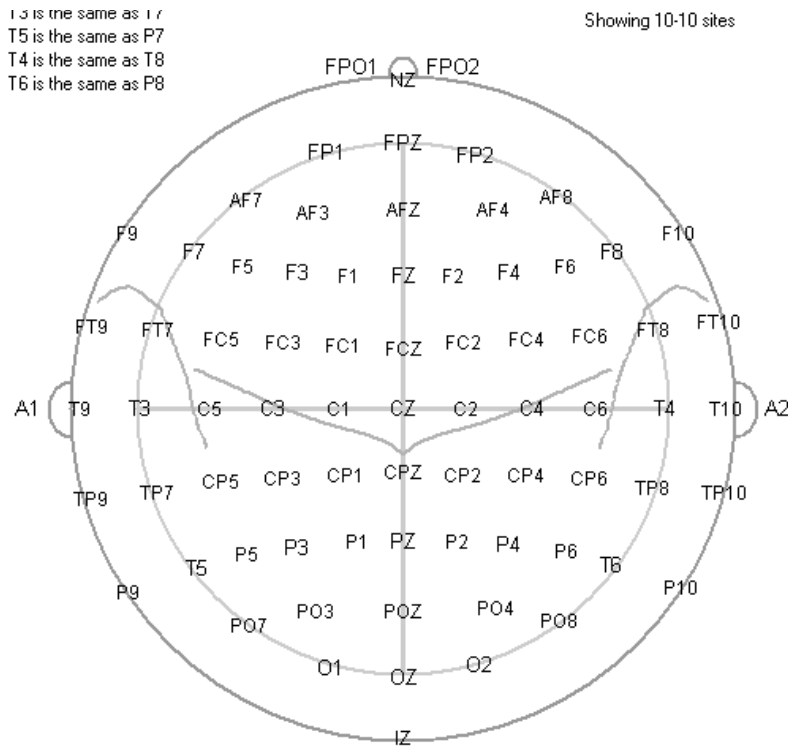
Options Menu
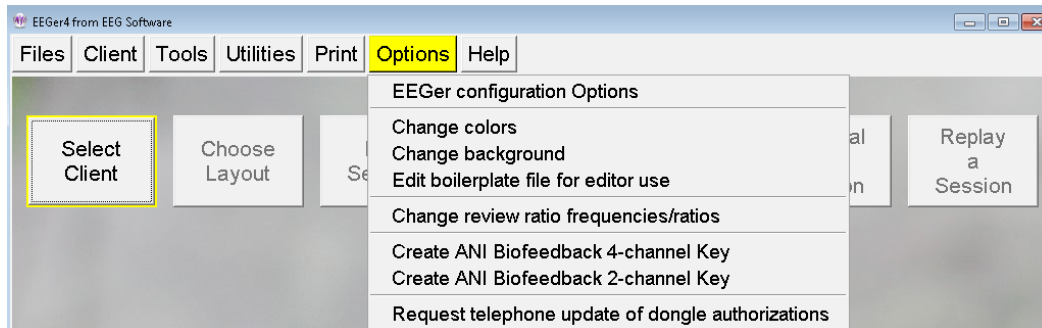
EEGer configuration Options

The **EEGer configuration Options** preference dialog brings up a screen with a number of tab-selected subsidiary screens. Most settings will work for all users. Some changes may have to be made on the **Devices** tab depending on the amplifier used with EEGer.

Above the tabs is shown some data to help identify any problems. The software version (430b in this sample), the computer name and numeric address, and the current date/time are shown.
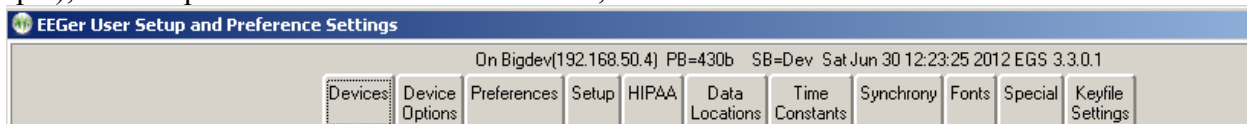
The **Devices** tab controls basic input and operations.

The **Device Options** tab controls options for selected data input devices.

The **Preferences** tab contains general EEGer preferences.

The **Setup** tab contains initial EEGer preferences.

The **HIPAA** tab contains general EEGer preferences.

The **Data Locations** tab selects the data and archive paths.

The **Time Constants** tab allows changing the smoothing time constants for display and averaging..

The **Synchrony** tab allows inspection/alteration of synchrony and comodulation settings.

The **Fonts** tab allows inspection of the current font settings.

The **Special** tab allows inspection/alteration of some user options as prescribed by Technical Support.

The **Keyfile Settings** tab allows inspection (only) of the various licensing/enabling files.

Devices

The **Devices** tab controls which connections are to be used for communications/data sampling.

On Bigdev(192.168.50.4) PB=430m   SB=RC   Thu Nov 14 10:13:28 2013 EGS 3.3.0.12

| Devices | Device Options | Preferences | Setup | HIPAA | Data Locations | Time Constants | Synchrony | Fonts | Special | Keyfile Settings |

1 System display mode	Dual monitor
2 Kind of connection to game computer	Ethernet
3 Serial port for game computer connection	COM4
4 Ethernet Client computer address/name	192.168.50.137
5 Ethernet TCP/UDP port(integer)	5510
6 Source of EEG/peripheral data	A400
7 Serial port for data source connection	COM14
8 Tactile audio device	None
9 Audible alert audio device	None
10 Alert level percentage volume	75

STORE settings   Reset to stored   Close preferences window

Values are only saved if the STORE button is pressed

●**"1 System display mode"** selects the mode of operation of the user interface. Changing this option requires an EEGer exit and EEGer restart.

●"**2 Kind of connection to game computer**" selects the particular interface style used to communicate with the game computer. Only used for 2-computer operation.

●"**3 Serial port for game computer connection**" allows the choice of a serial port. Only used for 2-computer serial operation.

●"**4 Ethernet Client computer address/name**" accepts either a name or (dotted IP) address of a Client computer if Ethernet style connection is desired. Only used for 2-computer operation.

●"**5 Ethernet TCP/UDP port(integer)**" allows selection of a port to be used for Ethernet connections. The default value is 5510. Only used for 2-computer operation.

●"**6 Source of EEG/peripheral data**" allows selection of an EEG/peripheral data source. **This is the type of amplifier/encoder component to be used.** Appendix 25 lists supported amplifier/encoders.

●"**7 Serial port for data source connection**" allows the choice of a serial port. Note that you cannot use the same port for both game computer connection and a data device. Also, only certain devices use serial ports as reported in Appendix 25.

●**"8 Tactile audio device"** specifies the desired port to use for tactile feedback. **Two audio devices are required for tactile feedback in single-computer operation.**

●**"9 Audible alert audio device"** selects a sound card to use for clinician audio alerts (from the session plan).

●**"10 Alert level percentage volume"** specifies the relative volume used for the alert when played. The default value is 75%.

Device Options

The "Device Options" tab contains:

Devices	Device Options	Preferences	Setup	HIPAA	Data Locations	Time Constants	Synchrony	Fonts	Special	Keyfile Settings

Thought Technology ProComp/Infiniti options

1 Thought Technology device type	ProComp2
2 ProComp/Infiniti Communications protocol	BioGraph
3 Use CD for 2-chan EEG on all except Procomp2	☐
4 ProComp/Infiniti peripheral 1	F-Temp
5 ProComp/Infiniti peripheral 2	None
6 ProComp/Infiniti peripheral 3	None
7 ProComp/Infiniti peripheral 4	None

J&J device options

8 C1 peripheral type	None
9 D1 peripheral type	None
10 Use unfiltered inputs	☑
11 Use CD for 2-chan EEG on 4-chan devices	☐

A/D device options

12 A/D board selection	0
13 External amplifier gain (usually 10000)	10000
14 Starting A/D channel for sampling (default 0)	0

BrainMaster device options

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● **"1 Thought Technology device type**" is a required selection for TTUSB interface usage since the TTUSB interface does not automatically detect the correct device type.

● **"2 ProComp/Infiniti Communications protocol**" allows either Spectrum or Biograph communications protocol to be selected. This must match the switch settings on the device. Biograph mode must be used for TTUSB interfaces (and the device switches set appropriately).

● **"3 Use CD for 2-chan EEG on all except ProComp2**" allows using channels C and D as the "2" channels for 2-channel inputs.
          The ProComp2 cannot process EEG on channels C and D.
● **"4 ProComp/Infinity peripheral 1"** allows selection of the kind of sensor attached (and how to interpret the inputs).

● **"5 ProComp/Infinity peripheral 2"** allows selection of the kind of sensor attached (and how to interpret the inputs).

● **"6 ProComp/Infinity peripheral 3"** allows selection of the kind of sensor attached (and how to interpret the inputs).

● **"7 ProComp/Infinity peripheral 4"** allows selection of the kind of sensor attached (and how to interpret the inputs).

● **"8 C1 peripheral type"** allows selection of the peripheral input channel (and interpretation of inputs) for appropriate J&J amplifiers.

● **"9 D1 peripheral type"** allows selection of the peripheral input channel (and interpretation of inputs) for appropriate J&J amplifiers.

● **"10 Use unfiltered inputs"** selects inputs that are NOT lowpass filtered within the device.

● **"11 A/D board selection**" allows selection of a which A/D board is to be used. The A/D board selection list must be prepared using InstaCal™.

● **"12 External amplifier gain (usually 10000)**" allows changing the gain of the external amplifier used.

● **"13 Starting A/D channel for sampling(default 0)"** allows changing the base A/D channel for sampling for use with amplifiers having "unusual" wired/programmed preferences.

```
BrainMaster device options

15 BrainMaster serial number          30125

16 BrainMaster passkey                79sd-6t04-f6ne

17 Atlantis peripheral channel 1           None           ⌐

18 Atlantis peripheral channel 2           None           ⌐

19 Atlantis peripheral channel 3           None           ⌐

20 Atlantis peripheral channel 4           None           ⌐

21 Use 24 bit data instead of 16 bit data   ☐

esiPRO/A200/A400 device options

22 Max voltage setting in microvolts        500            ⌐

23 esiPRO4.3/A400 (only) links references internally  ☐

24 Peripheral channel 1                    SCL           ⌐

25 Peripheral channel 2                    HRV           ⌐

QPET device options

26 QPET Gain values (64 is most sensitive)   64            ⌐

Wiz options

27 Linked references                       ☐

28 Inhibit monitoring of electrodes        ☑

29 Adjust gain to match EEGer filters      ☐

      STORE settings          Reset to stored          Close preferences window
             Values are only saved if the STORE button is pressed
```

● **"15 BrainMaster serial number"** is where the serial number of the connected BrainMaster device must be entered by the user.

● **"16 BrainMaster passkey"** is where the BrainMaster passkey must be entered by the user. This passkey allows but does not require dashes between fields and is case-insensitive. Note: passkeys for use with EEGer are different than passkeys for use with BrainMaster software.

● **"17 Atlantis peripheral channel 1"** allows selection of the appropriate input channel (and how to interpret the input) for Atlantis peripheral data.

●"**18 Atlantis peripheral channel 2**" allows selection of the appropriate input channel (and how to interpret the input) for Atlantis peripheral data.

●"**19 Atlantis peripheral channel 3**" allows selection of the appropriate input channel (and how to interpret the input) for Atlantis peripheral data.

●"**20 Atlantis peripheral channel 4**" allows selection of the appropriate input channel (and how to interpret the input) for Atlantis peripheral data.

●"**21 Use 24 bit data instead of 16 bit data**" allows selection of high-resolution unfiltered EEG data.

●"**22 Max voltage setting in microvolts**" selects the maximum gain setting for the amplifier.

●"**23 esiPRO4.3/A400 links references internally**" links both reference jacks together internally in the esiPRO4.3 and A40x.

●"**24 Peripheral channel 1**" allows selection of the appropriate input channel for peripheral data (and how to interpret data).

●"**25 Peripheral channel 2**" allows selection of the appropriate input channel for peripheral data (and how to interpret data).

●"**26 QPET Gain values(64 is most sensitive)**" allows selection of a gain control for the QPET device.

●"**27 Linked references**" allows internal linking of Wiz references.

●"**28 Inhibit quiet monitoring of electrodes**" allows disabling of the continuous monitoring/reporting of electrode status.

●"**29 Adjust gain to match EEGer filtersl**" allows changing the preset gain to match EEGer expected values.

Preferences

Devices	Device Options	Preferences	Setup	HIPAA	Data Locations	Time Constants	Synchrony	Fonts	Special	Keyfile Settings

1 Reward filter increment step size	.125 Hz
2 User-defined color set	1
3 Filter smoothing time (seconds)	.5
4 Default Minimum seconds between rewards	◄ 0.5 ►
5 Default on-task seconds before rewards	◄ 0.0 ►
6 Turn ON dominant frequency marker	☑
7 Maximum frequency to scan for dominant frequency	◄ 20 ►
8 Dominant frequency averaging time constant(seconds)	◄ 0.0 ►
9 Show thresholds on therapist spectral mirror	☑
10 Inhibit Z score processing even if licensed	☑
11 Use Power ratio instead of Voltage ratio	☑
12 FFT display NOT on at start	☐
13 Fast display speed at startup	☐
14 Enable autoreplay of stored data file actions	☐

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- The "**1 Reward filter increment step size**" of the reward filter center frequency shift can be selected (here it is .5 Hz but .125 Hz (50 Hz set only) and .25 Hz are also available). The step size is automatically 0.1 if either the Dynamic or FIDdll filter sets are used.
- The **"2 User-defined color set"** option allows specification of a custom color set (created using the color changer tool under **Options**).
- "**3 Filter smoothing time (seconds)**" controls the smoothing time constant for the filters. The default value is 0.5 seconds. The range is .1 to .9 seconds. This value is also controllable in game tailoring.
- "**4 Default Minimum seconds between rewards**" determines the rate at which rewards can be sent to whatever game is currently running. The default value is 0.5 seconds. The minimum value is 0.25 seconds. The maximum value is 30 seconds. This value is also controllable in game tailoring (which overrides this default) and during a session (E popup).
- "**5 Default on-task seconds before reward**" sets how long a client must be in a rewardable state before a reward can be given. The default time is 0 seconds. The minimum is 0.0 and the maximum is 30.0 seconds. This value is also controllable in game tailoring (which overrides this default) and during a session (E popup).
- "**6 Turn ON dominant frequency marker**" turns on the dominant frequency marker at the beginning of the realtime sessions. It can still always be toggled by using Alt-F10. This marker is shown on the FFT and spectral displays.
- "**7 Maximum frequency to scan for dominant frequency**" allows selection of a range of values to scan for a dominant (highest amplitude) frequency. Set to 0 means using the default of 15 Hz.
- "**8 Dominant frequency averaging time constant(seconds)**" allows selection of an averaging time for dominance determination.
- "**9 Show thresholds on therapist spectral mirror**" allows preselection of additional data on the clinician spectral mirror display. This can also be toggled on/off using the clinician display options popup menu.
- **"10 Inhibit Z score processing even if licensed"** turns off zscore computations if performance issues exist. This also inhibits attempts to use zscore in replay situations.
- **"11 Use Power ratio instead of Voltage ratio"** selects which form of ratio rewards to use.
- "**12 FFT display NOT on at start**" turns off the FFT display on the brainwave screen. It can be turned on/off using the Alt-F10 option.
- "**13 Fast display speed at startup**" sets the sweep rate of the brainwave screen to fast mode. The rate can be toggled using the Alt-F12 option during run.
- "**14 Enable autoreplay of stored data file actions**" enables keyboard actions recorded during a live session to be simulated during replay. Pressing any key which changes processing actions turns OFF any autoreplay capability. Note: editor actions are NOT supported for autoreplay since the editor keystrokes are not recorded in the raw data file.

Setup
The tab labeled **Setup** contains:

- **"1 Filter computation module"** selects which filter computation method is used. Choices are "**Internal**" (using the same filter sets as previous EEGer versions), "**Dynamic**" (using the same coefficient preparation method as the default set) or "**FIDdll**" (an open-source filter program). Details of the filtering logic are contained in the Technical Manual.

- "**2 Filter computation depth**" allows selection and control of the filters used by EEGer. Selecting 0 as a value means that EEGer uses its traditional internal filter coefficient sets (with 2 stages of data used). Selecting 2 through 5 specifies how many stages of data are used for the filtering operation.
- The **"3 Use 50 Hz 1/8 step filter set (additional memory required)"** checkbox allows selection of the internal 50 Hz filter set (instead of the 40 Hz set) but requires an additional 12 MB of memory.
- **"4 Lowpass filter in Hz"** allows selection of the lowpass filter frequency used on all data when the lowpass filter is not disabled.
- "**5 Power is 50 Hz instead of 60 Hz**" selects 50 Hz as the local powerline frequency.
- "**6 Use software powerline notch filter**" enables a software notch filter to remove powerline interference. Some EEG amplifier/encoders do not filter the correct powerline signals.
- "**7 Use metric units for peripheral data**" allows selection of metric units, notably for temperature data.
- The "**8 Default Processing Layout**" is set for 5-trace mode.
- The "**9 Display style**" is fixed at "Swept".
- The "**10 Maximum minutes of data saved (range 45-90)**" can be set. This value is used to prescale/preallocate data storage. While a session can go on longer than this time, only this much raw data will be recorded/saved!
- "**11 Show advanced sites (10-10) on session plan**" controls whether the 10-10 or 10-20 site locations will show by default on the "head" displays during session planning. Clicking on the "right" spot on the head will make them show up anyway.
- "**12 Anti-alias spectral raw data**" controls how raw line segments are drawn in the **Spectral** program. Some video modes/cards require different settings to make the "raw" graphs have a smooth appearance.
- The **"13 DC compensation error report level"** is a value that can be set to provide a (red) warning when the DC offset level correction exceeds a user-input value. If set to zero (the default), no warnings will be given (although the actual DC offset levels are reported on the debug screen).
- The "**14 Text for Down/Inhibit text display**" option allows selection of the text label for down/inhibit training. It is just a label and has no functional changes.
- The **"15 Hide unused trace data"** checkbox determines if currently-unused traces are hidden from view (to minimize clinician distraction). These traces include unused raw, filtered, and FFT displays. This setting can be turned on/off during realtime operation using Alt-F12.
- The **"16 Allow raw data files in Consult export"** option determines if raw data files are selectable for inclusion in consultation files.
- The **"17 (default) Print review files directly to default printer"** option controls whether the Review print buttons save files in the EEGer print directory (for later printing) or send them directly to the default Windows printer. Snap files and screen captures still only go to the print directory for later printing.
- The **"18 Combine summary print onto single page"** forces the summary data printout to be one page. The graphics and text are shrunk to fit and may not be readable.

- The **"19 Not save Results! files"** option disables the automatic creation of Results! files (for use with the optional Results! Program).
- The "**20 Reserved**" option is for future use.
- The **"21 Automatically create Consultation Export of Session"** option causes a Consultation Export of the session just run to be automatically created on the desktop.
- "**21 Destination for emailable Exports (EKR,ECE,etc.)**" allows destination choices for the Consultation Export files, remote user updates, etc.. These choices are: "Desktop", "My Documents", or wherever the "Exports" filepath is specified.
- "**23 Enable < 1Hz notch filter**" option enables a high pass filter to block fluctuating DC signals.

HIPAA

The **HIPAA** tab contains options used to obfuscate the client name. The options make NO alterations to the client ID which is used to identify files, etc. The display mode options are :
- **All**   Show the entire full name field
- **First+initials**Show first name and just first letter of later name(s)
- **Initials**   Show just the first letter of each name
- **GUID**   Show Globally Unique IDentifier of client

- **"1 Top screen name display mode"** controls the large name on the top screen.
- **"2 Client selection screens name display mode"** controls what you see on selection menus.
- **"3 Title bar/printout name display mode"** controls what shows on window title bars and on printouts (or possible printouts).
- **"4 Export name display mode"** controls what gets exported.
- **"5 Show birthday on top screen"** controls display of month and day of client's birthdate on the top screen.
- **"6 Data encryption key"** is the field where a data encryption passphrase is entered (not implemented in this version).
- **"7 Data encryption mode"** selects the encryption mode for data storage/transmittal (not implemented in this version).

Data Locations

The **Data Locations** tab selects the data and archive paths.   **THESE PATHS MUST ALREADY EXIST!!!** Client session plans, general information, and summary data are stored under the client info path. Raw data (which can be one to two megabytes per session) is stored in the client raw data path. By default, these are the same (raw data is stored in the same hierarchy as the summary data). PLEASE, use the same paths for raw and info data for outputs that match this documentation. A separate path is provided for archived (non-active) data. Do NOT attempt to use one of the EEGer clinician machines as a common data repository. During a feedback session on that machine, other machines will be unable to access the data.

When EEGer starts, the existence of the data paths is tested. If not currently available, a message is presented to the clinician informing of the issue. The clinician can continue and run a session locally (after creating a like-named client!). EEGer will internally direct the client and raw data to the internal default locations. The Files->Archive/File Management function has an option to copy the files to the remote locations once they exist - assuming the client code name matches.

Time Constants

The **Time Constants** tab allows changing the time constants used for display and averaging.

EEGer has been extensively tested using the default time constants. Other values may be used but the user must understand the consequences of making radical changes in these values.
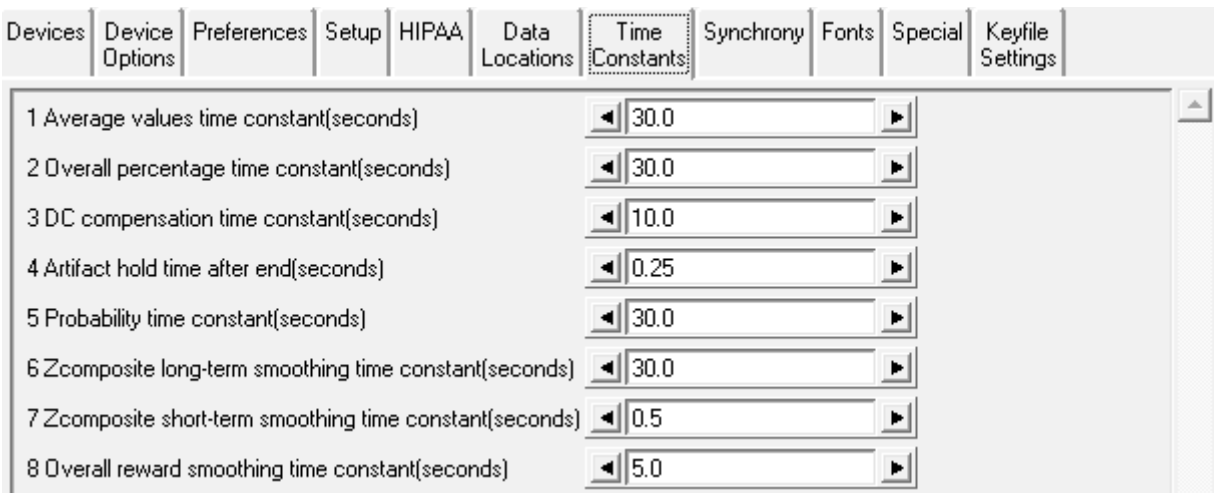
- **"1 Average values time constant (seconds)"** controls the smoothing time for the average values displayed.
- **"2 Overall percentage time constant(seconds)"** controls the smoothing time for the overall percentage value (shown in the upper right corner of the brainwave screen).
- **"3 DC compensation time constant(seconds)"** sets the averaging window for determining DC offset corrections.
- **"4 Artifact hold time after end(seconds)"** sets how long the artifact state is maintained after the artifact event has ceased (to prepare for more artifacts).
- **"5 Probability time constant(seconds)"** controls the smoothing window for maintaining the %over threshold values.
- "**6 Zcomposite long-term smoothing time constant(seconds)**" controls the smoothing window for maintaining the long-term values for the zscore display.
- "**7 Zcomposite short-term smoothing time constant(seconds)**" controls the smoothing window for maintaining the short-term values for the zscore display.
- "**8 Overall reward smoothing time constant(seconds)**" controls the smoothing factor for the overall reward computation.

Synchrony

The **Synchrony** tab allows inspection/alteration of synchrony and comodulation settings.

Devices	Device Options	Preferences	Setup	HIPAA	Data Locations	Time Constants	Synchrony	Fonts	Special	Keyfile Settings

1 Width of synchrony window (seconds)	◄ 0.5 ►
2 Scale multiplier for synchrony/comodulation	◄ 10.0 ►
3 Option flags for synchrony/comodulation	1
4 Width of comodulation window (seconds)	◄ 0.5 ►
5 Depth of comodulation history (seconds)	◄ 0.5 ►
6 Comodulation time constant	◄ 0.1 ►
7 Comodulation moving window width (samples)	◄ 64 ►
8 Restore old double-smoothing of coherence results	1
9 QPSlag time constant	◄ 0.5 ►

Please contact Technical Support for information on any changes to these parameters.

Fonts

The **Fonts** tab allows inspection of the current font settings.
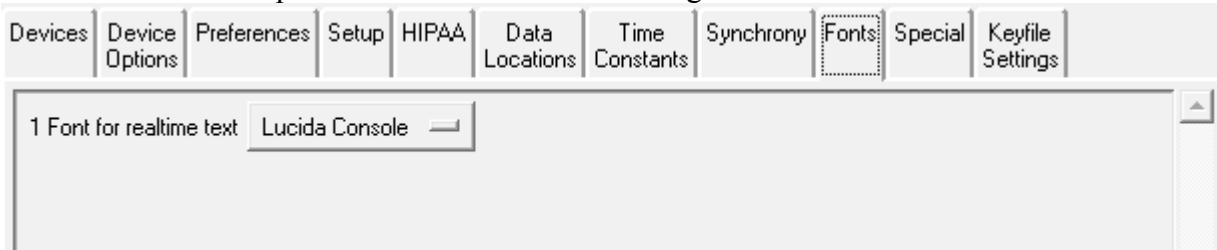
Clicking on the selection menu button gives a list similar to this:
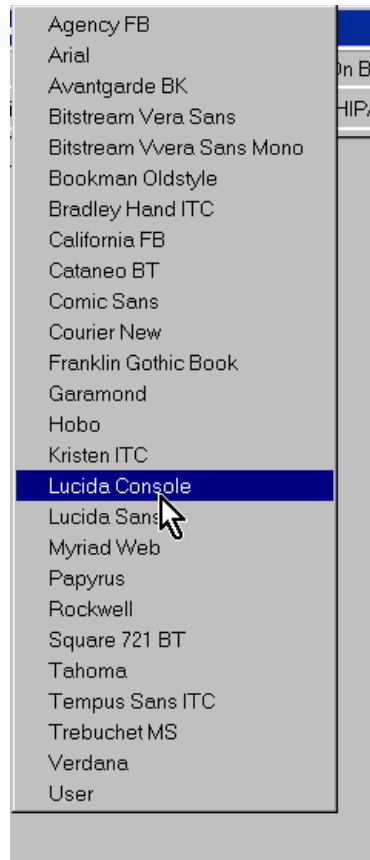
Please note that not all these font selections may not be the most readable or sized to your liking but the choices are yours.

Special

The **Special** tab allows user selection of some alternative modes of operation of EEGer4.
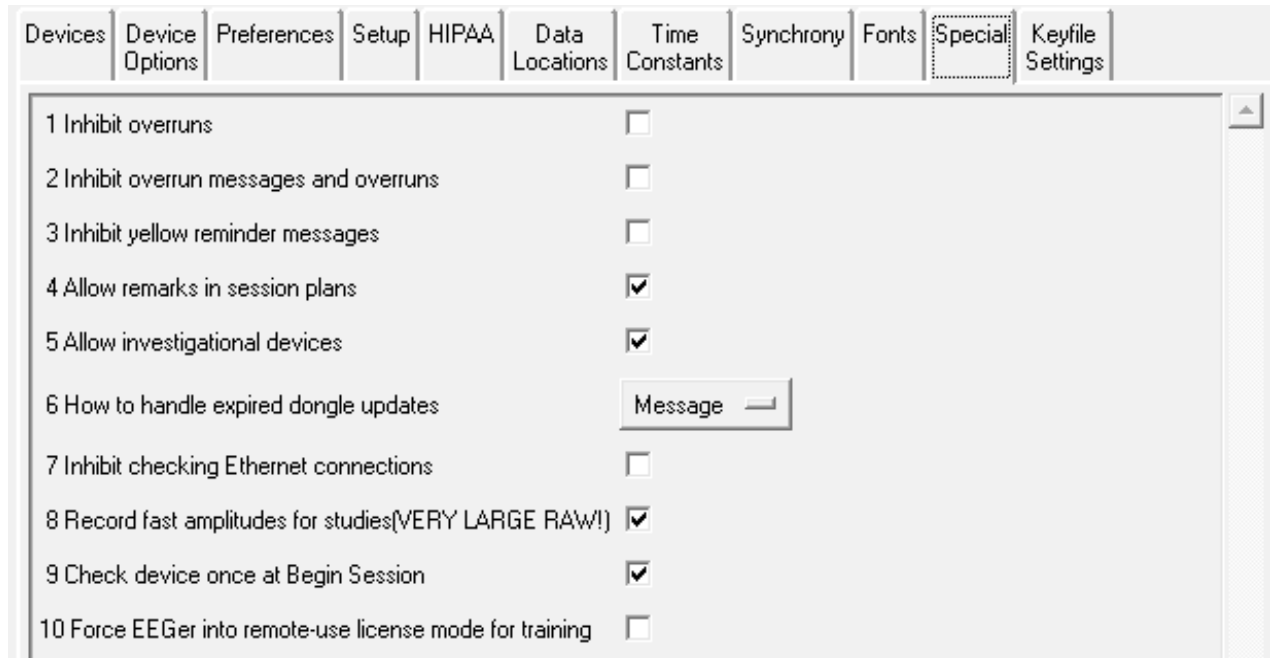
The **1 Inhibit overruns** option stops EEGer4 from terminating feedback if the display processor overruns (cannot complete its processing fast enough).

The **2 Inhibit overrun messages and overruns** option removes informational messages about overruns and stops termination of feedback on a display overrun.

The **3 Inhibit yellow reminder messages** option hides the (yellow) information messages that display at the bottom of the clinician feedback displays. These messages are the class of messages like "Keyboard Lost", "Not Running", etc.

The **4 Allow remarks in sessions plans** option controls whether the remarks field is displayed (and alterable) during session planning.

The **5 Allow investigational devices** option controls whether obsolete and/or devices under investigation can be selected for EEG input sources. Note: After changing this option, the user must exit the configuration menu and reselect it for the new setting to be observed.

The **6 How to handle expired dongle updates** option allows selection of the way expired dongle updates are handled:

>**Message**   Just display a message
>**Quiet**   Don't display a message
>**Delete**   Delete the expired update
>**QuietDelete** No message and delete the expired update

The **7 Inhibit checking Ethernet connections** option disables the check for a 2nd computer on an Ethernet connection. Checking can be confusing if there are multiple networks present.

The **8 Record fast amplitudes for studies(VERY LARGE RAW)** option causes the raw data file to contain high-speed recording of all the running average values.

The **9 Check device once at Begin Session** causes EEGer to check (the first time for each running of the EEGer program) for a valid amplifier/encoder. The only error result is a message about one not being found.

The **10 Force EEGer into remote-use license mode for training** allows a clinician to change EEGer operation to match what a remote-license system would be (menus, sequencing, etc.). This mode is intended for training. Changing this mode will require an EEGer restart.

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Keyfile Settings

The **Keyfile Settings** tab allows inspection (only) of the various licensing/enabling files. Displayed here is the dongle number read in from the hardware, various expiration dates (0 meaning non-expiring), remaining session counts (for session-limited dongles), etc.

Devices	Device Options	Preferences	Setup	HIPAA	Data Locations	Time Constants	Synchrony	Fonts	Special	Keyfile Settings

Dongle number	50024
Mode Code	0
Dongle Expiration date	12/31/2019
License type	Clinical
License Expiration Date	12/31/2012
Sessions remaining	0
Session limit enforced	0
Clients used	0
Client limit enforced	0
Maximum number of clients	0
Number of installations	0
Latest dongle update date	06/08/2012
BetaSMR status	1,exp=12/31/2012,build=01/30/2012
AlphaTheta status	1,exp=12/31/2012,build=01/30/2012
Multiple Displays permitted	1,exp=12/31/2012,build=01/30/2012
Synchrony status	1,exp=12/31/2012,build=01/30/2012
Tactile status	1,exp=12/31/2012,build=01/30/2012
EGS bypass allowed	0
Feature 1 enabled	1,exp=12/31/2037,build=07/21/2011
ZScore enabled	1,exp=12/31/2037,build=09/22/2008
Feature 3 enabled	1,exp=12/31/2037,build=02/27/2012
Feature 4 enabled	1,exp=12/31/2037,build=02/27/2012
Feature 5 enabled	0
Feature 6 enabled	1,exp=12/31/2037,build=09/03/2008
Feature 6 password	8424229CCB0A37D6C9D64D11A0263146

Further down in the same tab are the status of other enables such as game or mode enables. This screen is mostly for technical support.

Game enable	8370,1,12/31/2037,5834 DVDGame
Game enable	8308,1,,3126 Jumpbox
Game enable	8309,1,,3126 Boxlights
Game enable	8305,1,,3126 Highway
Game enable	8306,1,,3126 Island
Game enable	830a,1,,3126 Theta-Down highway
Game enable	830e,1,,3126 Mazes, fixed-dots
Game enable	830c,1,,3126 Mazes, var-dots
Game enable	830b,1,,3126 A-T display
Game enable	830d,1,,3126 4mation
Game enable	8303,1,,3126 LongTerm display
Game enable	8304,1,,3126 Spectral Mirror
Game enable	
Game enable	

                    4.3.0

Change Colors

You can run EEGer without ever changing the default colors. If you prefer different colors for EEGer, you can change the colors used to identify frequencies and some colors for the real-time feedback screen by selecting the **Change Colors** option of the **Tools** menu.

This screen will then pop up:
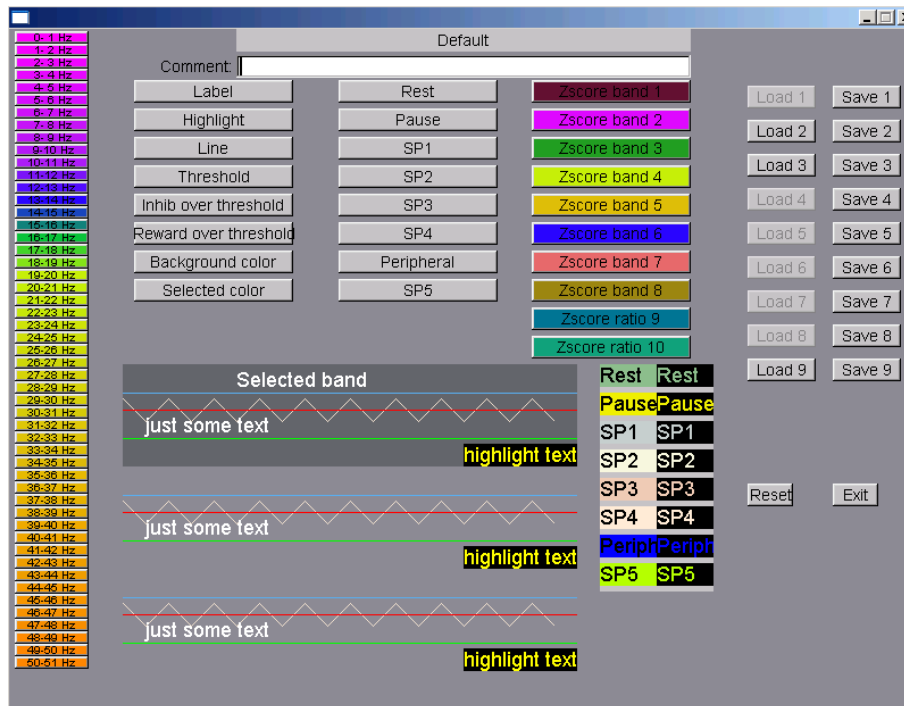
Clicking on any of the left-hand buttons brings up a color chooser window for that particular one Hertz frequency "color". Clicking on the buttons at the top brings up a color chooser window for that particular real-time color use. The color use is shown by the examples below the buttons. SP1 through SP4 are "spare" colors in this version and are reserved for future use. You must click on the **Save** button for the specified color set to save the current color scheme for use. Of course, **Reset** will return you to the default color scheme. The color set actually used is specified in the Preferences settings. Colors 49-50/50-51 have special meaning as they are used by the FFT Highlight option (Alt-F10) described later. Currently defined color sets can be seen by observing the 'active' Load buttons. You cannot load an undefined color set.

Change background

Selecting **Change background** brings up a screen similar to the main menu but with some colored text (and simulated buttons) to assist in determining the readability of the screen in the presence of a background image:
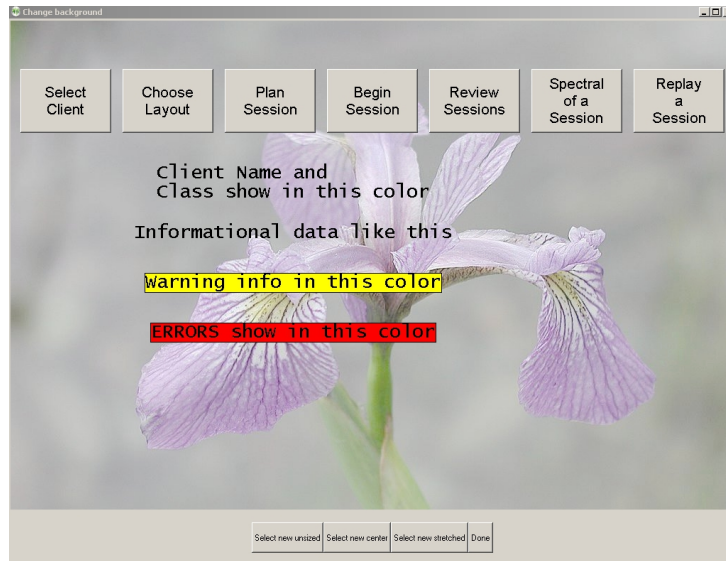
Images to display must be present in the C:\EEGer\Preferences\Images directory. Images can be of any kind that EEGer determines are images (currently .JPG, .BMP, .PNG, .GIF).

There are three image selection buttons at the bottom.

Select new unsized - Select an image and not change size
Select new center - Select and stretch minimally
Select new stretched- Select and stretch to fill screen
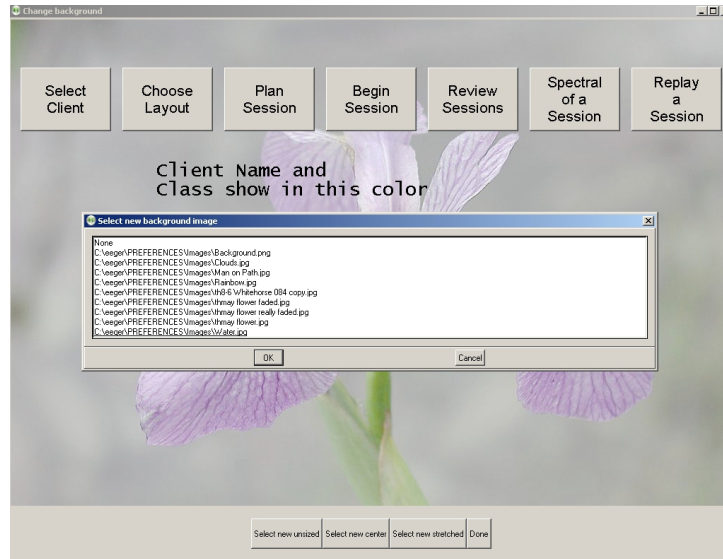
When the appropriate image is selected (or None), the **Done** button saves it in the fastest drawing format for the current screen settings.

EEGer4 Operator Manual

Edit boilerplate file for editor use

This function brings up the editor to allow entering whatever common data/questions the clinician wants to be entered in the client's notes file (whenever the "Header" button on the editor menu is selected). The editor is exited by using F8, the Files->Exit menu, or the x in the upper right corner.
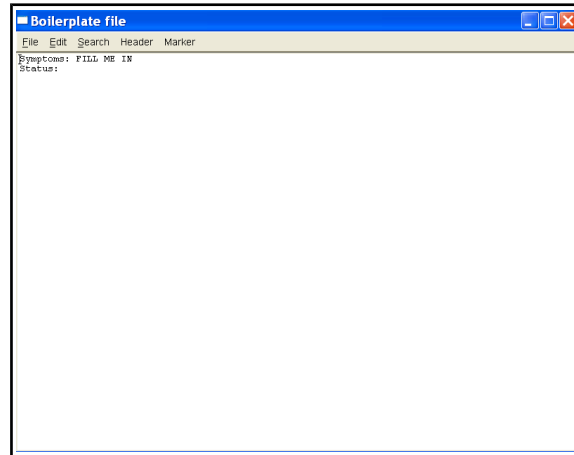
Change review ratio/frequencies/ratios

This option allows editing the definition file for Review frequency bands and ratios. Clicking brings up a menu similar to this:
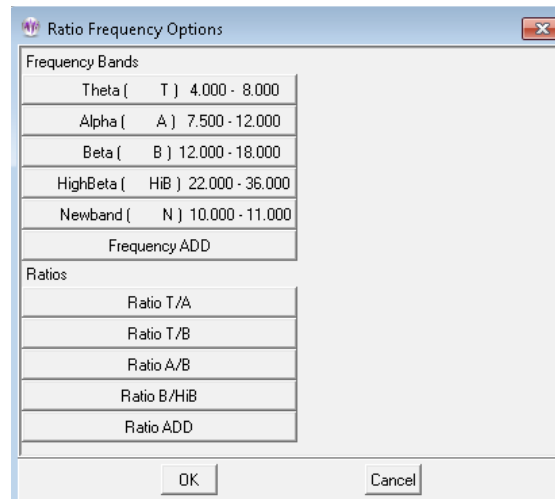
This is the current set of values. Clicking on an exiting button allows altering or deleting that value.

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Clicking on Frequency ADD or Ratio ADD brings up the following typical menus:
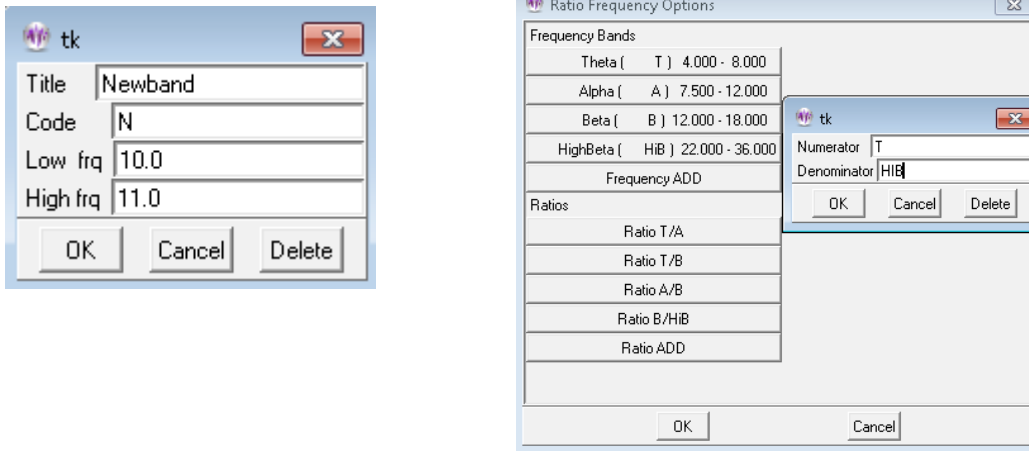
Note that the ratio numerator/denominator names used are the "Code" values from the frequency settings.

Create ANI Biofeedback 2-Channel Key
Create ANI Biofeedback 4-Channel Key

These options are used to create/enter keys for Applied Neuroscience, Inc. zscore usage.
Details are in Appendix 12.

Request telephone update of dongle authorizations

This process allows updating of dongle authorizations using codes (spoken) over the telephone. It is not intended to replace the emailed dongle update process (which has many other options) but only as an immediate method of adding authorizations or extending an expiration date.

This process uses a time-sensitive code which is ONLY maintained DURING the display of the code values. Closing/re-initiating the process gives/requires different code values.

When the process is initiated (by "Request telephone update of dongle authorizations"), the following screen is displayed:

EEG Store must be called <u>WHILE THE SCREEN IS DISPLAYED</u> and arrangements made to purchase additional dongle authorizations. When the 26-character code is read off to EEG Store, they enter it into their program and generate a 26-character response code. The response code must be entered into the blank field. Dashes are automatically put in the correct places. When the entered code is valid (no transposed digits, etc.), the "Apply" button will become active. Clicking on "Apply" will cause the code to be further validated and the encoded changes made. There will be either a "Successful" or "Failed" message box. Failure is caused by an incorrect code (or dongle removal).

Help Menu
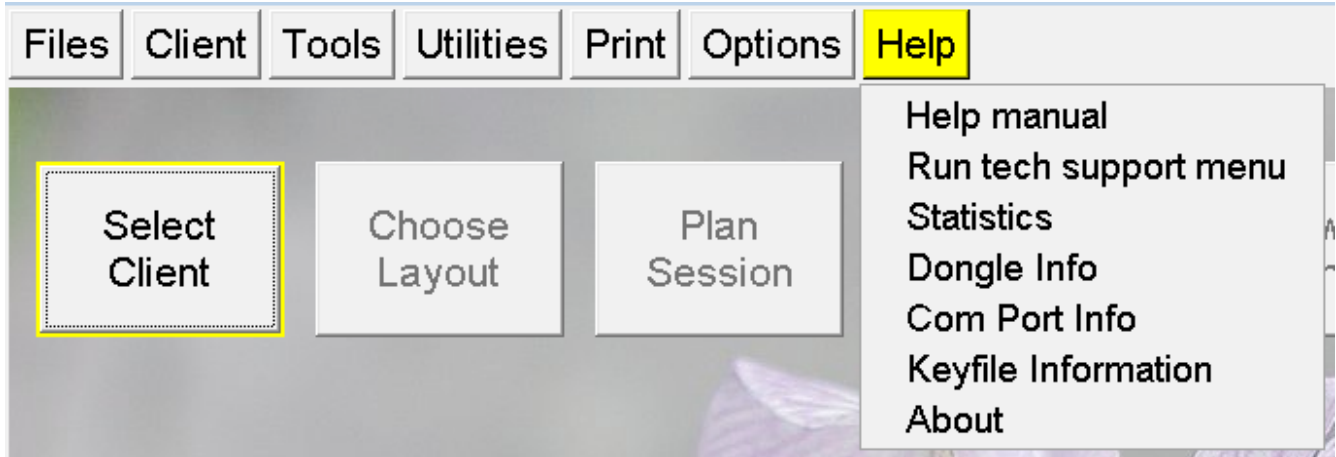
Help manual

The **Help manual** contains the same material as in this operator manual. This same data is shown whenever the **F1** key is pressed.

Run tech support menu

The "**Run tech support menu**" option brings up a menu with functions to assist in technical support issues.   This menu is described in Appendix 22.
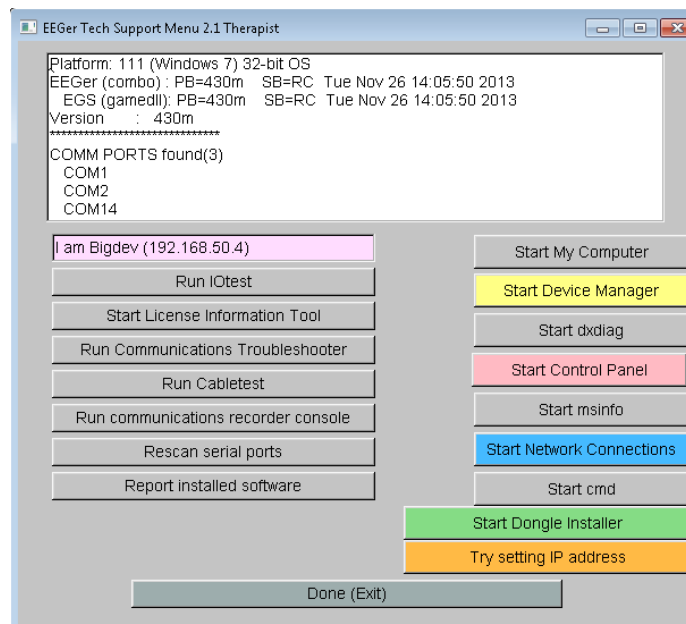
Statistics

The **"Statistics"** item shows a short summary of sessions run (since 4.2.1...) as shown below. Bad sessions are sessions that aborted for some reason or another.
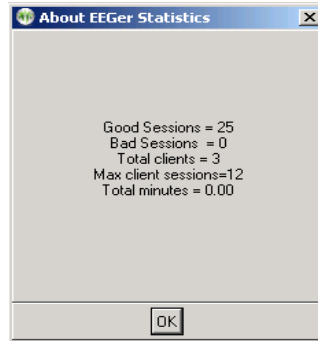
Dongle Info

The "**Dongle Info**" display shows some information about the currently-installed dongle.
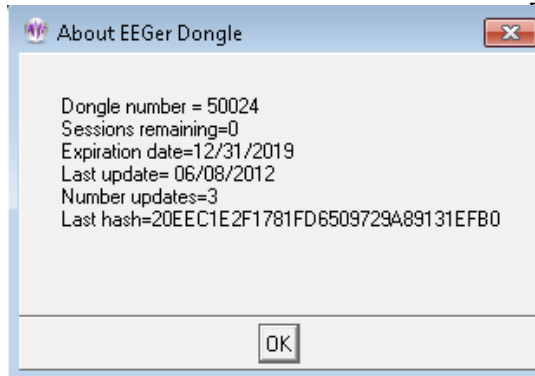
Com Port Info

This shows the currently detected communications ports.
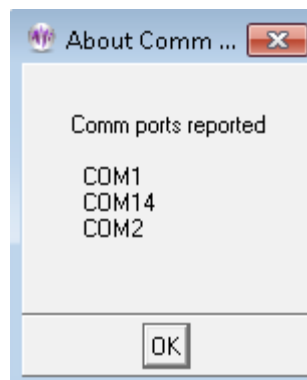
Keyfile Information

The "**Keyfile Information**" selection brings up a screen showing the currently installed license and option files. This is primarily used assist Technical Support.

```
License Data
Build Date= 20120130
Expiration Date = 20121231
License Kind = CLINIC
Licensed dongles=50024
```
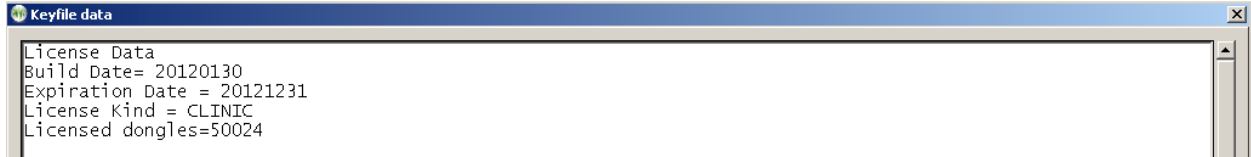
About

The **About** screen displays information about the version of EEGer and subsidiary files used.

EEGer4 Neurofeedback Software

PB=430m   SB=RC Thu Nov 14 10:13:28 2013

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For information and assistance,
Contact EEG Education & Research Customer Support
(800) 789-3456

EEGer4 uses the following open-source libraries
(supplied on the distribution CD or at support.eeger.com):
Python 2.5
Pmw.1.2
egenix-mx-base-2.1.0_20060922
blt24z-for-tcl84
Imaging-1.1.6
pywin32-210
zlib-1.2.3
fltk-1-1.2
freetype2-3.1
jpeg-6b-11
tcl8.4.14
tk8.4.14
hge18
fidlib-0.9.10
cdx 3.1
libpng.1.2.34

OK

Buttons for Client Activities

The screen prior to a client selection looks like this:
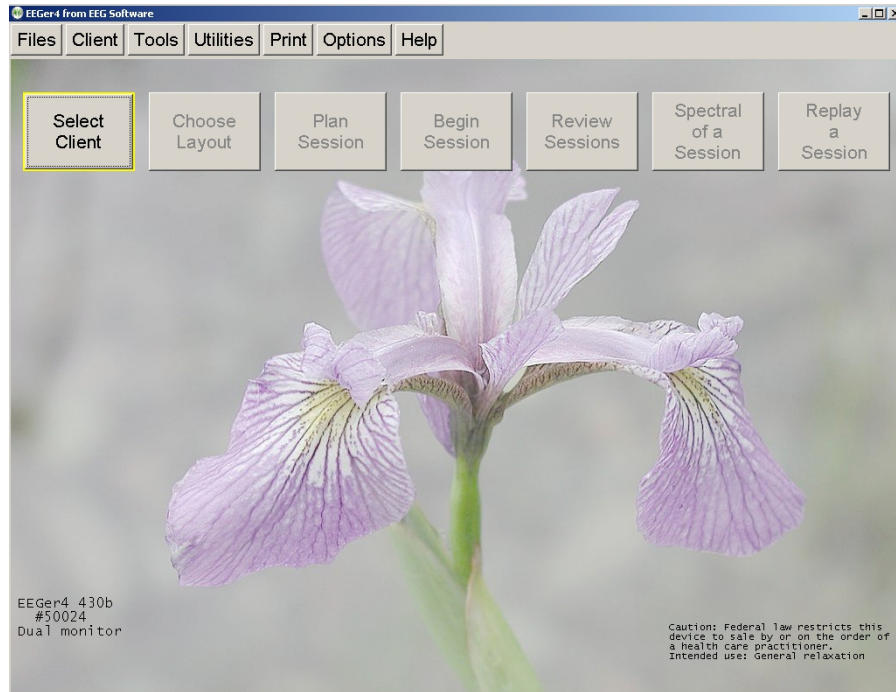
Select Client
Clicking on the **Select Client** button brings up the client selection menu:
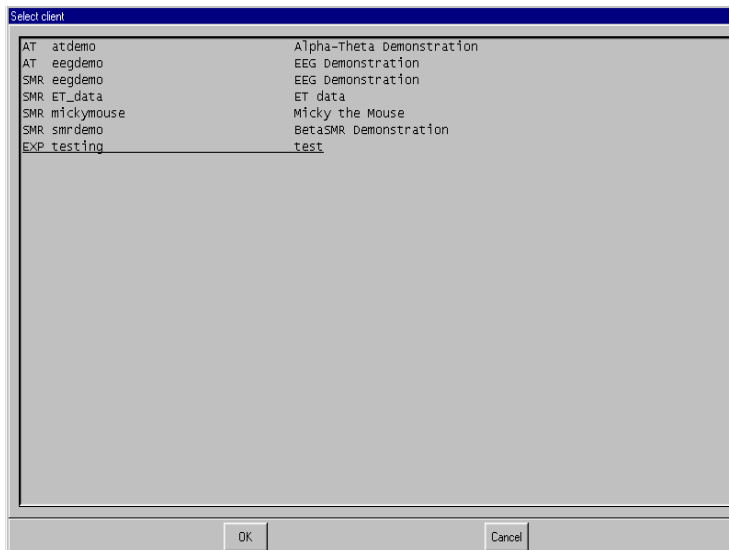
This screen is different from previous client selection screens in that you are now selecting both a
CLIENT and a PROTOCOL CLASS.

Once a client/protocol is chosen, the buttons become active. Note that the current client, protocol class, and layout are displayed on the top screen. Also, the button formerly marked as **Select Client** is now labeled **Change Client Selection**.
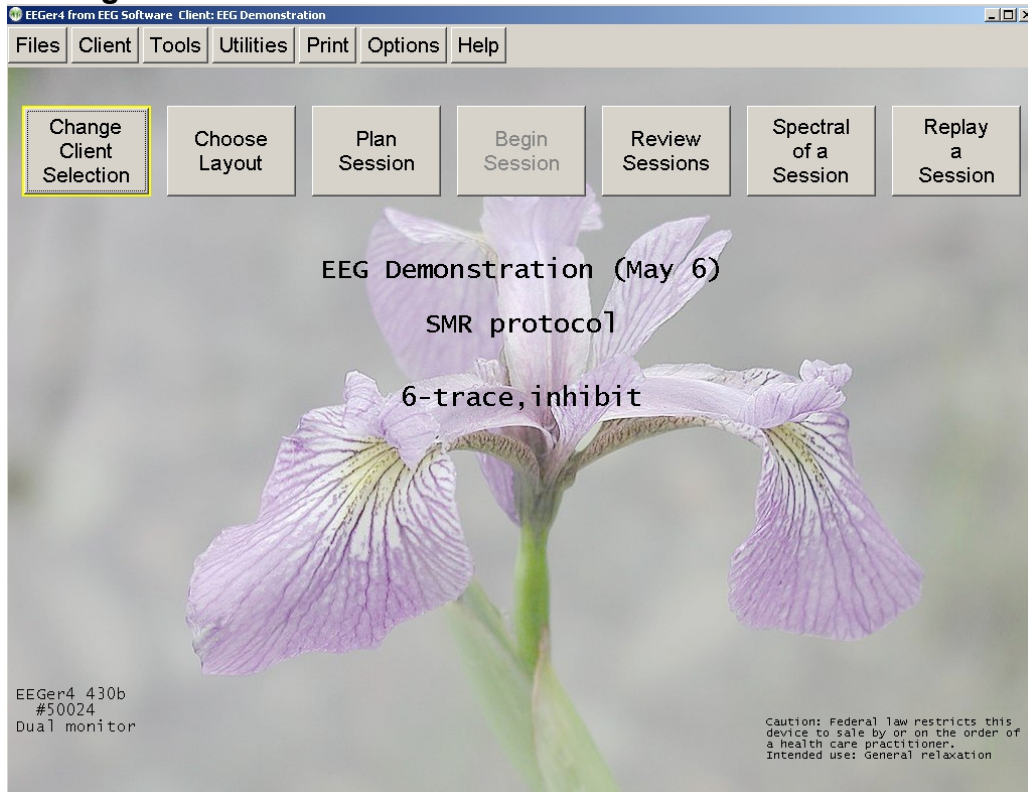
Choose Layout

The layout for this client can be changed using the **Choose Layout** button. Layout details are contained in the Technical Manual. The latest layout selection for each client is remembered for that client.

Choose layout		☒
	Select layout	
(5) 5-trace	2 chan,1 reward,2 inhibit	
(6i) 6-trace,inhibit	2 chan,1 reward,3 inhibit	
(6r) 6-trace,reward	2 chan,2 reward,2 inhibit	
(8) 8-trace	2 chan,2 reward,4 inhibit	
(5r) Reward-only	2 chan,1 reward,2 monitor	
(8q) 8-trace	4 chan,1 reward,3 inhibit	
(8z) 8-trace-4zcomp	4 chan,4 reward	
(8p) 8-trace	4 chan,2 reward,2 inhibit	
(10c) 10-trace,coherences	4 chan,2 reward,4 inhibit	
(10r) 10-trace,ratios	4 chan,2 reward,4 inhibit	
(12) 12-trace	4 chan,4 monitor,1 reward,3 inhibit	
(14b) ChanB,screen	14 traces,no rewards	
(14a) ChanA,screen	14 traces,no rewards	
(14ab) 2-chan,screen	14 traces,no rewards	

 4.3.0

Plan Session

Note: Remote-use clients cannot use Plan Session to alter the session plan established by the clinician unless enabled by the clinician. Changes made here are ignored when a session is started unless enabled.

Every session requires a "session plan".   This is the time/place that initial site locations, frequencies, feedback modes, and autogoal selections are made. Most of these selections are changeable during a session but an initial plan is <u>required</u>. There is a separate session plan for each layout. A session plan is comprised of a number of "stages". Each stage is a particular action/operation such as electrode placement, providing feedback, etc. In this version of EEGer, there are two kinds of "stages": **Setup** stages (electrode placement, frequency/mode establishment); and **Run** stages (actual feedback for a planned time). A plan is saved for each client/protocol class/layout combination (Each client has a session plan for each protocol class created using the **Add Protocol Class for Existing Client** option). Clicking on the **Plan Session** button brings up the following screen:
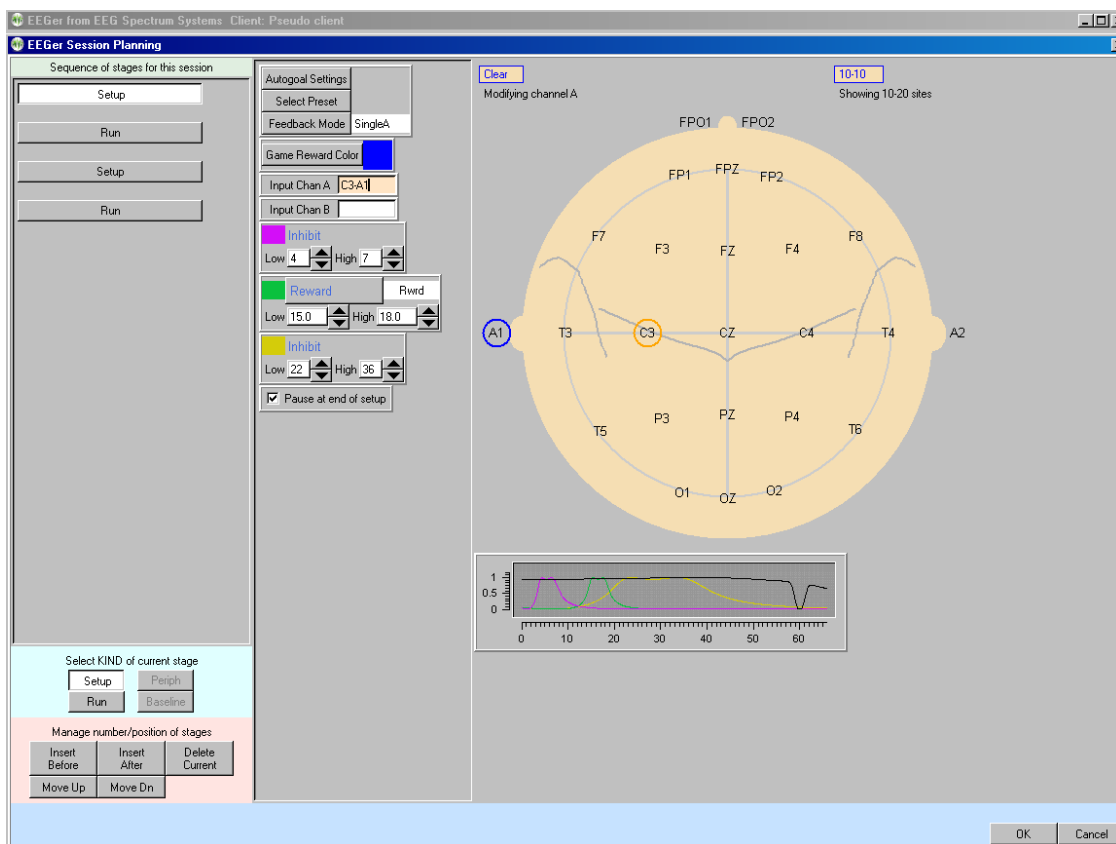
This display has three "panes". The leftmost pane is where stages are created or selected. At the top of the left pane is a series of buttons showing which "stage" of a session is being modified. Clicking these buttons "selects" that stage for modification (and changes the display shown in the center and right

panes). The bottom of the left pane has buttons allowing for creating and deleting stages or changing what kind of stage it is to be. In the center pane are the values for the currently selected stage. On the right pane (for Setup stages) is a symbolic head with electrode placements and a graph showing the frequency bands for the current filter frequency settings.

Clicking on the **Insert Before** or **Insert After** button adds a new stage with a type of "Empty".
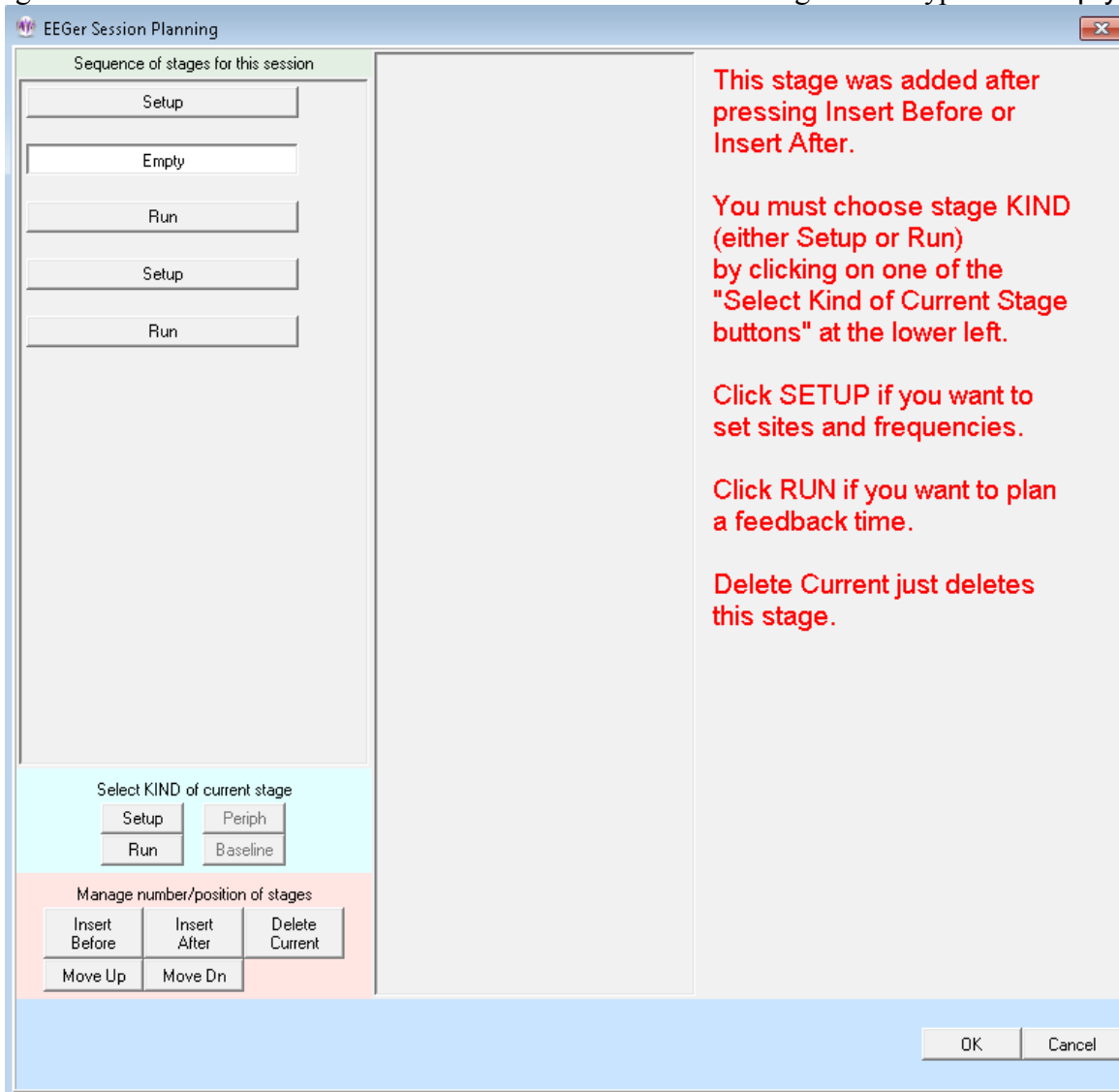
The Empty stage type must be set to a valid type by clicking on either **Run** or **Setup**. The **Delete Current** button deletes a stage (in this case bringing us back to the original screen).

To change the site locations, you must click in one of the channels. You can then type in values or use the mouse to click on desired locations (or the **Clear** box to reset channel values). Clicking on the blue box labeled 10-10 (or 10-20) toggles between the 10-20 placement diagram and the 10-10 (modified) placement diagram.

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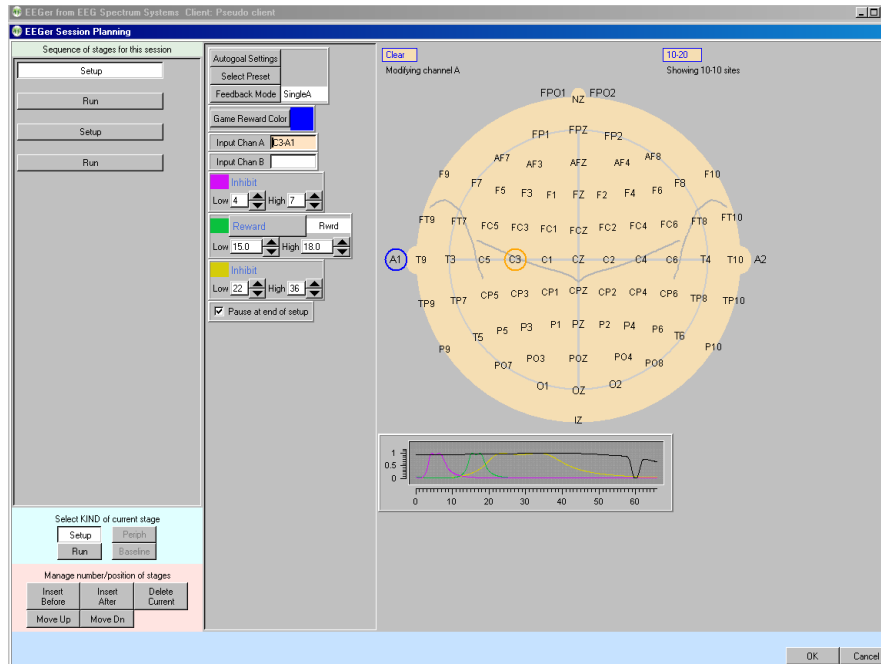
Clicking on the **Feedback Mode** button (top center) pops up a menu of choices for (starting) feedback modes showing all the possibilities for the current layout. It is possible to select a mode at the planning stage (now) that there is no license for. At actual feedback time, any unlicensed condition will cause **SingleA** (single channel, A input) to be selected. Of course, you can change the feedback mode (using F3 and Shift-F3) during the actual feedback process.
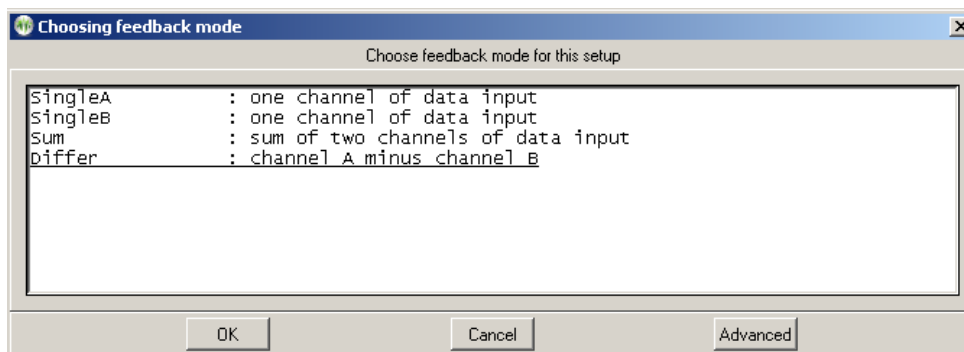
Advanced modes are like these (depending on actual layout selected):


```
Choosing feedback mode                                          ×
                     Choose feedback mode for this setup
SingleA        : one channel of data input
SingleB        : one channel of data input
Sum            : sum of two channels of data input
Differ         : channel A minus channel B
Psync          : synchrony measure between channel A and B
Async          : comodulation measure between channel A and B
GAsync         : global comodulation measure between channel A and B
AminusB        : A channel relationship to B channel
BminusA        : B channel relationship to A channel
PDelta         : Peak Time Coherence
ZCompAB        : ZComposite
ZAsymm         : Zscore amplitude asymmetry
ZCohere        : Zscore coherence
ZPhase         : Zscore phase
ZAbsPwrA       : Zscore Abs Amp A
ZAbsPwrB       : Zscore Abs Amp B
ZRelPwrA       : Zscore Rel Pwr A
ZRelPwrB       : Zscore Rel Pwr B
ZPRatioA       : Zscore Power ratio A
ZPRatioB       : Zscore Power ratio B

         OK              Cancel            Standard
```

There is detailed documentation of modes in the Technical Manual.
Some common modes are :

SingleA- Single channel, source data from the "A" input channel
SingleB- Single channel, source data from the "B" input channel
Sum - Sum of A and B channels is used as source data
Differ - Difference of A and B channels is used as source data
Psync- Comparison between filtered A and B envelopes (formerly Synchrony)
Async- Comparison between filtered A and B envelope slopes (formerly Comodulation)
GAsync- Comparison between lowpass A and B envelope slopes (formerly Global Comodulation)
AminusB- Difference between filtered A and B envelopes
BminusA- Difference between filtered B and A envelopes
PDelta- Phase difference between A and B signals
RatioA- Ratio of reward to inhibit (A as source)
RatioB- Ratio of reward to inhibit (B as source)
RatioAB- Ratio of A channel reward band amplitude to B channel reward band amplitude.
RatioBA- Ratio of B channel reward band amplitude to A channel reward band amplitude.
D/S-Ratio- Ratio of (A-B) to (A+B)
Unity − Compute 1-|(A-B)|/(A+B) similar to **D/S ratio** except absolute value

There are about 160 modes actually defined.

Clicking on the **Presets** button (top center) brings up a selection list of defined presets. These are the values set (changed) from the user-defined presets established as preferences using the **Preferences** menu (**Edit filter setups**).

.
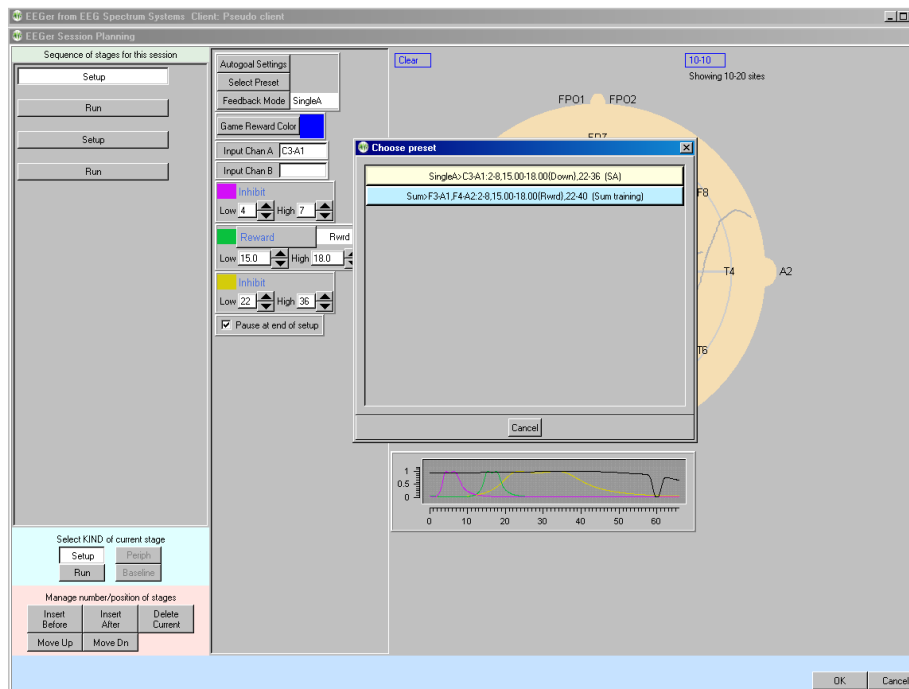
Selection of one of the presets from the list causes the preset-stored filter and site values to replace the current setup stage values and the specified feedback mode and reward mode to be selected.

Clicking on a **Run** stage button brings up a slightly different screen. Notice there is no "head" shown. The important field on this screen is the run time (**Minutes to run**). If this value is zero, there is no limit on run time and a manual F5 or F4 will be required to end a particular setup/session. It is possible to select an audio file to be played at the end of the run stage.
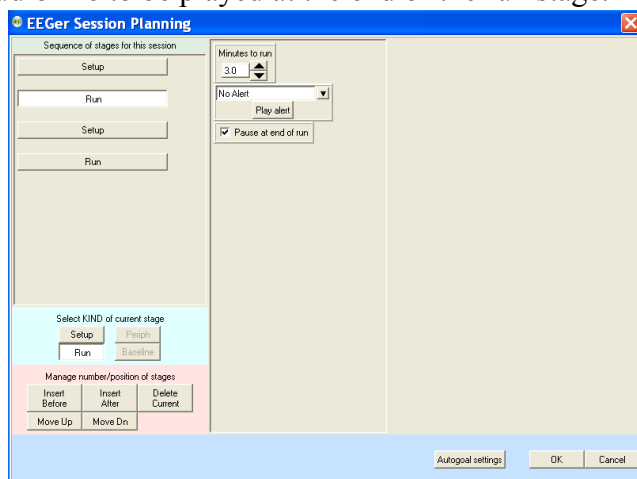
Autogoal settings

Clicking on **Autogoal settings** button in a setup stage of the session planning screen brings up a menu which allows adjustment of threshold values used when F11 is pressed (Alpha-Theta example shown).   There is a separate set of settings for each setup stage.

Any stream with 0 % selected will have NO change made when F11 is pressed. The **Minimum µv** (minimum microvolt) value is the minimum (measured average value) threshold that will ever be "automatically" set by F11. The **Maximum µv** value is the largest threshold value that will be set by F11. The **Autogoal only on F11** button is a toggle where the other value is **Automatic autogoal every rest period** or **Automatic autogoal every xx seconds** where **xx** is the number of seconds in the entry box. Clicking on **OK** saves the autogoal settings and returns to the session planning screen. When the F2 key is used during real-time processing to switch between up and down rewarding, the appropriate percentages would be reversed (i.e. 65% would become 35%).

On the session planning screen, clicking on the **OK** button saves the session plan and returns to the top menu. Clicking on **OK** if any field is highlighted with a pink background (marking it as in error) is ignored (and a bell sound is played as an error cue).

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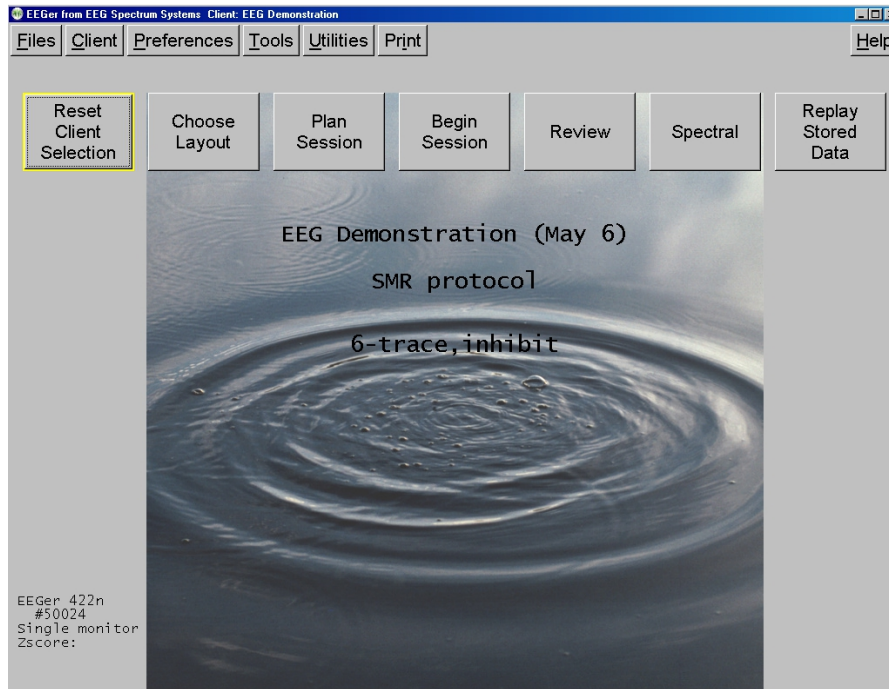
Begin Session

To begin a live session, click on the **Begin session** button. This brings up the game selection screen with a list of choices. **Games shown in pink are NOT licensed and cannot be selected**.
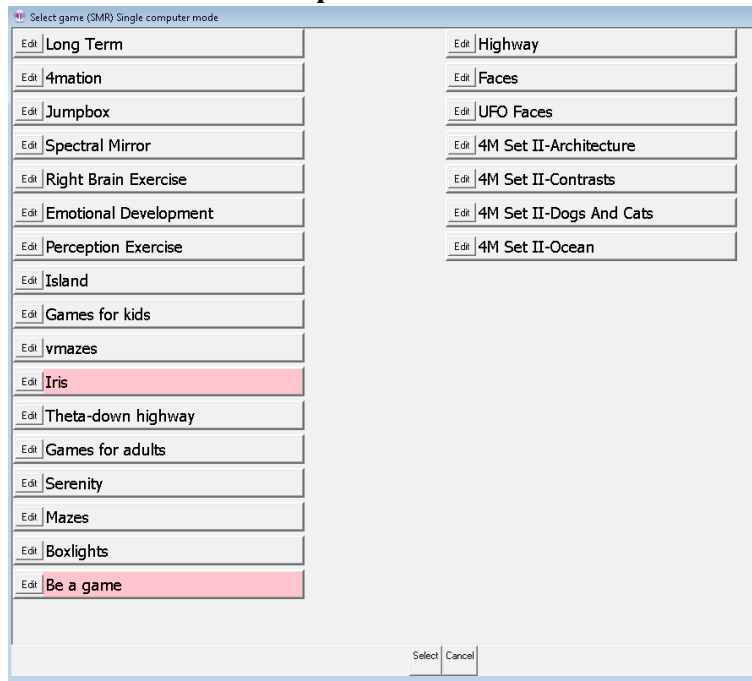
Clicking on the **Edit** button brings up a game tailoring screen. Changes made here affect **ONLY** this selection and are not saved as defaults.

Selecting a game (highlight and click **Select** or double-click on game line) brings up the realtime display screens described in a later section.

Review Sessions

The **Review Sessions** button brings up the session review screens for post-session analysis. These screens and controls are described in a later section.

Spectral of a Session
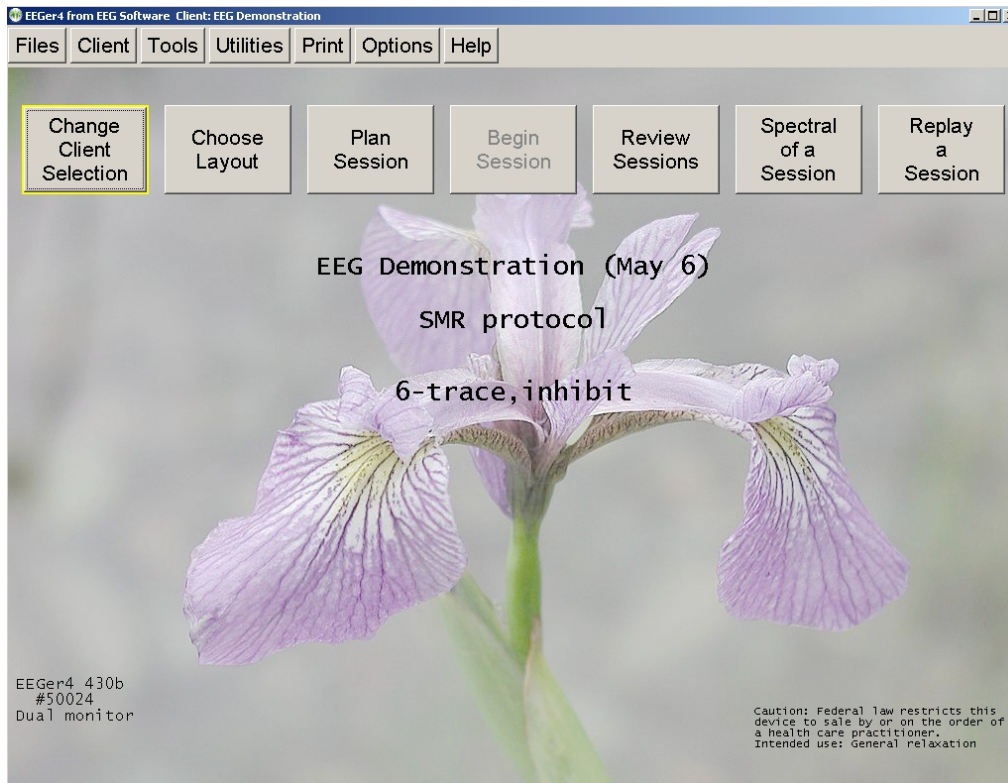
Clicking on the **Spectral of a Session** button brings up a raw file selection screen.
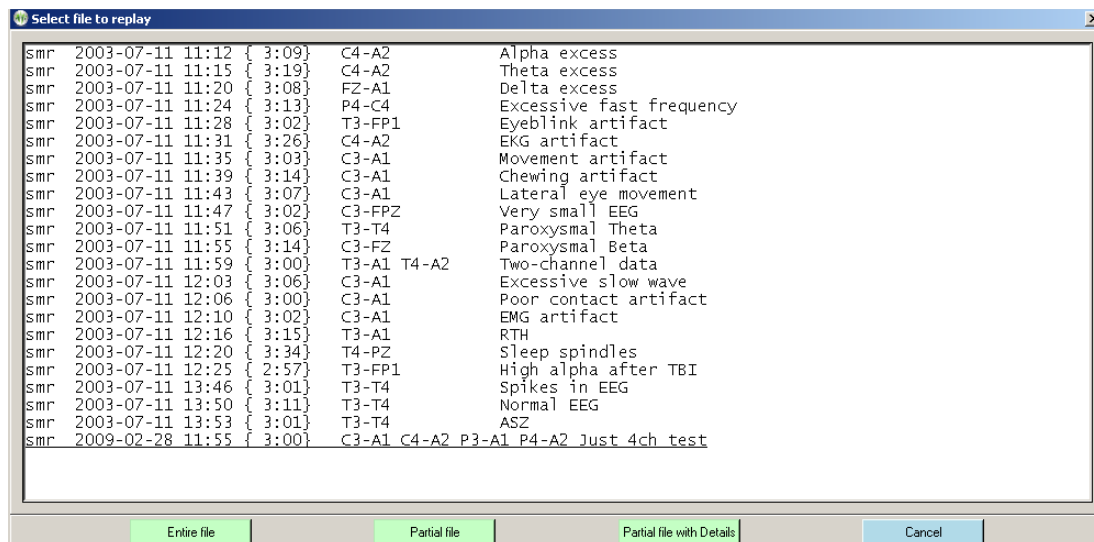
Once the file is selected, the graphical display of the data is begun. A typical screen looks like this:
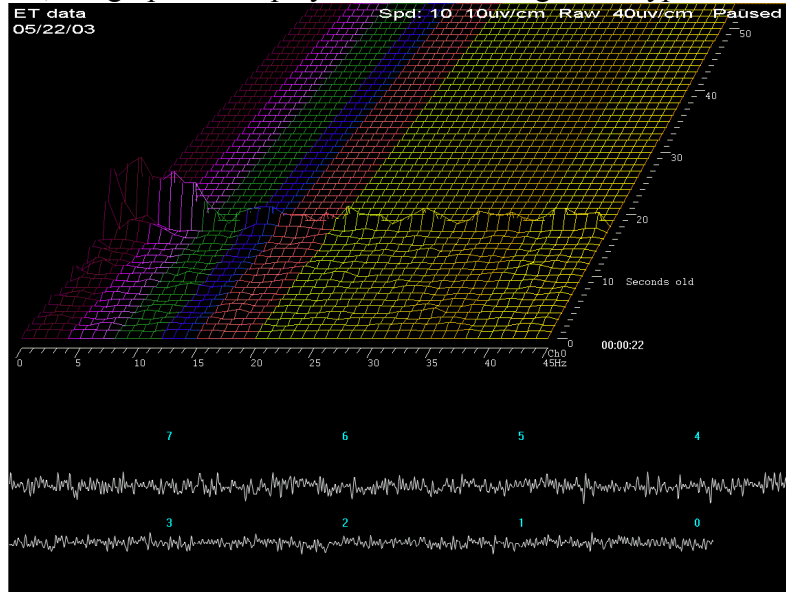
The top part of the screen shows spectral (FFT) data as a three-dimensional plot of frequency (horizontal), time (perspective), and amplitude (vertical). The coloration of the frequency bands uses the customizable color scheme used throughout EEGer. The bottom part of the screen shows the raw signal corresponding to the spectral data. The legends on the raw data show how many seconds "old" the raw data is. The "newest" raw data corresponds to the front-most spectral display row.

This is the screen with the time axis shown vertically (by moving the viewing angle left) and the dominant frequency marker turned on. Notice the 10-second average dominant frequency value shown to the immediate right of the channel assignment value.
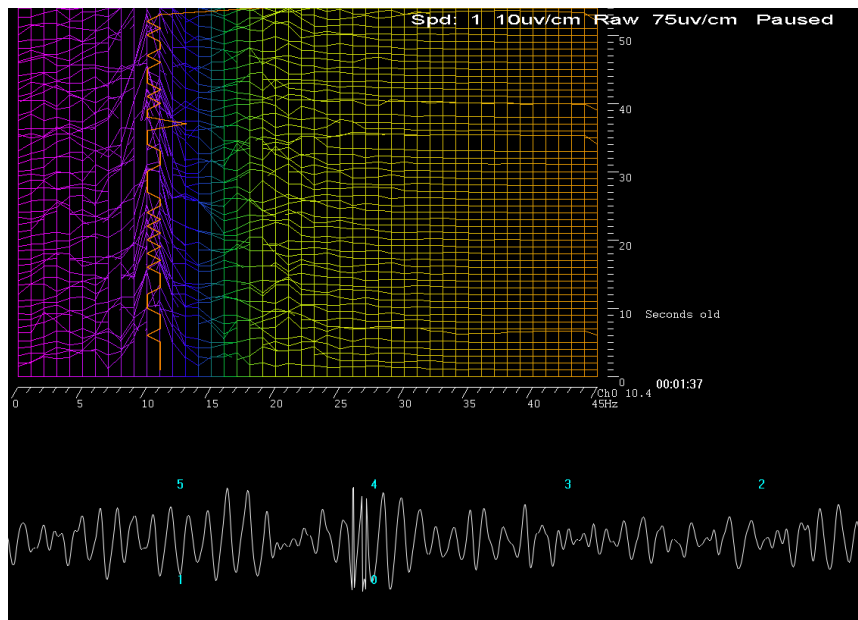
Pressing F1 brings up a help menu showing the key options available.
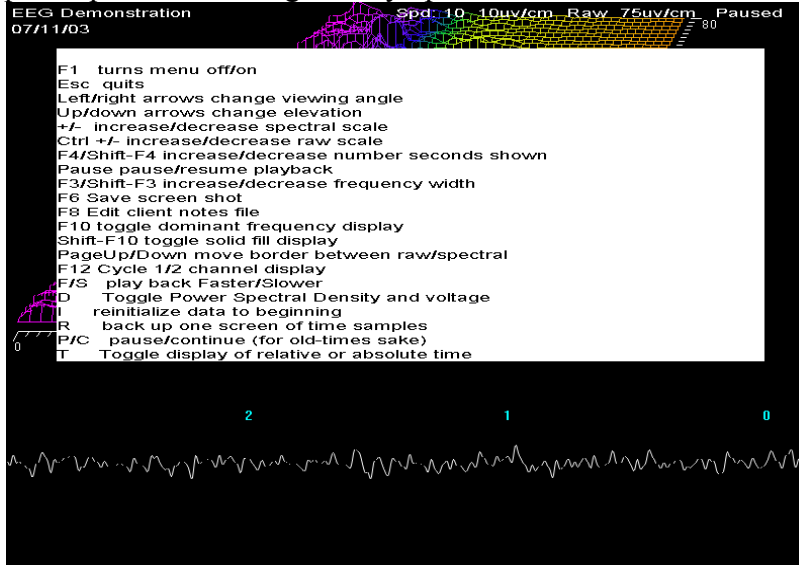
F1	toggles the help screen off/on.
Esc	terminates the spectral replay and returns to the top menu.
left/right arrows	change the viewing angle by moving the apparent vanishing point left/right.
up/down arrows	change the apparent elevation angle by moving the apparent vanishing point up/down.
+/-	change the relative spectral scale.
Ctrl +/-	change the relative raw data scale.
F4/Shift-F4	increases/decreases the "number of seconds" of data shown (apparent depth of display).
Pause	pauses/resumes playback of data.
F3/Shift-F3	increases/decreases the displayed number of frequency bins. The computation always uses a 1 Hz bandwidth but the clinician may only be interested in the lower 10 Hz.
F6	saves a screen for later printing. Black and white are reversed in the print file.
F8	Raise/lower the editor screen
F10	Toggles display of dominant frequency line (which uses color 49 of the current color set).
Shift-F10	Toggles display of solid fill for colors
Page-Up/ Page-Down	moves the border between the raw and spectral data.
F12	changes the display between two-channel/channel A only/channel B only modes.
F/S	make the playback be faster/slower than real time.
I	pauses playback and rewinds the data point back to the beginning.
R	pauses playback and backs up one "number of seconds" worth of data.
P	pauses playback.
C	continues playback from a pause.
D	Toggles between voltage amplitude on spectral display and Power Spectral Density display (voltage squared). PSD tends to show changes more dramatically.
T	Toggle time display between time-of-day and relative time in session.

This is what a two-channel screen display looks like (after pressing F12 several times).
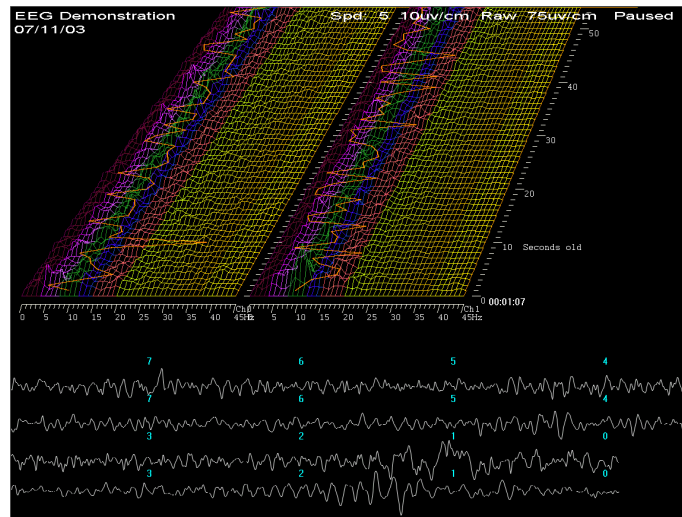
Note that the dominant frequency display marker is turned on (using F10).

Pressing F6 causes a printout to be saved with black and white reversed (to save printer ink).
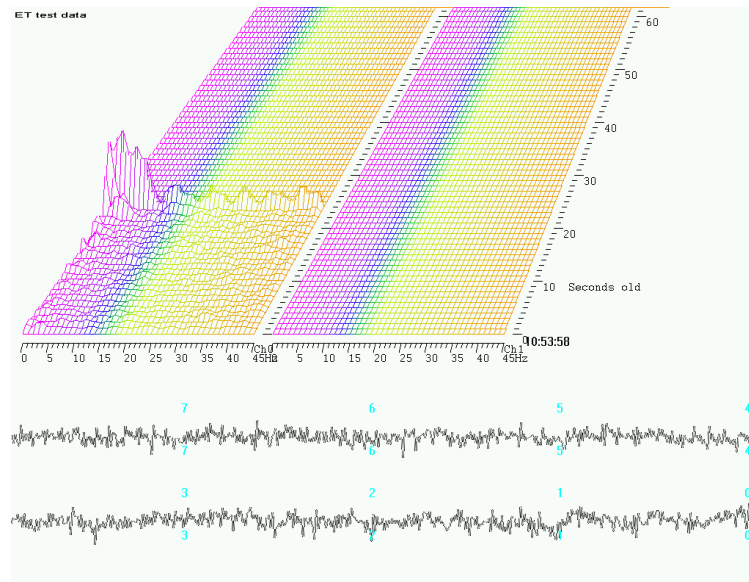
Replay a Session
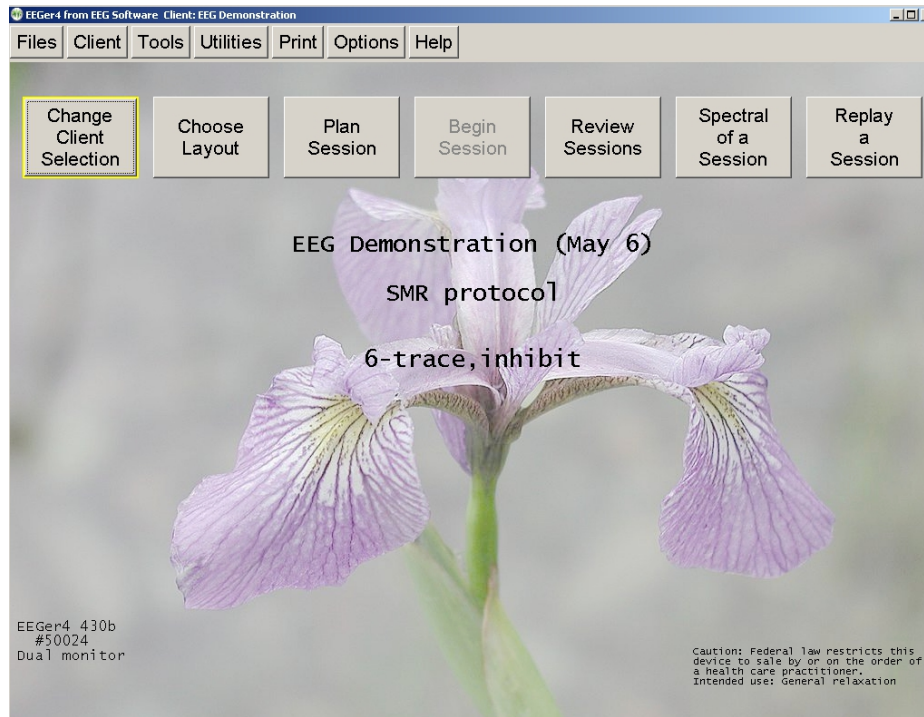
Clicking on the **Replay a Session** button brings up a list of raw data files to choose to replay.
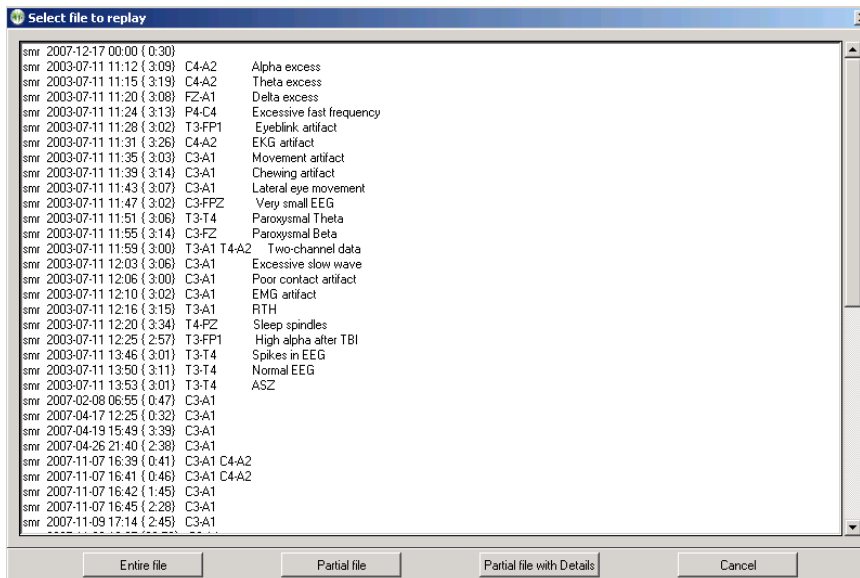
Clicking on **Partial file** brings up a selection option which allows just a portion of the file to be used.
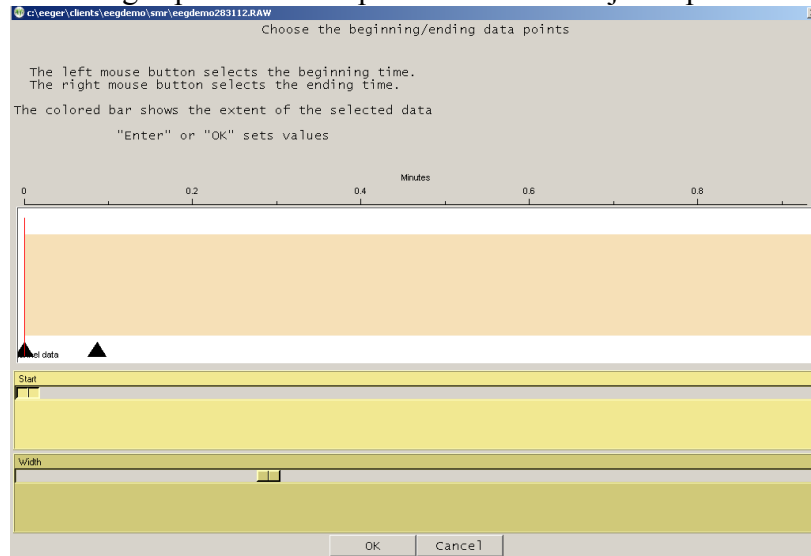
If you select the **Partial file with Details** option, be prepared to wait for some time since the details include the actual waveshape of the data.
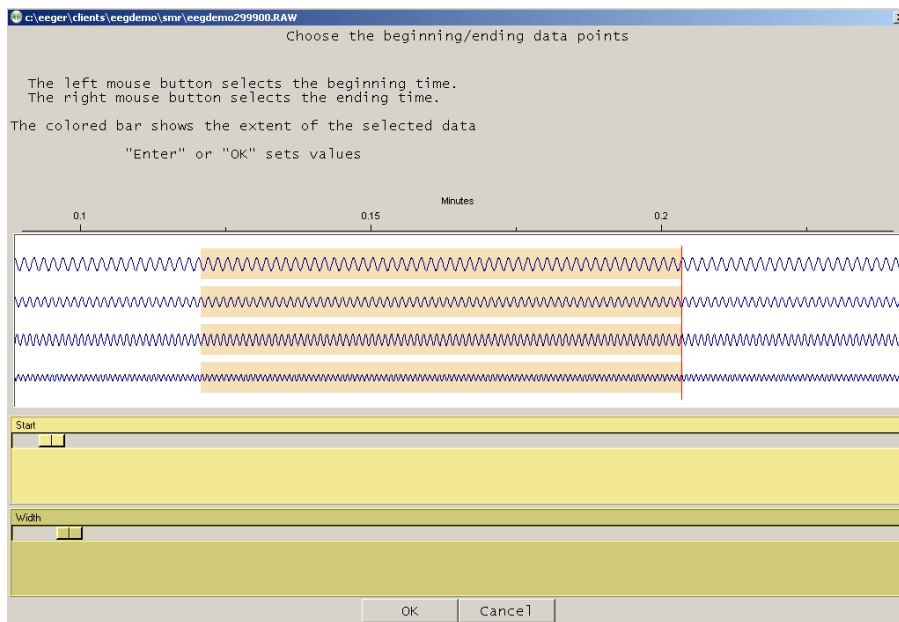
The top slider controls the origin of the left edge of the graph. The bottom slider controls the "time" width of the displayed data.

After selecting the replay file, a game must be chosen.
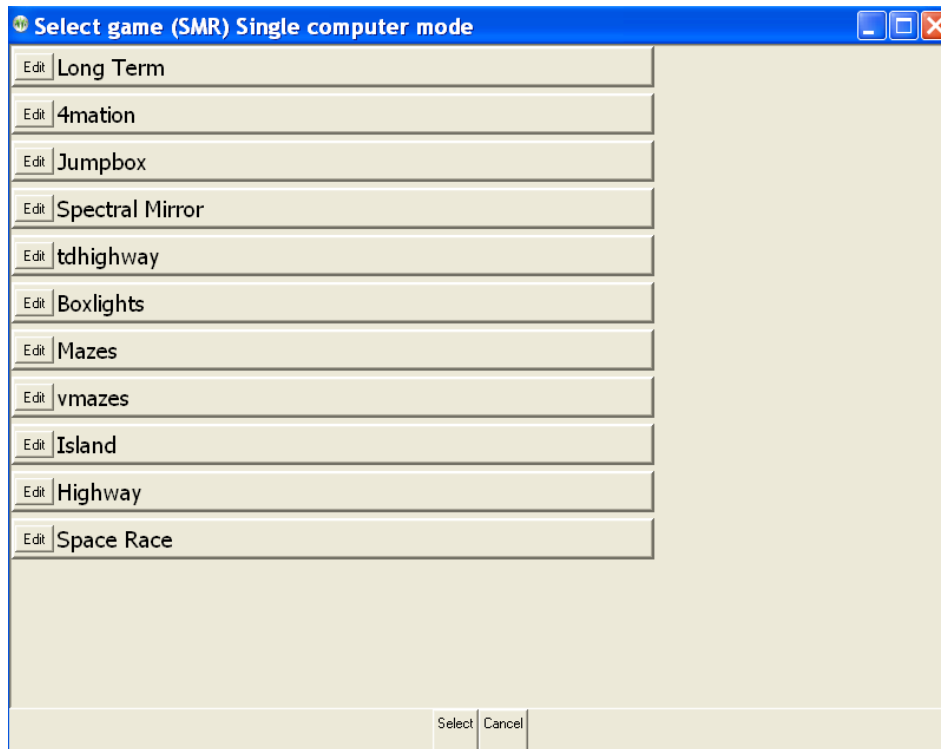
At this point, the feedback screens come up. During replay, new summary and data files are **NOT** stored, nor can Shift-F8 be used for annotation (since no new files are being saved). The F8 editor option **DOES** work so you can add notes or comments while observing the replay of a past session.

Session Screens and Controls

Brainwave Display

The brainwave screen looks like this:

There is a lot of information on this screen. Generally speaking, the upper part of the screen contains signal data and the lower part contains process/progress data.

There are several popup menus which can be used to control autogoal thresholds, volume, tactile feedback settings, etc. The menus work alike in that the line to alter is controlled by PageUp/PageDown and the settings change by the "+" and "-" keys or left/right arrow keys (just like threshold settings).

The **Esc** key closes any popup screens and continues processing. If no popups and in **Run**/**Rest**, it places EEGer into **Pause** state. If in **Pause** state, it terminates realtime processing (without warning) and returns to the top menu.

This previous screen shows a typical single channel setup. The top two streams are the input channels (labeled "**A**" and "**B**"). The "**A**" channel electrodes are at T3-T4.   The black highlight of the channel trace labels shows which input channels are being used for feedback.

The three streams below that are reward and inhibit streams (labeled at about the middle of each stream display). Possible legends are:
1. **ArtI**   Artifact Inhibit   (lowpass data)
2. **Inhb**   Inhibit

3.   **Rwrd**   Reward (signal above threshold
4.   **Down**   Reward (signal below threshold)
5.   Monitor

(Additionally, for advanced users:)
6.   **Cntr**   Reward (signal close to threshold)
7.   **Elev**   Reward (signal above threshold, clamp to threshold)
8.   **DevU**   Reward (deviation above)
9.   **DevD**   Reward (deviation down)
10. **Band**   Band (within band limits of threshold setting)

The current frequency range of each stream is shown at the left near the colored blocks. The "color" of the blocks is based on the center frequency of the frequency range (using the customizable colors previously mentioned in the **Tools** menu description). The **Sc** (scale), **Thr (**threshold), and **Avg** (average) values are in microvolts (peak-to-peak). The **inhib%** value is the percent of time the signal was over the threshold voltage (for inhibits). The **rwrd%** is the percentage of time in reward state (smoothed over the previous 30 seconds). The **Avg** value is the average value of the signal smoothed over the previous (user-specified) 30 seconds. The blue horizontal lines represent the relative position of the threshold setting. The **Tot Rew %** value in the upper right corner is the (smoothed over 30 seconds) percent of time the client is in overall reward state (no inhibits/artifacts and in rewardable state).

The (frequency) colored bars at the bottom are a measure of the energy contained in each 1 Hertz frequency range from 0 to 45 Hz. They are computed as FFT (Fast Fourier Transform) values every ½ second.   If the FFT Highlight mode is on (toggled by Alt-F10), the highest/lowest FFT amplitudes between 1 and 20 Hz will be color-coded with colors 49/50 of the current color set. This is a method of seeing where dominant values lie every ½ second.   The FFT scale maximum value is shown in microvolts on the left of the FFT area.

Some amplifier/encoders have a built-in impedance measurement capability. If the device used has this capability, the Ctrl-F7 option while NOT running (**Pause** or **Stage** mode) turns this measurement mode on or off. When on, the red letters shown below on the brainwave screen report the kilohms of impedance detected.
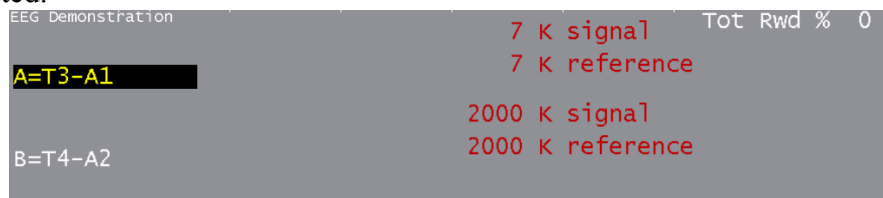
The above example shows very large values for the B trace since no electrodes are connected to the B channel. You should ensure that the reported impedance signal and reference values for a channel are similar in range and generally below 10 K. During impedance mode, no trace data is shown.

If there are scratches (or mismatches) on the electrodes, a large dc value may be reported as shown

below. Generally, this means the electrodes need to be replaced.
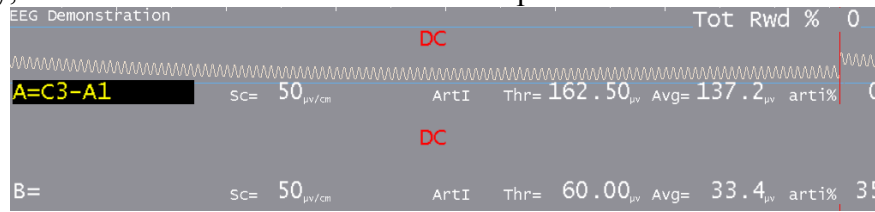
A typical two-channel screen is shown below. Several other features are shown on this screen. The reward stream shows a GREEN line in the center meaning signal-in-reward-condition. The high frequency band below it has a RED line meaning signal-above-threshold. Red lines inhibit rewards while green lines permit rewards (if there are no inhibits). The red lines in the input streams are times when an artifact (signal over threshold) has been detected/processed. The horizontal green lines are times when all reward criteria have been met (no artifacts/inhibits and all rewards ok). The vertical green lines reaching from threshold line to threshold line indicate a reward/"score" has been issued.
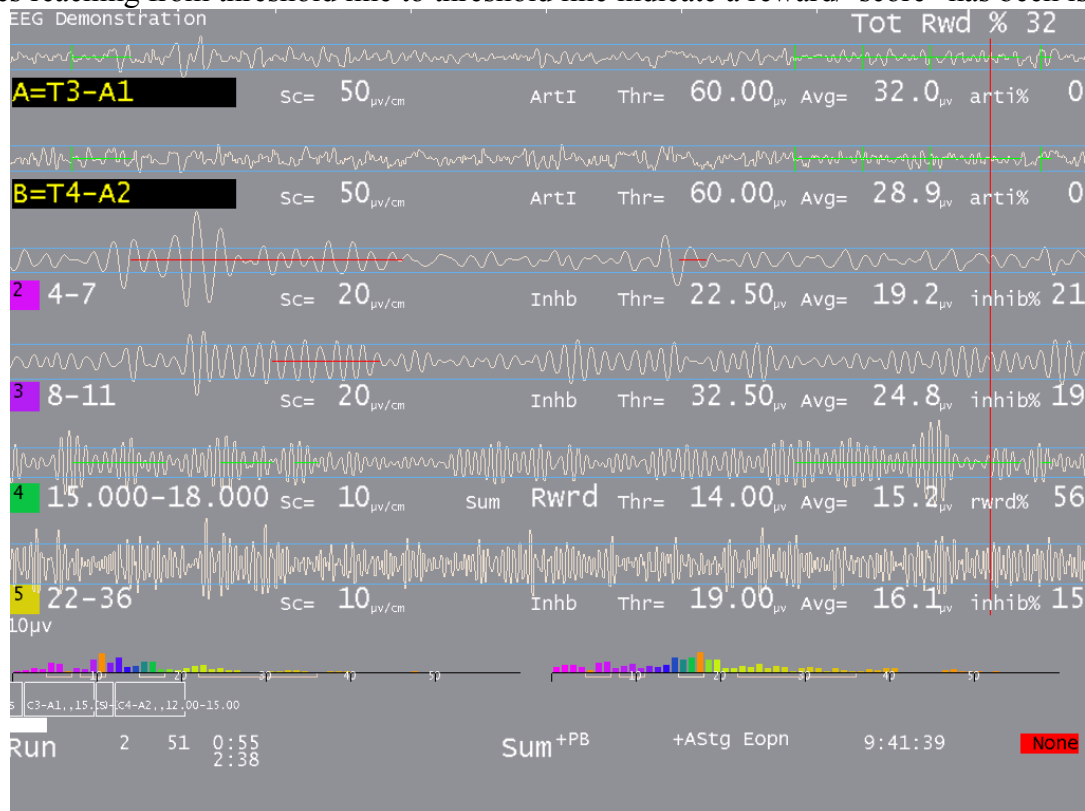
A 4-channel display has similar characteristics:
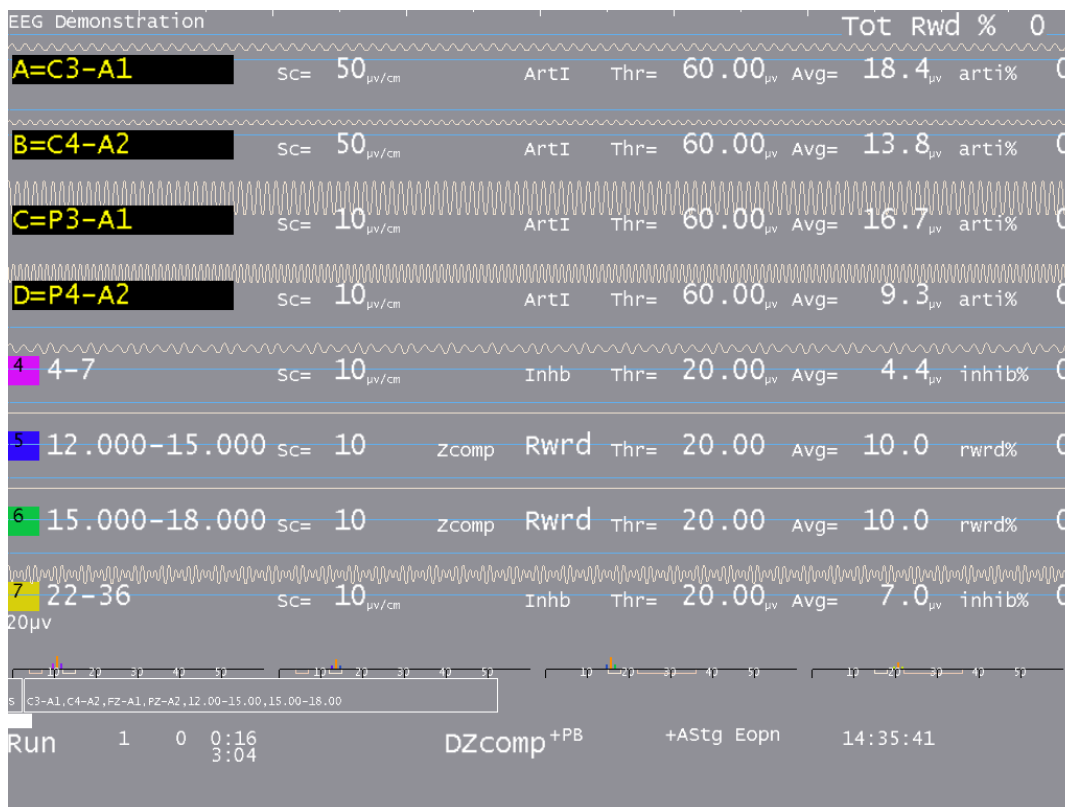
The bottom area of the realtime screen has a number of regions of data. Shown below are some boxes with text inside. This is a graphical representation of the session plan. The little boxes with "S" inside represent Setup stages. The run stages have the setup text from the previous setup and a width proportional to the specified run time. The entire bottom width is scaled to represent the maximum session time (from the preferences screen). The white progress bar is filled in to show the current position in the session plan.
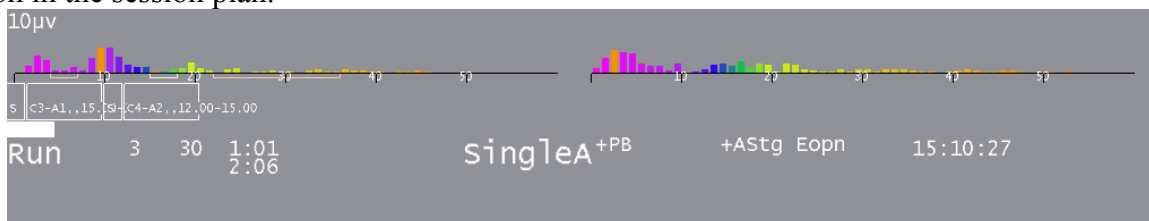
Below the boxes is a line of status information. The leftmost field contains the current status of feedback (**Pause, Run, Rest, Stage, Wait**) with a different background color for each status. "**Pause**" is shown when an operator action (F5) is required to continue the session. "**Rest**" status is shown during the rest periods between periods and implies no operator action is required. "**Stage**" is shown when there is an operator action/decision needed (move electrodes, continue/change session process, etc.). "**Wait**" is shown while waiting for the game to respond to its initialization.

The current period, score, and feedback time (minutes:seconds) is shown to the right of the current status. Below the feedback time is shown the time remaining before a status change takes place (like Run to Rest or Rest to Run). Next is shown the current feedback mode (**SingleA**).

There are a number of flags and operator-changeable modes whose state is shown in the middle of this line. Possibilities are:

+PB playback mode (not live)
+Gen signal generator mode (not live)
+Athr autothreshold (auto F11) at beginning of rest period or at some user-specified rate
+Astg auto stage processing enabled
+Arpl Auto replay running
-DC DC compensation turned off
-Ainh artifact inhibit turned off
-lpf lowpass filter disabled
-Nuse unused raw trace data is suppressed
Eopn Eyes open
Ecls Eyes closed

Further right the current time-of-day is shown. At the right edge, the device voltage or status is shown. A value in a GREEN background means everything is OK. A yellow background means a warning about something. In all cases, a flashing RED message indicates a fatal error condition for live sessions.

The boxes, text, and bar disappear if the session plan is no longer being followed.
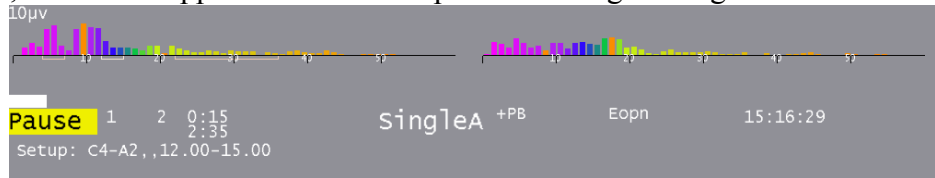
Additionally, some generic messages may be shown about the feedback process.
Among them are:

NOT RUNNING	- EEGer paused before first run
REWARDS BLOCKED	- No more rewards are sent to game. A reason "number" tells why rewards are blocked.
NOT RECORDING	- Session has run more than 90 minutes. Feedback can continue but no more data recording will occur.
INPUT FAILURE	- Live input lost (amplifier failure or dongle removed)
KEYBOARD Lost	- EEGer is not the focus for keyboard inputs. If this occurs, move the mouse to the brainwave screen and left-click.
RAW% TOO HIGH	-One of the in-use raw channels has too many artifacts. Please adjust artifact thresholds until percentage gets lower and then readjust as needed.
TRACE NOT SELECTED	-A trace was not highlighted to tell which trace is to be used/modified.

If the keyboard focus is taken by another program (such as Boat Race or Grind), this will appear:
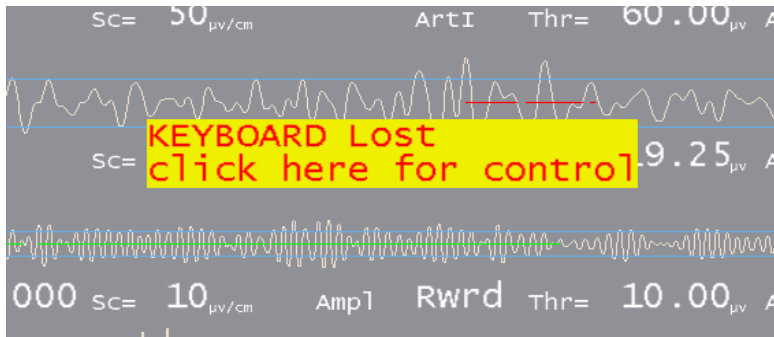
Clicking the mouse on the yellow block will return the keyboard to EEGer.

Pressing Shift-F8 causes the two bottom lines to be used as a single-line entry area as shown below. This data is recorded and displayed during review.
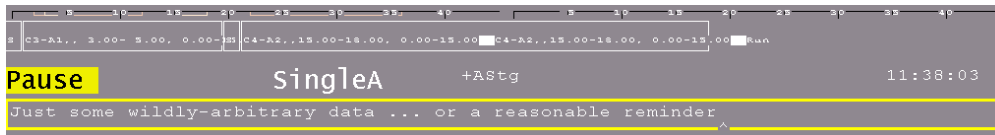
F8 raises/lowers the editor screen which can be used while feedback is ongoing.

Popup Menus

There are a number of popup menus which can be used to control autogoal thresholds, volume, etc.,. The menus work alike in that the line to alter is controlled by PageUp/PageDown or the Up/Down arrow keys and the settings changed by the "+" and "-" keys or Left/Right arrow keys.

Autogoal Popup

The autogoal threshold popup is initiated/dismissed by the "%" or the "G" keys.

         4.3.0
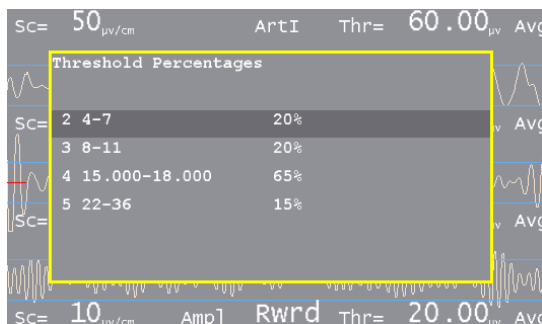
Feedback Mode Popup

The Feedback Mode popup is selected/dismissed by the Shift-F3 key. Only valid modes for the current layout are shown. The first window shows the standard modes.

```
Feedback mode selection

SingleA          : one channel of data input              Active
SingleB          : one channel of data input
Sum              : sum of two channels of data input
Differ           : channel A minus channel B
RatioA           : Ratio of rwd/inhib
RatioB           : Ratio of rwd/inhib
```

A second Shift-F3 brings up the advanced mode window.
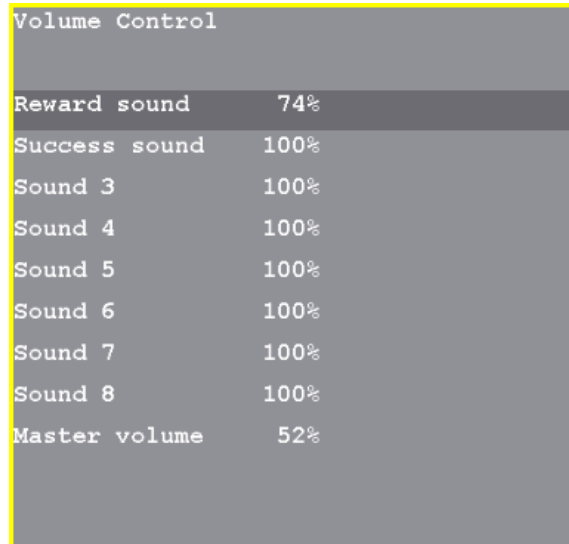
```
Feedback mode selection

SingleA          : one channel of data input                    Active
SingleB          : one channel of data input
Sum              : sum of two channels of data input
Differ           : channel A minus channel B
Psync            : synchrony measure between channel A and B
Async            : comodulation measure between channel A and B
GAsync           : global comodulation measure between channel A and B
AminusB          : A channel relationship to B channel
BminusA          : B channel relationship to A channel
PDelta           : Peak Time Coherence
RatioA           : Ratio of rwd/inhib
RatioB           : Ratio of rwd/inhib
RatioAB          : Ratio of A to B in reward band
RatioBA          : Ratio of B to A in reward band
D/S-Ratio        : Ratio of AB diff/AB sum
Unity            : 1-Ratio of AB diff/AB sum
ZCompAB          : ZComposite
ZAsymm           : Zscore amplitude asymmetry
ZCohere          : Zscore coherence
ZPhase           : Zscore phase
ZAbsPwrA         : Zscore Abs Amp A
ZAbsPwrB         : Zscore Abs Amp B
ZRelPwrA         : Zscore Rel Pwr A
ZRelPwrB         : Zscore Rel Pwr B
ZPRatioA         : Zscore Power ratio A
ZPRatioB         : Zscore Power ratio B
```

Volume Popup
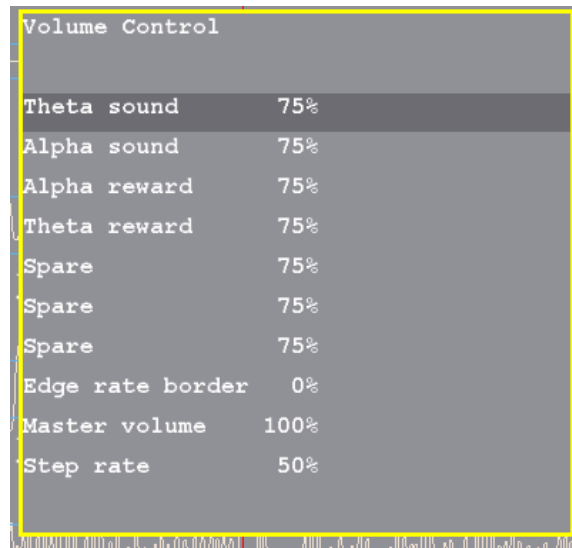
The volume popup is selected/dismissed by the "V" key. Volume controls here only work for those games which "understand", in particular the EGS games.
For SMR and EXP protocol classes, the volume popup looks like this:

```
Volume Control


Reward sound        74%
Success sound       100%
Sound 3             100%
Sound 4             100%
Sound 5             100%
Sound 6             100%
Sound 7             100%
Sound 8             100%
Master volume        52%
```

If an Alpha Theta session is being run, the volume popup looks like this:

```
Volume Control


Theta sound         75%
Alpha sound         75%
Alpha reward        75%
Theta reward        75%
Spare               75%
Spare               75%
Spare               75%
Edge rate border     0%
Master volume       100%
Step rate           50%
```

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Tactile Popup

The tactile feedback popup is initiated/dismissed by the "T" key. This popup is only enabled if a tactile audio device was selected on the configuration menu.
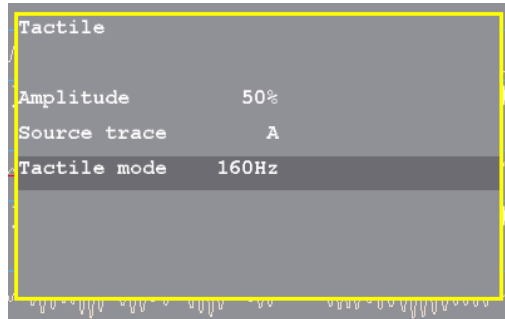
Any trace can be selected as the source of tactile data. The tactile mode can be OFF, 10 Hz, 60 Hz, or 160 Hz. This is the frequency of the signal being modulated by the source trace amplitude. Note that many laptops cannot produce 10 Hz signals due to poor audio systems.

Peripheral Control Popup

The "P" key initiates/dismisses the peripheral data control.
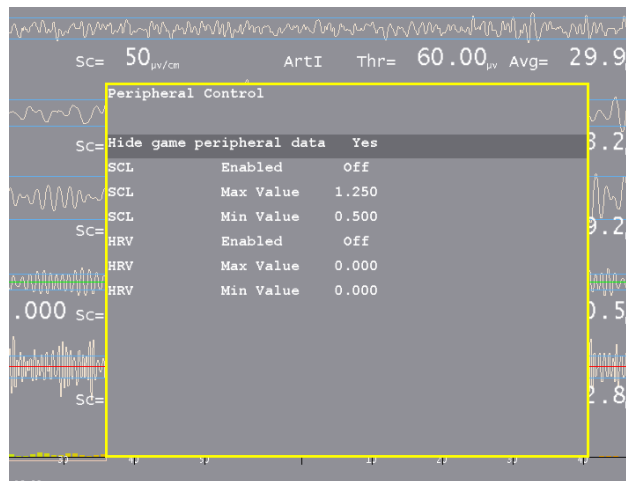
- The "**Hide game peripheral data**" option controls display of peripheral data on the game long-term display (just as the control on the Game Feedback Control menu does).

Other options depend upon the peripheral types specified in the Device Options configuration page. In general, there will be an enable/disable option and minimum/maximum value options.

Therapist Display Control Popup
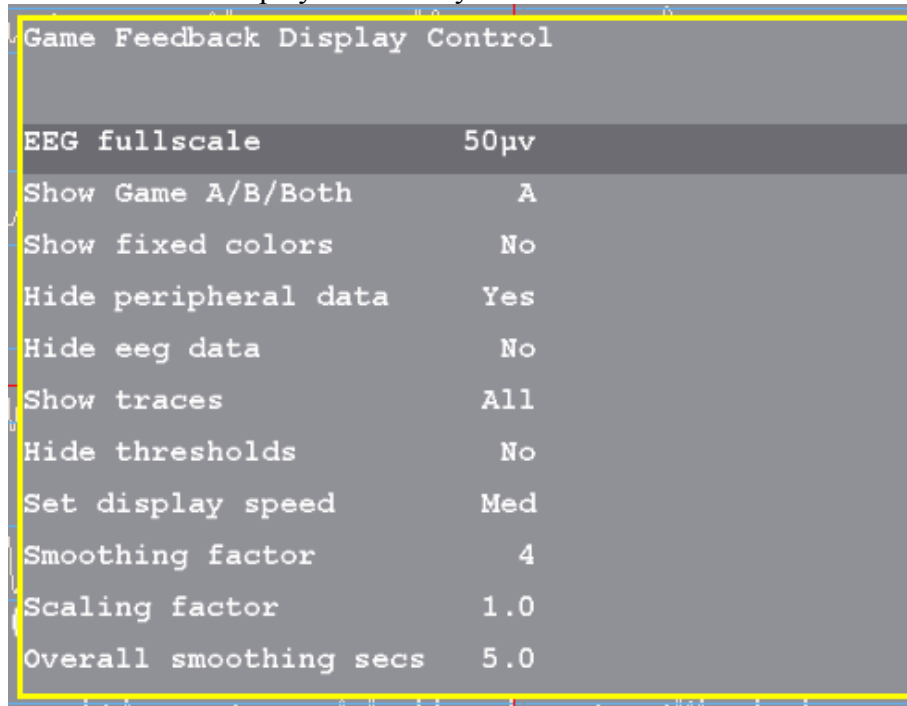
The "D" key initiates/dismisses the Therapist Display Control. This controls ONLY the Therapist display options.
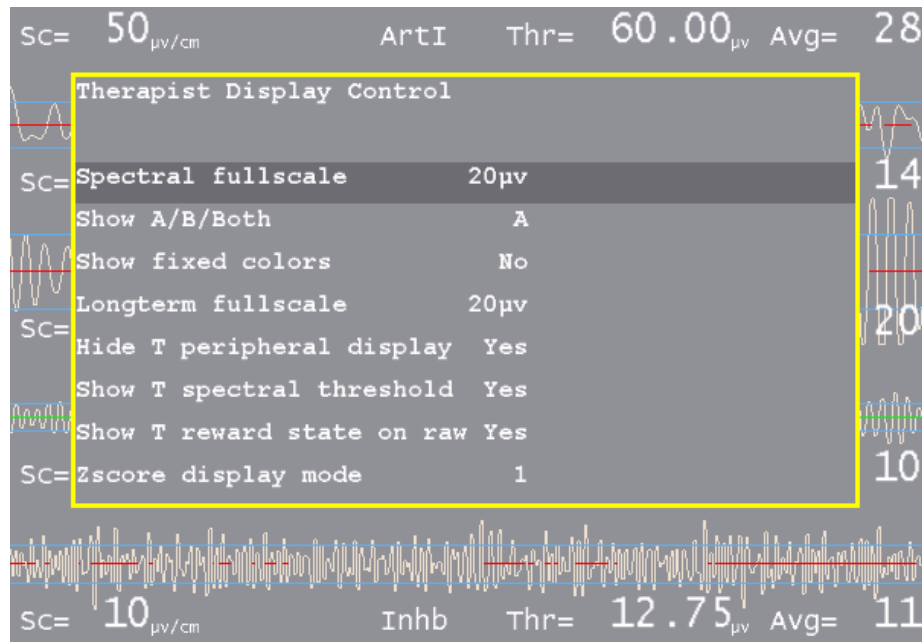
- The "**Spectral fullscale**" setting controls the full-scale setting of the Therapist Spectral Mirror display.
- The **"Show A/B/Both"** control determines if the Therapist sees just the A trace signal mirrored, just the B trace signal mirrored, or both (A on the left and B on the right). For 4-channel systems, C, D and C&D are also available.
- The **"Show fixed colors"** option determines if the fixed color set is used instead of the user-chosen color set (but just on the Therapist displays).
- The "**Longterm fullscale**" setting is another way to control the long-term display scale.
- The "**Hide T peripheral display**" removes the peripheral data from the long-term display (assuming there is any peripheral data).
- The **"Show T spectral threshold"** controls whether or not the threshold and average values are displayed over the spectral mirror display.
- The **"Show T reward state on raw"** option controls display of the green reward line display on the raw traces.
- The "**Zscore display mode**" option determines if the zdisplay bar colors are driven by the over/under logic.

Game Feedback Display Control Popup

The "F" key initiates/dismisses the "Game Feedback Display Control" popup. Note that this controls only display aspects at the client display and not any feedback decisions/controls.

```
Game Feedback Display Control


EEG fullscale              50µv
Show Game A/B/Both          A
Show fixed colors          No
Hide peripheral data       Yes
Hide eeg data              No
Show traces                All
Hide thresholds            No
Set display speed          Med
Smoothing factor            4
Scaling factor             1.0
Overall smoothing secs     5.0
```

- "**EEG fullscale**" controls the scale used on both the game long-term display and the game spectral mirror display.
- The "**Show A/B/Both**" option controls whether the game spectral display shows A mirrored, B mirrored, or both A & B.
- The "**Show fixed colors**" causes the game long-term display to use fixed colors rather than the color set selected in the game tailoring logic.
- The "**Hide peripheral data**" option hides/shows the peripheral data (if there is any) on the game long-term display.
- The "**Hide EEG data**" option controls display of the EEG data on the game long-term display.
- The "**Show traces**" option allows selection of all traces, just the uppermost reward trace, or the uppermost reward and the inhibit just above the uppermost reward trace.
- The "**Hide thresholds**" option controls display of the EEG threshold(s) for the selected trace(s).
- The "**Set display speed**" allows selection of slow, medium, or fast displays of data. The slow display shows the entire session. The medium display shows ten minutes of data. The fast display shows one minute of data. The "per" display shows one period of data.
- The "**Smoothing factor**" controls how smooth the data will be on the display (just as is done in the Review process).
- The **"Scaling factor"** option changes the scaling logic for the IRIS game display.
- The "**Overall smoothing factor**" allows changing the smoothing time constant for games that use overall reward as the driving factor.

Game Control Popup

This menu has different values depending on the currently running game and is initiated with the "**S**" key. One set of games uses this menu:

```
Special Game Control

Show Game Menus
Group Selection
SubGroup Selection
Enable penalty logic       Yes
Show reward bars           Yes
Show inhibit bars          Yes
Show fixed colors           No
```
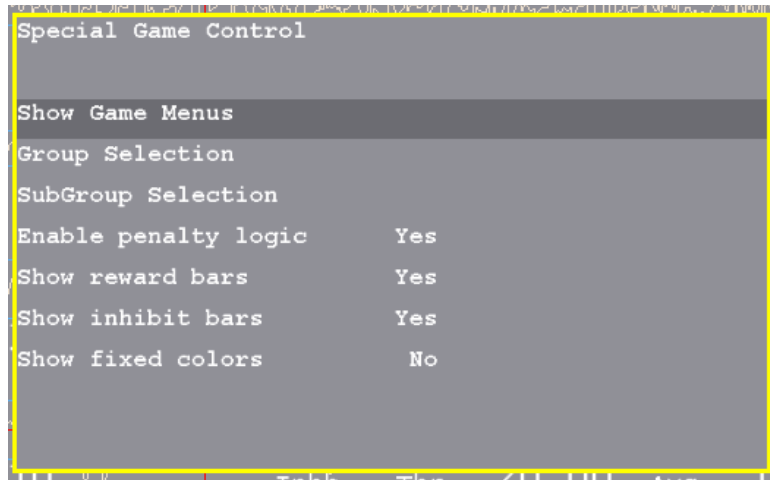
- **"Show Game Menus"** allows hiding/showing of the special game selection menu. A '+' raises the screen and a '-' hides it. The menu is only displayed if EEGer is in a PAUSE or STAGE state. The special menu shows the title of the main group, the current subgroup, and the instructions for the client for the current game/subgame.
- **"Group Selection"** cycles through all the allowed game main game groups.
- **"SubGroup Selection"** cycles through the subgroups of the current game game group.
- **"Enable penalty logic"** turns on/off the logic in the game that backs up displaying pieces if rewards do not occur within the timeout. This only works if the game definition has a time specified for the timeout.
- **"Show reward bars"** turns on/off the display of the reward amplitude bars at the bottom of the game display. The threshold setting is the bottom of the picture and the reward bars are on the right side.
- **"Show inhibit bars"** turns on/off the display of the inhibit amplitude bars at the bottom of the game display. The threshold setting is the bottom of the picture and the inhibit bars are on the left side.
- **"Show fixed colors"** turns on/off the display of fixed colors (instead of the frequency sensitive colors) in the reward/inhibit bars.

The DVD game has this menu:

```
Special Game Control


Video impact mode          Overlay
Feedback sounds wanted        Yes
Pause DVD during Pause         No
Time to reach best video     1.50
Time to reach worst video    3.00
Worst video floor %            50
```
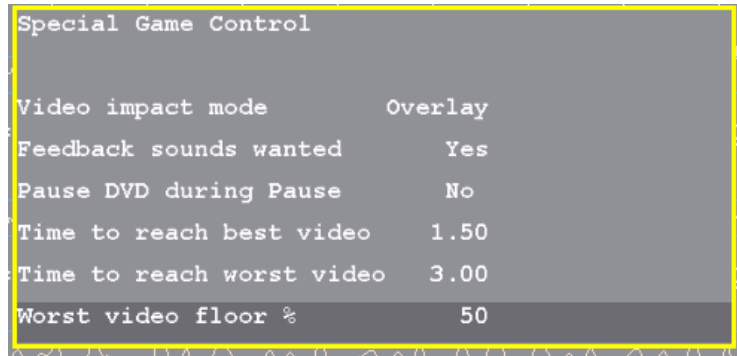
- **"Video impact mode"** allows selection of the video modification applied to the current video playback. Choices are Overlay, Blur, Black White.
- **"Feedback sounds wanted"** allows feedback sounds (reward, etc.) to be heard.
- **"Pause DVD during pause"** allows pausing/not pausing video playback during PAUSE or STAGE phases.
- **"Time to reach best video"** is the number of seconds of on-task time to reach minimal video modification.
- **"Time to reach worst video"** is the decay time in seconds to reach the most video modification.
- **"Worst video floor %"** is the minimum amount of video that will always be seen. Setting 100% means that NO video modification is performed. Setting 0 % means that the full range of modification/obscuration will be performed.

Band Control Popup

```
B=T4-A2          SC=  50 µv/cm         ArtI    Thr=  60.00 µv  Avg=  29.2 µv

              Band range settings 4

 2  4-7        SC=                              12.1 µv
               Reset band offsets         0
               Upper limit offset       2.00
 3  8-11       Lower limit offset      -2.00
                           Inhb    Thr=  24.75 µv  Avg=  18.2 µv

 4  15.000-18.000  SC=  10 µv/cm    Amp1   Band   Thr=   9.00 µv  Avg=   9.1 µv
```

- **"Reset band offsets"** sets the upper and lower offset limits to 10% of the current threshold setting.
- **"Upper limit offset"** adjusts the allowable range above the threshold for a rewardable condition.
- **"Lower limit offset"** adjusts the allowable range below the threshold for a rewardable condition.

Expert Settings Popup

- "**Min Time between Rewards**" allows changing the minimum time between rewards from the value set by the game definitions (down to a minimum of 0.25 seconds).
- "**Reqd Time-on-Task**" allows setting the minimum seconds needed to be in a rewardable state before a reward is allowed.
- "**Reqd On-Task Percent**" allows setting the minimum overall reward rate required before rewards are allowed.
- "**Max artifacts before holdoff**" allows setting the number of artifacts within the holdoff time before rewards are inhibited for the holdoff time.
- "**Artifact holdoff time**" allows setting the artifact monitoring period and the length of holdoff if the count is exceeded.
- "**Frequency step size**" allows changing the step size used when changing the reward-band frequency when using the Ctrl-Up and Ctrl-Down arrows.
- "**Spike enable mode**" allows changing the spike detector mode. Any mode except '**Disabled**' causes (yellow) vertical bars to be shown on the raw traces. If mode is "**In Period**" or "**Always**", an optional sound can e produced on the game computer. Modes are:
  Disabled
  In Period   - display on therapist display, sound triggered on game if in feedback
  Always   - display on therapist display, sound triggered on game at any time
  Just Show - display on therapist display
- "**Spike wait time**" allows selection of how long to wait after a spike to see if its really an artifact.

Note that these changes are NOT saved for future sessions.

 4.3.0

Help Screens

The F1 key brings up a several help displays that shows the key usage during feedback. When pressed with help not already displayed, it brings up the primary help display.

Controls   (F1 again for more help, Enter or Esc to quit)   4.3

```
F5............Start/Pause feedback
Esc..........Close popups/exit realtime session
F2............Change reward mode (Shift goes backward)
F3............Change feedback mode (Shift brings up menu)
F9............Scale adjust if selected/autoscale filtered bands if no selection
F11..........Autothreshold selected band/all filtered bands if no selection
Ctrl-F7.....Impedance mode control
F4............Change stage

PageUp/PageDown (or arrow keys).....SELECTS a band
+/= and - .....Increment/decrement threshold or scale
Return...........UNSELECTS a band/closes popups

F12.........Change therapist display (brainwaves, long term, spectral, summary, zscore)
F10/Shift-F10 ....Change FFT bar and/or trend display scale
```

Popups

```
G=Goal      F=Feedback (game)   D=Display (therapist)   E=Expert      V=Volume
T=Tactile   P=Periph            B=Band                  O=Options     S=Special(DVD,DK,IRIS)
```

Status codes

```
+AThr...Autothreshold is enabled (F11/Ctrl-F11)     +AStg...Auto stage is enabled (re-enable Shift-F4)
Eopn.....Eyes Open (Alt-E)                           Ecls......Eyes closed (Alt-E)
+PB........Playback (replay stored data)             +Gen....Generated data (from internal generator)
-Nuse.....Unused raw data hidden (Alt-F12)           -AInh.....Artifact inhibit disabled (Alt-F8)
-DC.......DC compensation disabled (Alt-F9)          -lpf........Lowpass filter disabled (Alt-F3)
+ARpl...Autoreplay enabled (Replay only)
```

Pressing F1 again brings up this display:

Frequency Adjustments
```
   Ctrl- ↑↓  Increase/Decrease center freq of selected band (or CF of all rewards if no selection)
   Ctrl- →←  Increase/Decrease lower frequency edge of selected band
```
Display Controls
```
   F7............Cycle display of wave/integral values
   F10..........Decrement FFT or long term display scale (Shift-F10 Increments)
   Ctrl-F10...FFT display off/on
   Alt-F10.....Dominant frequency markers off/on
   Shift-F7....Fixed colors off/on
   Ctrl-F3......Change game color Green/Magenta
```
Controls (Miscellaneous)
```
   Alt-F11.............Reset history values (start recomputing averages)
   Ctrl-F5.............Like F5 but turns OFF auto-staging
   Shift-F4............Turn auto-staging back on
   Delete..............Delete topmost alert message
   F6.....................Save 16-second snapshot
   F8.....................Editor open/close
   Shift-F8............Event marker (enter text on bottom line)
   Alt-F7..............Calibration mode on/off (amplifier dependent)
   Alt-F8..............Artifact inhibit off/on
   Alt-F9..............DC compensation off/on
   Alt-F3..............Lowpass filter off/on
   Ctrl-F11...........Auto-autothreshold off/on
   Pause...............(Replay only) Pause replay
   Alt-A/B/C/D...Allow entry of channel A/B/C/D site location
   Ctrl-F2.............State hold off/on
   Alt-E................Eyes open/closed status change
   Spacebar........Change therapist/game display (single monitor only)
```

Another press of F1 removes the help display and returns to the previous display.

If there is some problem with (lack of) graphics memory or if Shift-F1 is pressed, the following textual display may appear (containing the same information).

```
Key NORMAL          |SHIFT          |CTRL                |ALT
F1  Help            |Help           |Help                |Debug display
F2  Cycle reward+   |Cycle reward-  |Toggle state hold   |+CTRL=toggle rwds
F3  Cycle FB kind+  |FB popup menu  |Toggle game color   |Toggle LP filter
F4  Cycle stage     |Autostage+     |Previous session freq|
F5  Begin/pause FB  |               |B/P FB,end AutoStage |
F6  Save printout   |               |Change FB src       |Sig Gen Impulse
F7  show integral   |Fixed clr on/off|Toggle impedance chk|Toggle Cal mode
F8  Editor          |Marker         | *togl saves        |Toggle Arti Inhib
F9  Scale adjust    |Scale adj. trace|*game actv kind thrsh|Toggle DC comp
F10 Decr slow scales|Incr slow scales|Toggle fft disp    |Toggle fft hilite
F11 AutoThresh      |               |Toggle autoAutoThresh|Clear ampl history
F12 Cycle display+  |Cycle display- |Toggle draw spd     |Blank unused traces
up    like PageUp   |               |Incr CF/upper edge  |
down  like PageDown |               |Decr CF/upper edge  |
right/left          |               |Incr/Decr lower edge |
Scroll Lock or spacebar  (Toggle game/therapist display
Pause        Pause/resume replay
Esc          End feedback/dialog
+/-          Incr/Decr Thresh/Scale
Enter        End scale/trace selection
PageUp       Cycle trace selection-
PageDown     Cycle trace selection+
Alt-A/Alt-B/Alt-C/Alt-D  Change sites for channel A/B/C/D
Delete       Delete highest level message
Alt-E        Change eye open/closed status
V Volume, T Tactile, % or G autothreshold %, E Expert settings, B Band controls
S game menu, P Peripheral, F Feedback displays, D Therapist display, O Options
Z zscore controls
Status codes: +PB=playback, +Gen=signal generator, Eopn/Ecls=eyes open/closed
  +Athr = Autothreshold at Rest or Periodic, +AStg = Autostaging enabled
  -DC = DC compensation disabled  -Ainh= Artifact inhibit disabled
  -lpf = low pass filter turned off -Nuse=Hide unused raw data
  +Arpl = AutoReplay enabled
```

The debug screen contains (cryptic) information for use in troubleshooting and further development of EEGer. It is selected/terminated by the Alt-F1 key.

```
                     Debug Display



Dongle = 50024, Build: PB=430b    SB=Dev  Tue Jul 31 20:29:54 2012

ATmode=0 seconds=    96 hfr= 24736 fr= 24739      58.70953
behind 375 nest=0 mn=0 fr 24484 avg=   4001.569008 dt=   3902.819321

dofr=2414 avg dtm=    11.206 o/r=0 last=0 gcalls=2926 avg gtm=    2.119 Key 40070
State 11 Stg#  0 Type  Setup  Seq Stage  Per  0  Auto=0 Filt=-2 notch=2

Proc  24574    3.04  228.01  Read   24739    1.33   59.39
esiPRO 4.3
Comm: conn=2 (-2) kind=1  Slave: used=1 conn=3 (-3)
Mode=1 GR=1 GRto=0 DspCl=0 GO/fl=2/0 Leg=0 (115200) LegSt=0 high=0 num=0 192.168.50.8
Last BC=
Zscore Ins=2 Lic=0 enab=1 err=0 proc=1 ageErr=0 siteErr=0 chgs=0 0 3
Dongle=50024 DV=1 IV=1 GV=0 lstat=0 gvstat=1 pvg=1 gcode=8306 numg=34
Thr (F11)    20.00 ( 13.00)    20.00 (  6.75)    20.00 ( 13.50)
DC compensation levels (0):    -0.02   -0.06
state=0 A200=0 gain=0 mode=0 ver=(null) type=0 olddvr=0
running=0 reading=0 qqty=1 err=0 started=0 power=0
```

Control Keys

Table of keys:

Key	Modifier	Action
F1		Toggles help screen off/on
	Alt	Toggles debug screen on/off
	Shift	Toggles text mode help screen on/off
F2		Cycle reward style to next available reward style **Rwrd** Reward (signal above threshold) **Down** Reward (signal below threshold) **Cntr** Reward (signal close to threshold) **Elev** Reward (signal above threshold, clamp to threshold) **DevU** Reward (deviation above) **DevD** Reward (deviation down) **Band** Reward (signal between limits) Note that switching between up and down rewards alters the target percentages.
	Shift	Cycle reward style to previous available reward style
	Ctrl	Toggle state-hold-required logic which inhibits rewards unless a state is maintained for the specified rate/time.
	Ctrl+Alt	Toggle blocking of rewards for test purposes
F3		Cycle feedback mode to next available mode
	Shift	Raise popup menu of available feedback modes
	Ctrl	Toggle game 'color' between Green, Blue
	Alt	Toggle lowpass filter on/off
F4		Cycle to next stage; turns off autostage logic
	Shift	*Turn autostaging back ON
	Ctrl	Set frequency values to ending values from last run.
F5		Begin/pause feedback
	Ctrl	Begin/pause feedback; turn autostaging OFF
F6		Save 16 second data sample for later printout
	Ctrl	*Change feedback data source: raw, playback, signal generator
	Alt	Signal generator impulse (if signal generator is source)

Key	Modifier	Action
F7		Show integral value instead of signal value on display (3 settings: just waveshape, just integral, both)
	Shift	Toggle fixed colors on/off
	Ctrl	Toggle impedance mode (if hardware-supported and in Pause)
	Alt	Toggle calibration mode (if hardware supported)
F8		Start/terminate editor
	Shift	Insert marker. User has (60 second) option of entering a line of text.
	Ctrl	*toggle saving debug data
	Alt	Toggle artifact inhibit control on/off
F9		Scale adjust. If no streams are selected (highlighted), performs autoscale of all non-lowpass streams. If a stream is selected, toggles between threshold and scale adjustment (using +/-).
	Shift	Autoscales currently selected stream (including raw streams!)
	Ctrl	* toggle game data activity control
	Alt	Toggle DC compensation on/off
F10		Decrease scale used to display FFT data and long term data
	Shift	Increase scale used to display FFT data and long term data
	Ctrl	Toggle FFT display on/off
	Alt	Toggle FFT highlight mode
F11		Autothreshold. If a stream is selected, choose appropriate threshold value for only that stream. If the stream is a lowpass stream, choose threshold based on 1% over threshold as target. If no streams are selected, choose appropriate threshold value for all non-lowpass streams. If the user-specified threshold percentage is zero, no autothreshold action is ever taken on that stream.
	Ctrl	Toggle automatic autothreshold at beginning of each reset period (or specified time frame) on/off.
	Alt	Reset history data (used for display, autogoal, averages)
F12		Cycle display shown. Current displays are : brainwave, long-term, spectral mirror, zscore, realtime summary
	Shift	Cycle display shown in reverse order
	Ctrl	Toggle drawing speed of brainwave screen between fast and

Key	Modifier	Action
		slow (normal).
	Alt	Toggle "hide unused traces" mode. Turns off DISPLAY of unused input/FFT traces to minimize screen confusion.
Up arrow		Just like Page Up
	Ctrl	Increase reward center frequency or inhibit upper edge of selected stream. If no trace is selected, adjust ALL reward streams at the same time.
Down arrow		Just like Page Down
	Ctrl	Decrease reward center frequency or inhibit upper edge of selected stream. If no trace is selected, adjust ALL reward streams at the same time.
Right arrow	Ctrl	Increase frequency of reward lower edge (decreasing width) or inhibit lower edge of selected trace.
Left arrow	Ctrl	Decrease frequency of reward lower edge (increasing width) or inhibit lower edge of selected trace.
Spacebar	(any)	Toggle between Therapist display and game display if NOT entering text for an F8 mark
Scroll Lock	(any)	Toggle between Therapist display and game display
Pause	(any)	PLAYBACK ONLY. Pause/resume playback
Esc	(any)	Exit popup screen if shown (goal/threshold, tactile, volume, help, debug). If not in Pause state, set Pause state. Otherwise, exit realtime processing and return to top menu
+ or =		Increase threshold/scale value on selected stream.
	Shift	Increase threshold/scale value on selected stream by ½ step
-		Decrease threshold/scale value on selected stream.
	Shift	Decrease threshold/scale value on selected stream by ½ step
Enter	(any)	End scale/threshold selection. If a scale value is currently highlighted, Enter just switches to threshold modification mode. If a threshhold is highlighted, deselects trace.
Page Up	(any)	Cycle trace selection upwards
Page Down	(any)	Cycle trace selection downwards
A	Alt	Start/terminate option to change the text for the site that the A channel is connected to. Automatically terminates (without change) after 60 seconds.
B		Popup/remove the Band Control popup (to adjust band reward

Key	Modifier	Action
		mode range).
	Alt	Start/terminate option to change the text for the site that the B channel is connected to. Automatically terminates (without change) after 60 seconds.
C		Continue feedback from a Rest state
	Alt	Start/terminate option to change the text for the site that the C channel is connected to. Automatically terminates (without change) after 60 seconds.
D		Popup/remove Therapist Display Control menu
	Alt	Start/terminate option to change the text for the site that the D channel is connected to. Automatically terminates (without change) after 60 seconds.
P		Popup/remove Peripheral Control menu
	Alt	*Capture a screen dump of the current screen
Delete	(any)	Delete highest priority message from display
% or G		Popup/remove target threshold setting menu
V		Popup/remove volume setting menu
T		Popup/remove tactile feedback controls
S		Popup/remove special game control menu (only for games that have game control menus)
F		Popup/remove Game Feedback Display menu
E		Popup/remove Expert settings menu
	Alt	Change eyes open/closed status

Items in the table marked with an asterisk (*) are provided as debug aids only.

Long-term Display

The long-term display (selected with F12) shown below is a display of signal amplitudes drawn at a one-second interval during the session. The width of the display is taken from the (user-preference-specified) maximum session time. The vertical scale of the display is set using F10/Shift-F10 or the Therapist Display Control popup menu. The (faint) vertical green lines mark beginning/ending of periods.
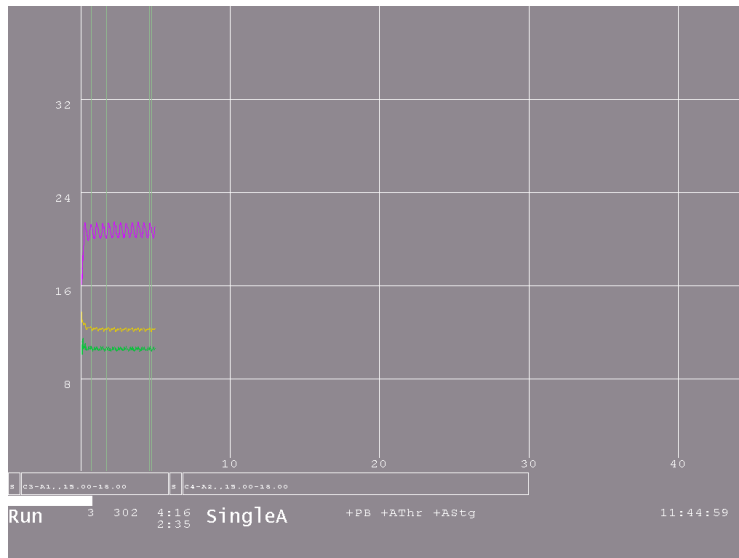
If peripheral data is displayed, it overlays the screen with its own scale.
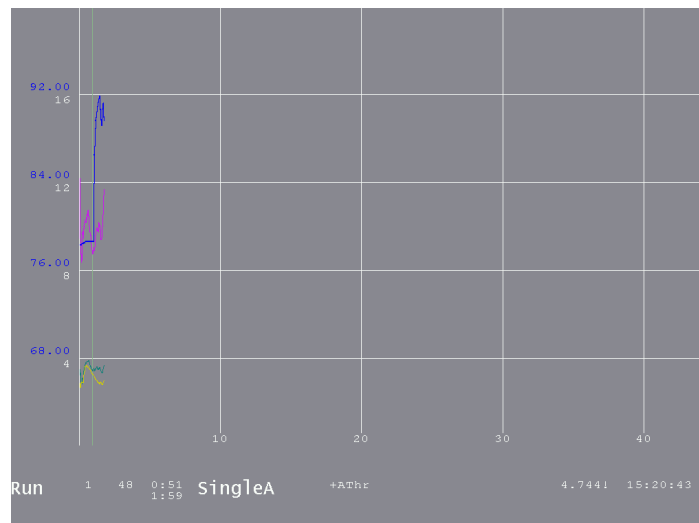
Spectral Mirror Display

The Spectral Mirror display shown below displays the same spectral data as the FFT bars but in a different format. The "D" Therapist Display Control popup allows control over the scale for this display. The A channel is on the left and B channel on the right when A&B is selected as the display mode. For 4-channel modes, C&D can be selected where C is on the left (and either C or D can be also selected). Otherwise, a single channel is mirrored on left and right.
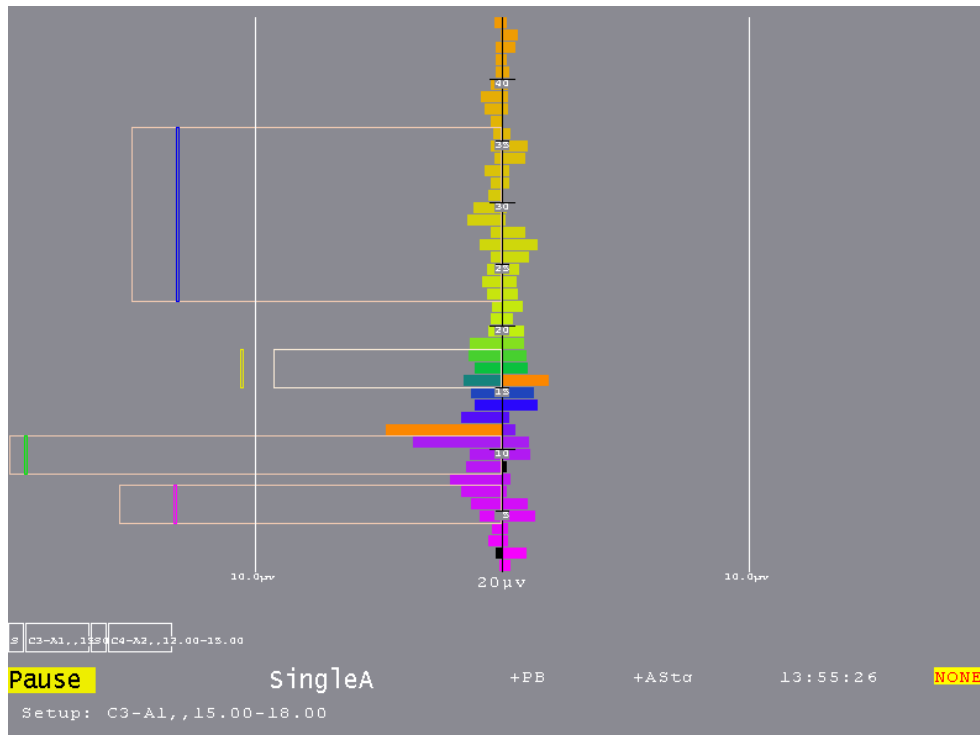
Notice that the filter bands are shown with a threshold value as the edge of the outline and the current average amplitude is shown as a vertical colored bar at the appropriate position. The orange bars are the dominant frequency markers.

Zscore Display

The zscore display is only available if the ANI zscore module is installed and operating. Based on user selections during session planning or by realtime selections (shown below), the display shows various values in one of three colors and with two intensities. The display is organized by type of computation and by frequency band. Shown below is a 2-channel representation. Note: the displays are not of real data! The dim colors are values NOT being used for feedback while the bright colors are part of the reward/feedback decisions. A green color means the value is below the user-set "good" threshold, red means above the "bad" threshold, and yellow means between the two. Also, there are TWO displays of each value. The left-hand display of each value-pair is a 30-second moving average of the value while the right-hand value-pair is the 0.5 second moving average. These times are part of the time configuration setup.

The conditions for reward/feedback can be set during realtime using the Z popup display as shown below.
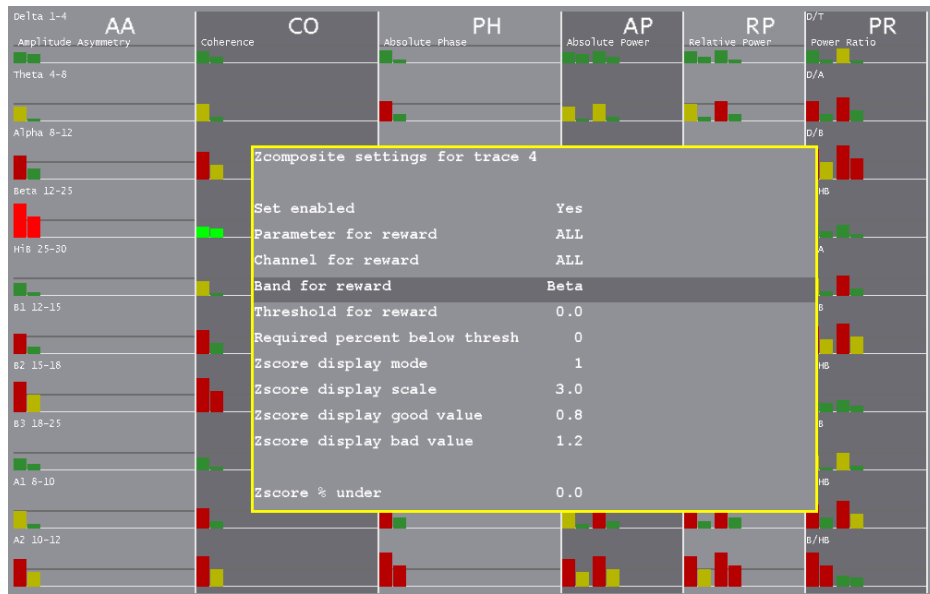
When operating in a 4-channel mode, there is much more data to display as represented below:
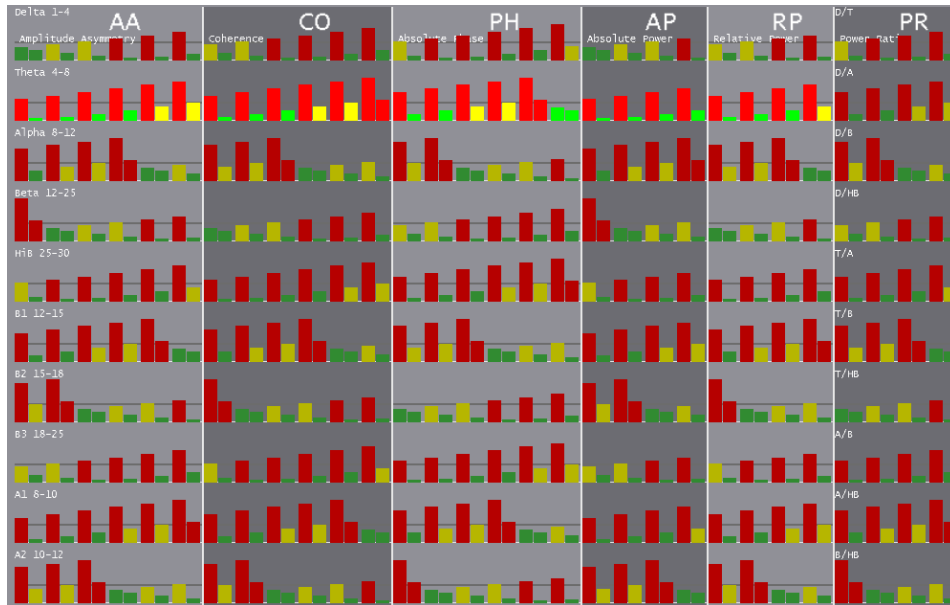
Realtime Summary Display

The realtime summary display shows significant values for the latest 16 periods.

During a period, the (latest) current values are shown/updated. The end-of-period values are the same as those shown on the review data screens.

Of course, there will be more data than can be shown on one screen. PageUp/PageDown control display of additional trace data.

The **Esc** key closes any popup screens and continues processing. If no popups, it sets **Pause** mode. If **Pause** mode is set, it terminates realtime processing and returns to the top menu.

Review

The **Review** button brings up the session review screens for post-session analysis. Most of the option selections are "sticky" - that is, they persist across all clients and review sessions until changed. A typical screen is shown. The top portion has a number of different display formats (graph, summary, bar, and details). Shown is the **Graph** format with a single session's data shown in graphical format.
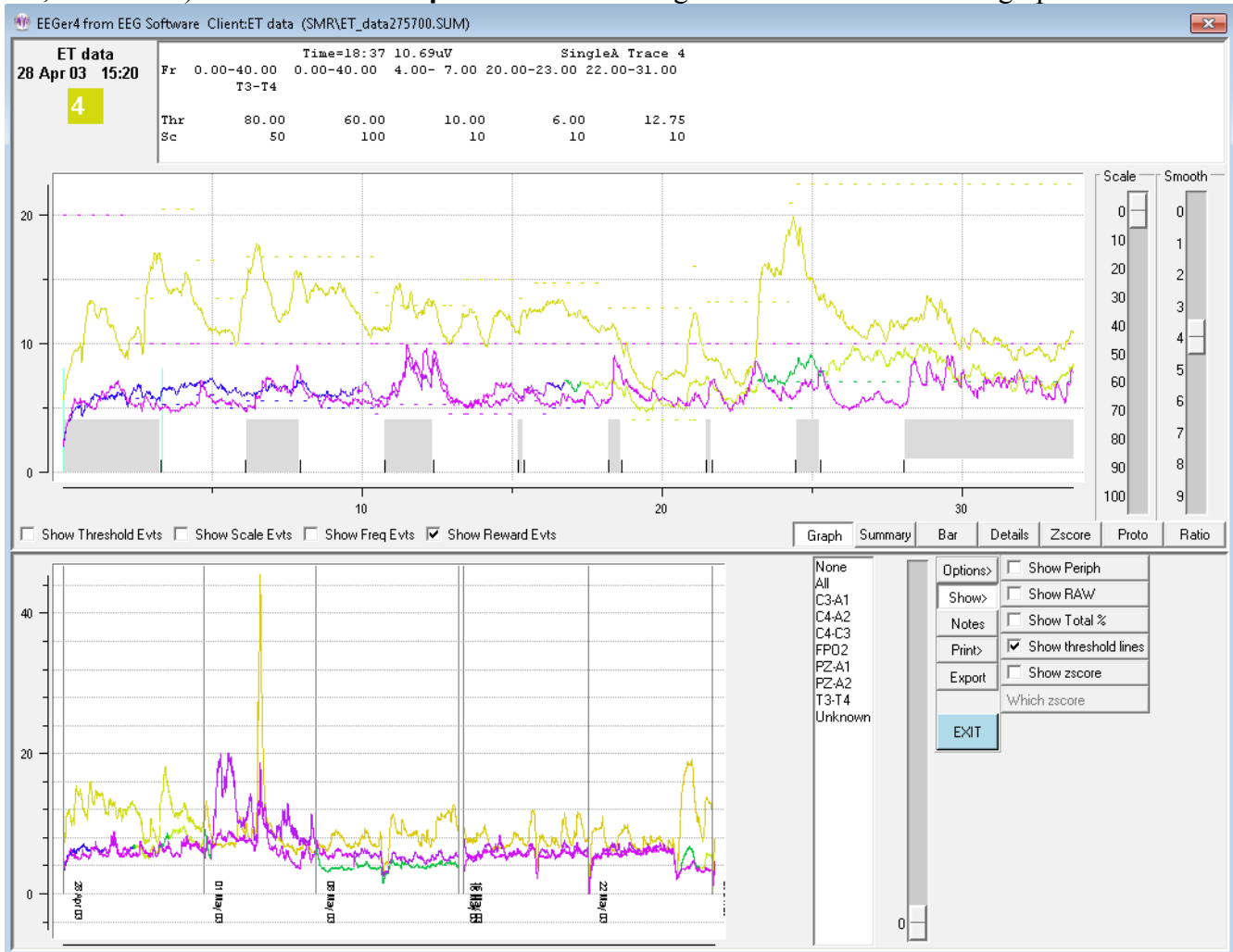
To the right of the graph are two sliders for controlling the scale and smoothing of the graphical data. Just below the graph are some checkboxes and buttons controlling the display at the top of this screen.

The graph shows each stream plotted as amplitude versus time (in minutes). The colors are the frequency-specific colors used throughout EEGer unless changed by a user option (discussed below). The short vertical black lines mark the beginning/ending of periods. Non-feedback times (paused or resting) are shown by the gray shading between period lines. Short red lines mark the time-location of significant events such as frequency changes, user F8 marks, etc.

 4.3.0

Threshold change events, scale change events, and reward events can optionally be shown if the respective checkboxes are checked. These checkboxes also control whether threshold/scale changes appear in the details data. Whenever the mouse cursor is moved over the top graph area, the text display at the top represents the state at that (horizontal) time.

The top scale slider allows selection of a voltage scale for the session graph (or 0 for autoscaling). The smoothing slider allows control of data smoothing for graphical display. The value 4 represents 16-second smoothing and the value 5 represents 32-second smoothing. The value 0 is no smoothing.

The bottom graph is a trend graph of sessions. The colors of the lines are the frequency-specific colors used throughout EEGer. To the right of the trend graph is a list of all the sites used in the displayed sessions. To the right of that list is a scale slider allowing selection of a voltage scale for the trend graph (or 0 for autoscaling). At the right edge are some buttons and checkboxes allowing various options.

The **options** available are shown here: The **Show** choices available are:

Options>	☐ Recompute avg
Show>	☑ Show CV
Notes	☐ Fixed colors
Print>	☐ Tabular
Export	☑ Trend Graph
	☐ Last 25
EXIT	☐ Show raw sumry data
	Proto:Date order

Options>	☐ Show Periph
Show>	☐ Show RAW
Notes	☐ Show Total %
Print>	☑ Show threshold lines
Export	☐ Show zscore
	Which zscore
EXIT	

If there is zscore data embedded in the data file, the additional button choices for display after clicking on **Which zscore** are:

The **Notes** button brings up the embedded editor with notes for the current client. **F8** can also be used to start/end the editor function. The **Print** button options will be either

   or

By default, the raw data streams are not shown. Clicking on the **Show Raw** checkbox toggles display of the raw data streams. On the top graph below , raw data is shown with a black color. On the bottom graph, raw data is shown with a color representing the lowpass filter width.

In some cases, it is hard to see/print the colors or to determine which stream is which if the frequencies (colors) are similar. The **Fixed colors** checkbox toggles between frequency-specific colors and a fixed set of colors that is independent of frequency.

     4.3.0
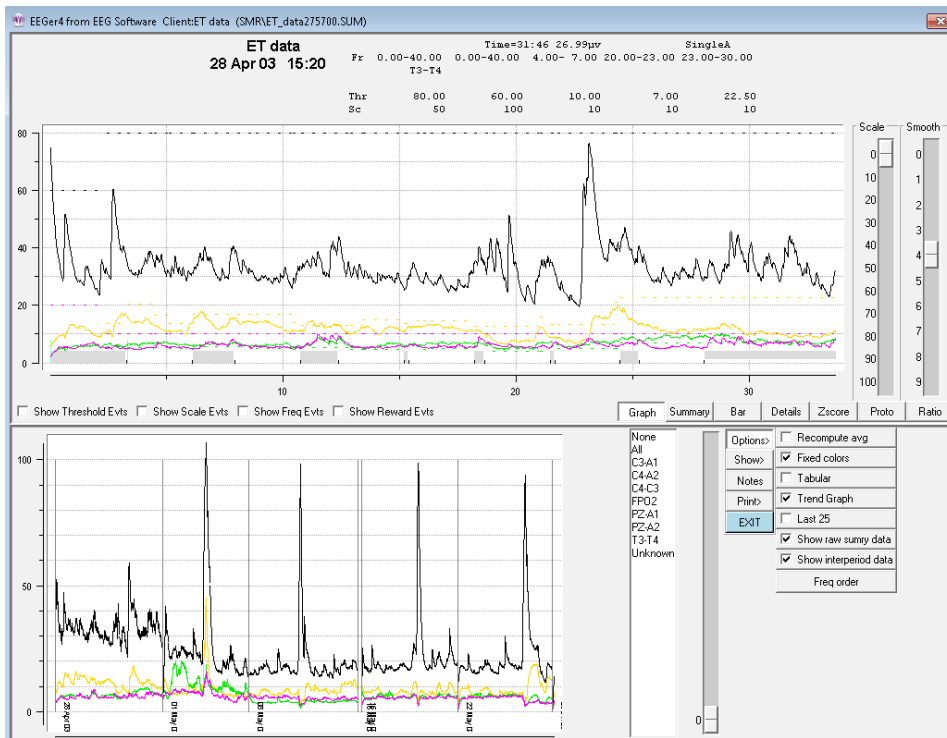
The screen below shows the summary data (text) for the currently-selected session. Clicking on one of the sites listed in the site list produces a gray shading (in the trend graph)for the periods where the selected site was used.
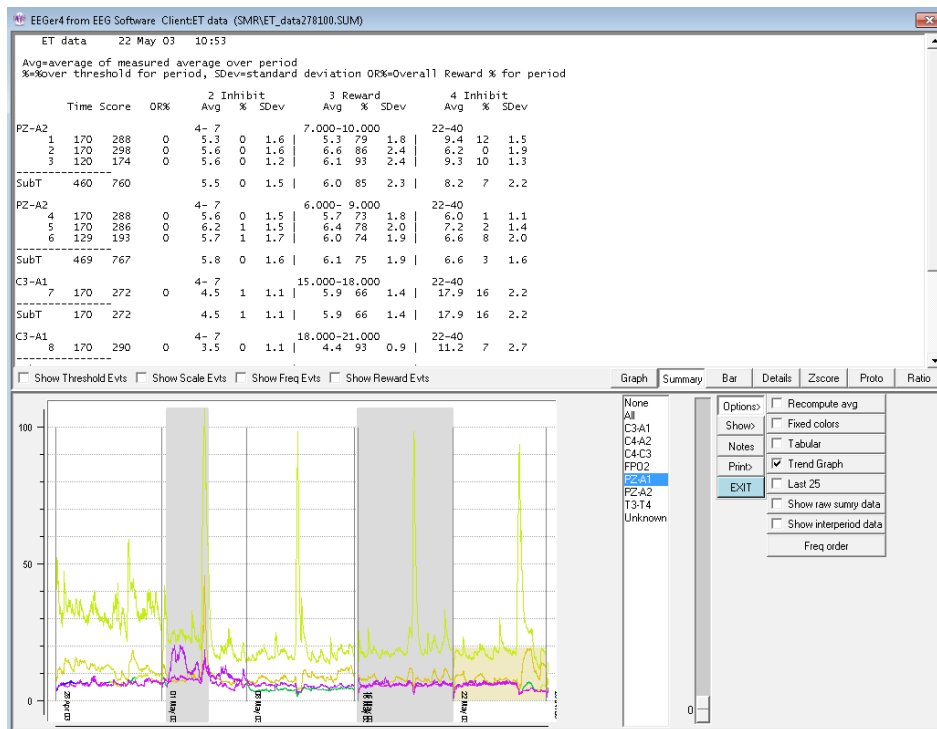
The average values shown above are the average values at the end of the period. Checking the "Recompute avg" checkbox produces the same display except that the average values are recomputed to be the average value across the entire period rather than just the ending values.
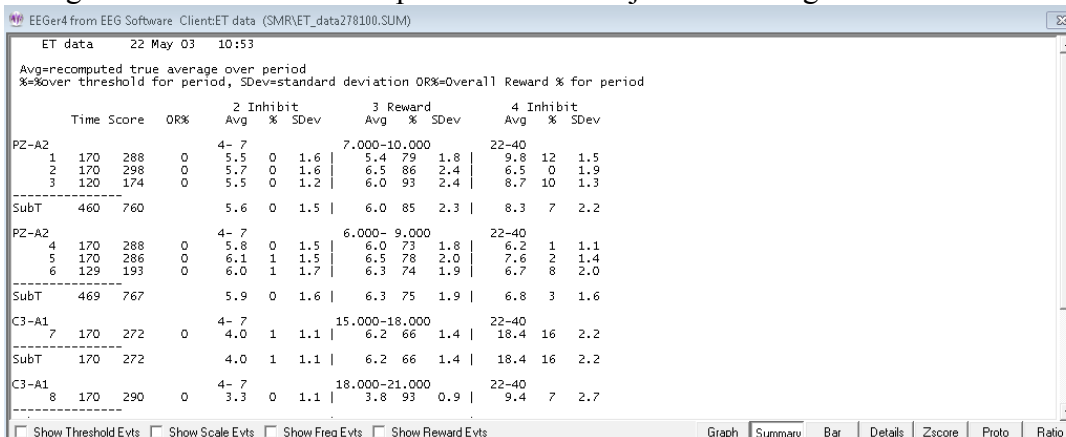
Above is the same screen with the raw data option checked (to show channels A and B) and with the interperiod data shown. The interperiod data is the average value and standard deviation of the time BETWEEN feedback periods. Note that some of that cannot be seen on the screen until scrolled down. All the data will be printed or saved at one time.

There is also an option to display the Coefficent of Variation (CV) for the summary data. This value is computed and displayed as a percentage (CV * 100).
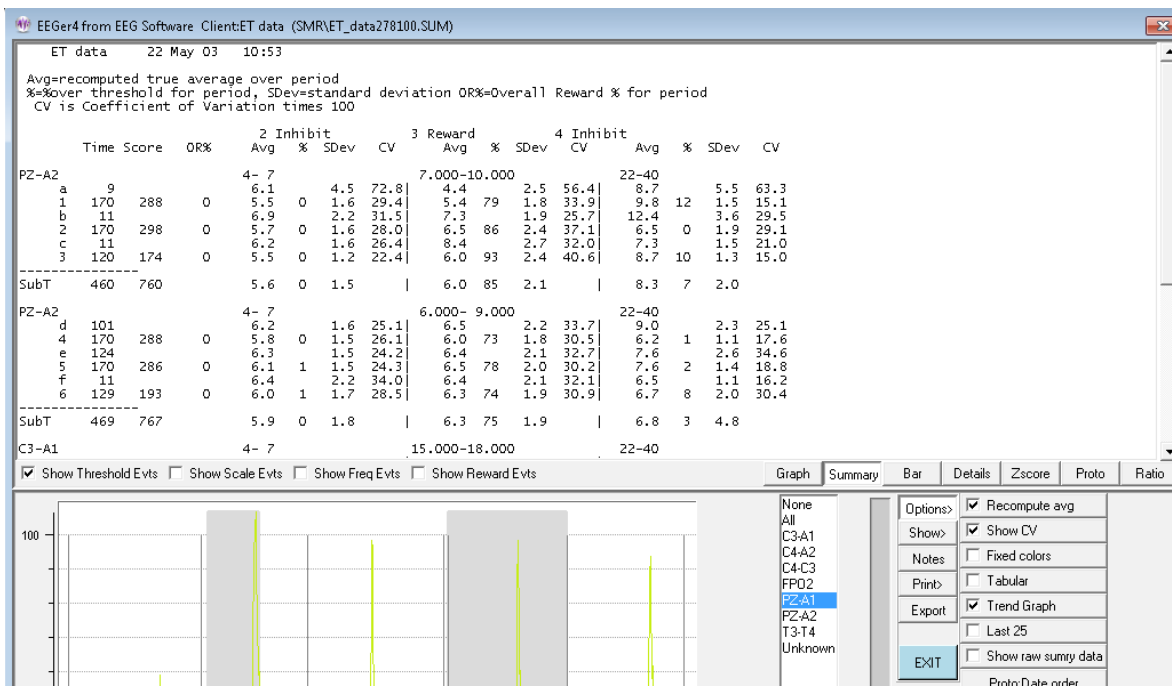
The **Bar** screen shows a barchart representation of the time (red bars) and scores (frequency specific color at end of period) for the selected session's periods.
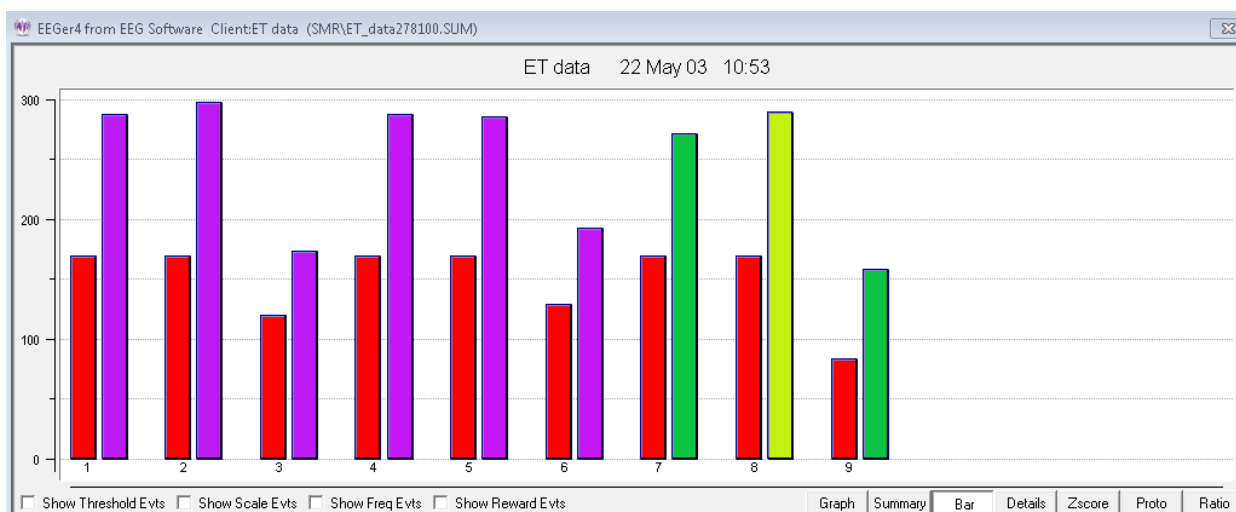
The following image shows the **Details** screen. This is a chronological list of significant events during the selected session.

Note that the threshold and scale checkboxes were selected so that threshold and scale adjustments were reported. The time of the threshold/scale adjustment is the time at the beginning of the adjustment and the value at the end of the adjustment (10 seconds without change).

For recently acquired sessions, the details screen also displays the amplifier type used, the software version used, the game used, and the layout used for the session.

If there are many sessions, the **Tabular** checkbox allows display of all the sessions for the current client. Double-clicking on a line causes that session to be displayed in the top area.
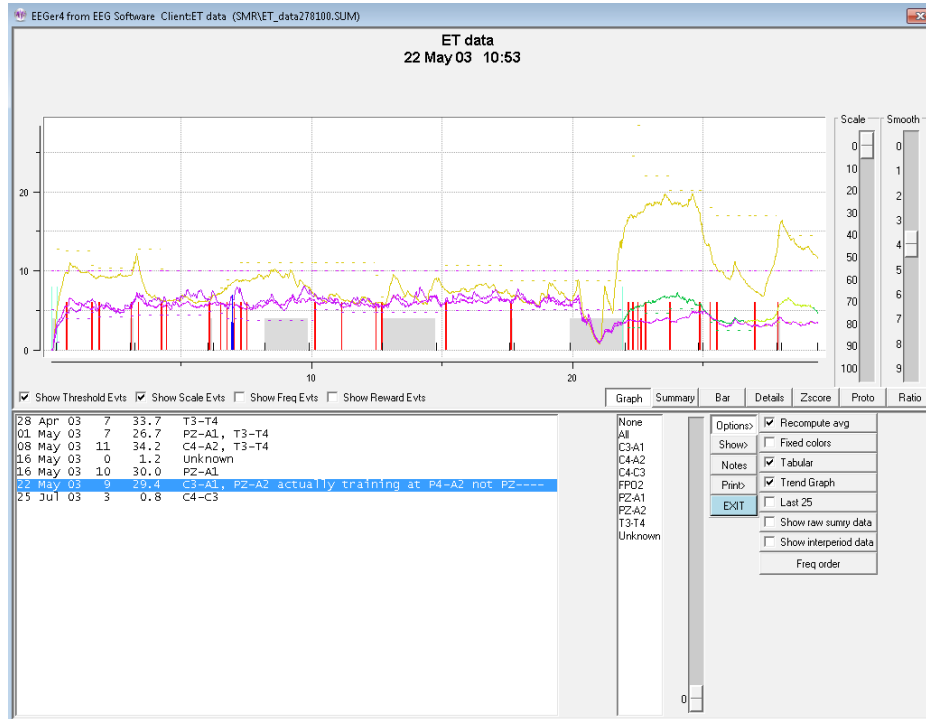
The **Trend** checkbutton controls whether or not the trend graph is shown on the bottom graph.
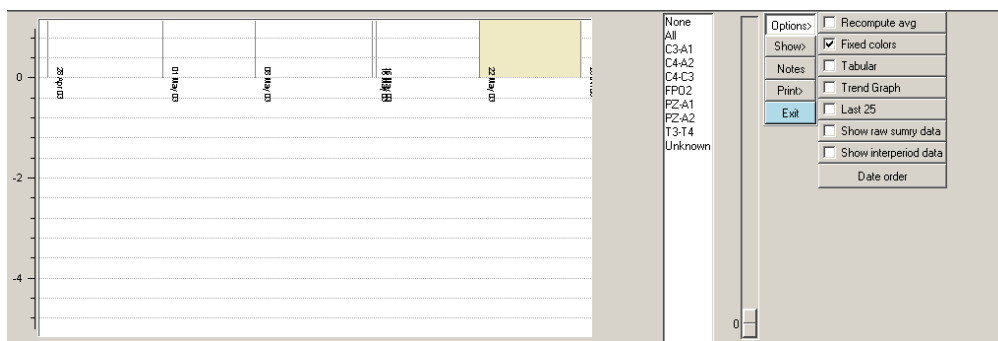
If the **TOTAL %** checkbox is selected, the total reward percentage will be shown on the graph as a bold green line.

If peripheral data exists in the summary file, the **Show Periph** button controls the display of the data. The scale and graph line are drawn in a forest green color.
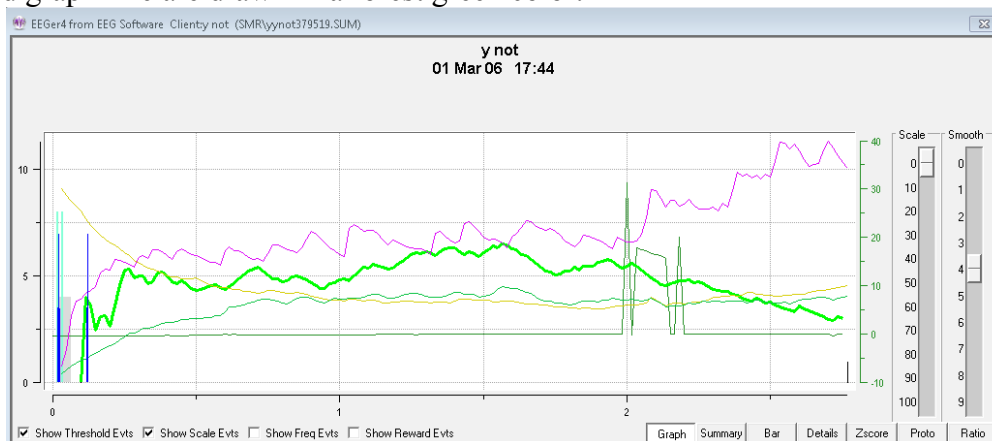
The **zscore** button shows one or more measures as selected by the "**which zscore**" buttons. The green buttons determine which zscore measures are selected. The blue buttons determine which frequency bands are selected. The beige buttons determine which channel or channels of data are selected.

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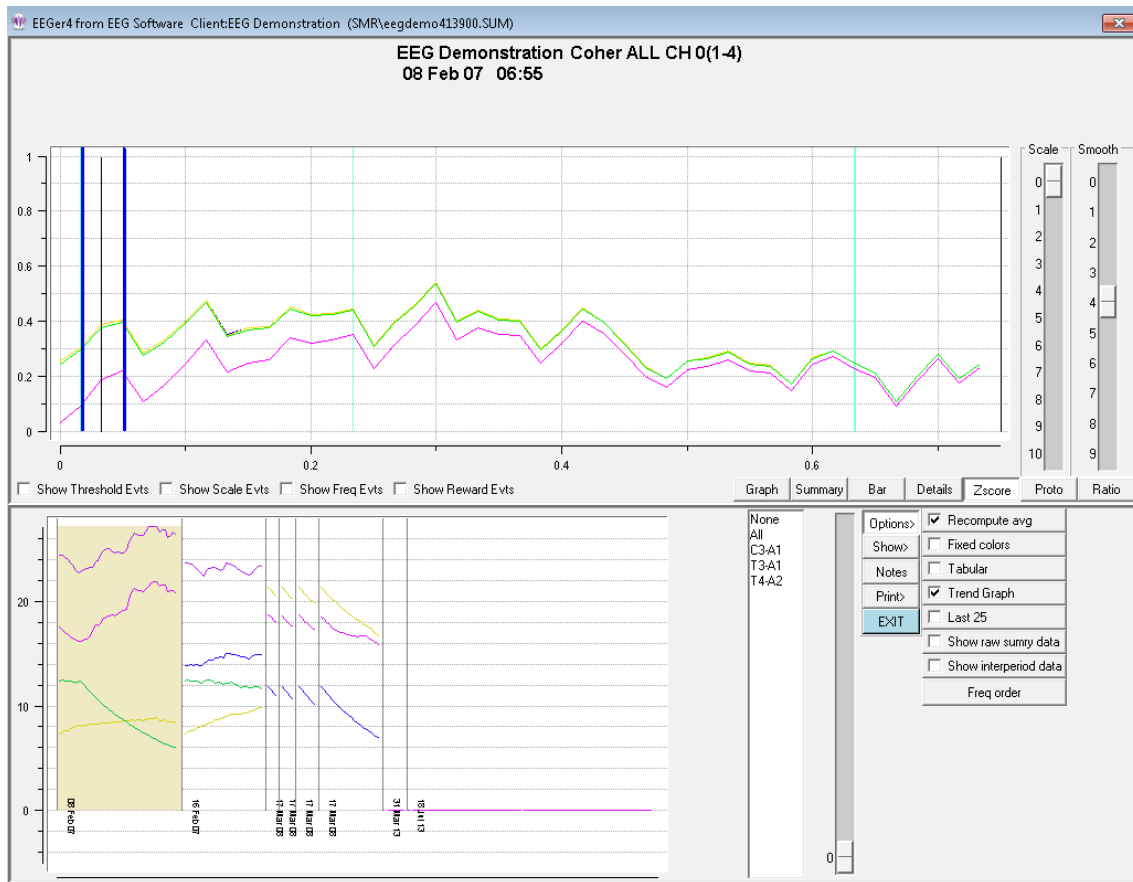
The displayed measure is always shown in the title of the graph, however, when too many multiple options are selected, only the last in sequence of values may be the "title". Above is shown zscore coherence in the 1-4 Hz band.

Below is shown all measures in the 4-8 Hz band.
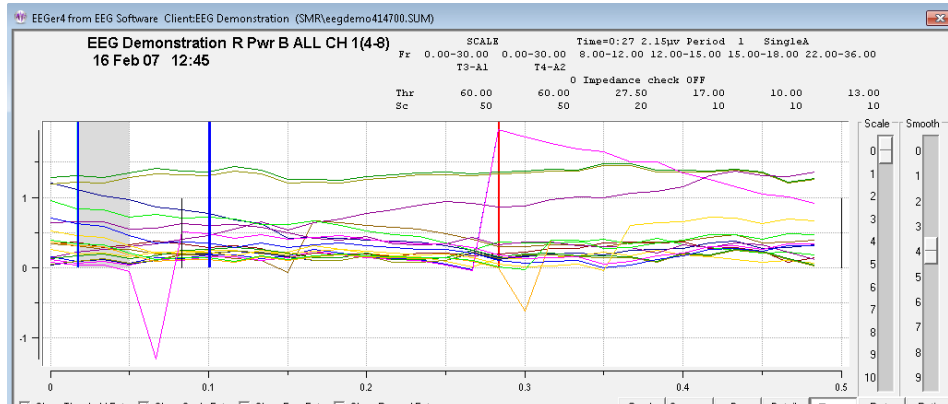
Below is a single zscore measure (coherence) for all bands using channels A and B as input.
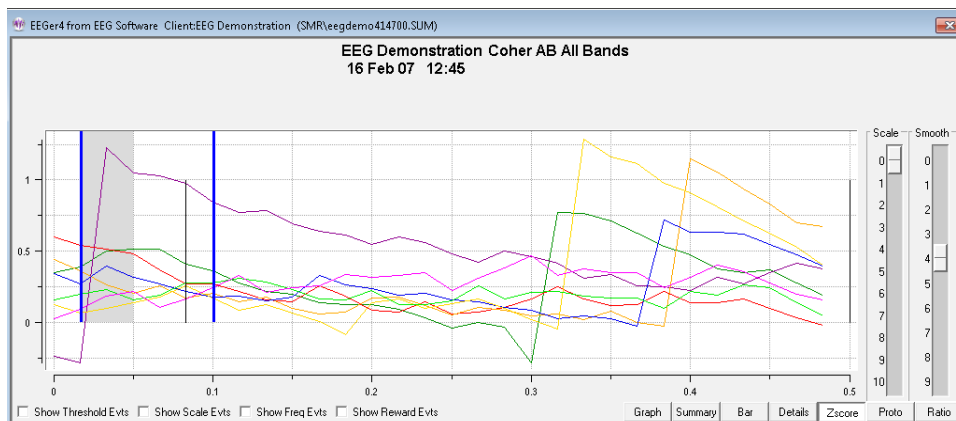
For completeness, you can also show all measures for all bands. It is pretty to look at but not of much use.
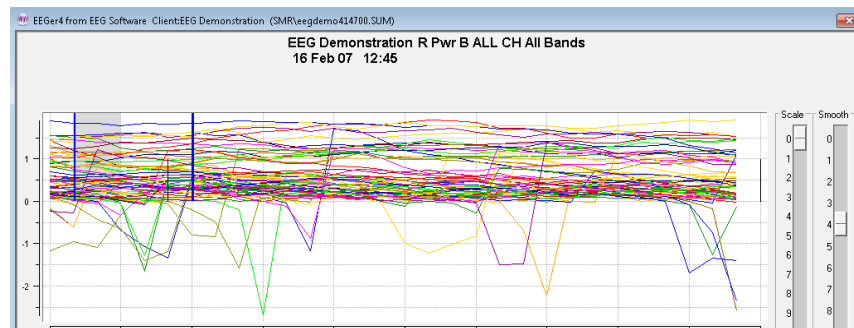
The **Proto** screen shows the (textual) values of the selected sessions (all or last 25) for the current client. This data is sorted by session date (Date order), frequency settings (Freq order), or reward frequency (Reward Freq order) as selected by the Option selection. Each group is comprised of like layouts, sites, feedback modes, and eyes open/closed status. Each line has the date of the session, the length (in minutes), and the frequency range/ending value/percent change for each band. The percent value will be 0 or 100 if the beginning value was zero (based on the ending value...).
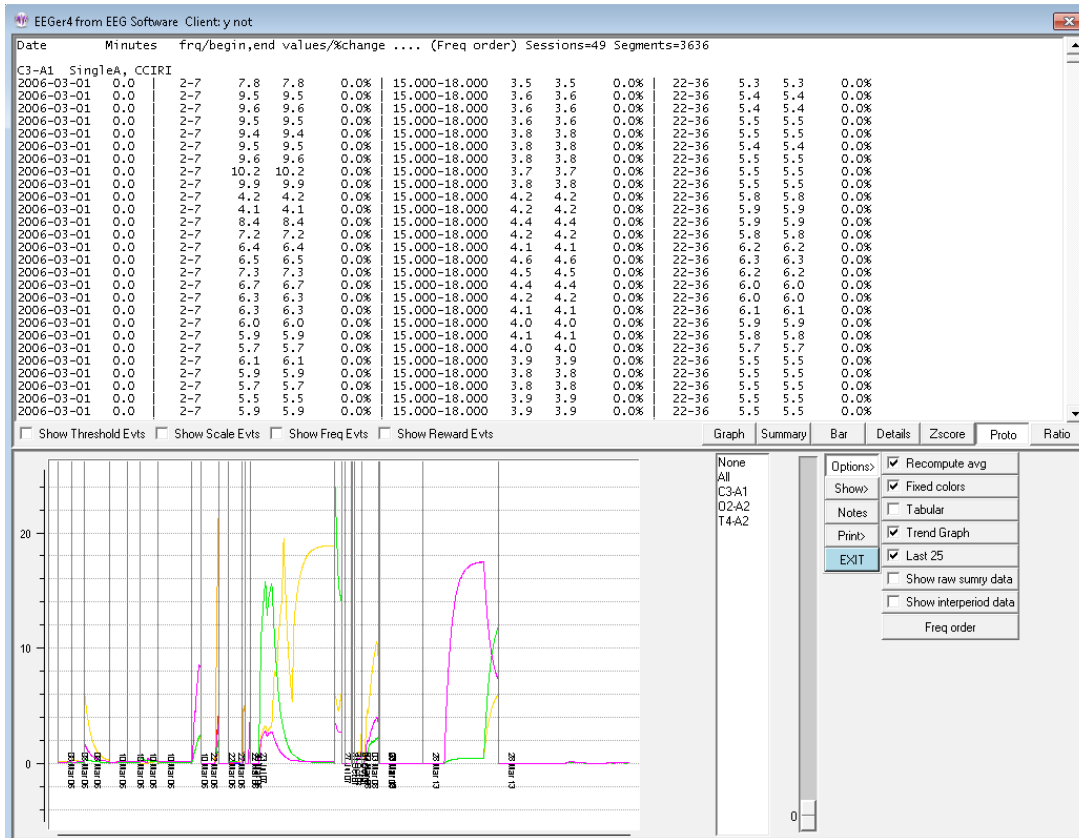
Order selection options are:

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The **Ratio** selection computes various ratios between certain frequency bands. This data is recomputed from the raw data samples of the session so that the frequency bands need not match those used for feedback, inhibit, etc.
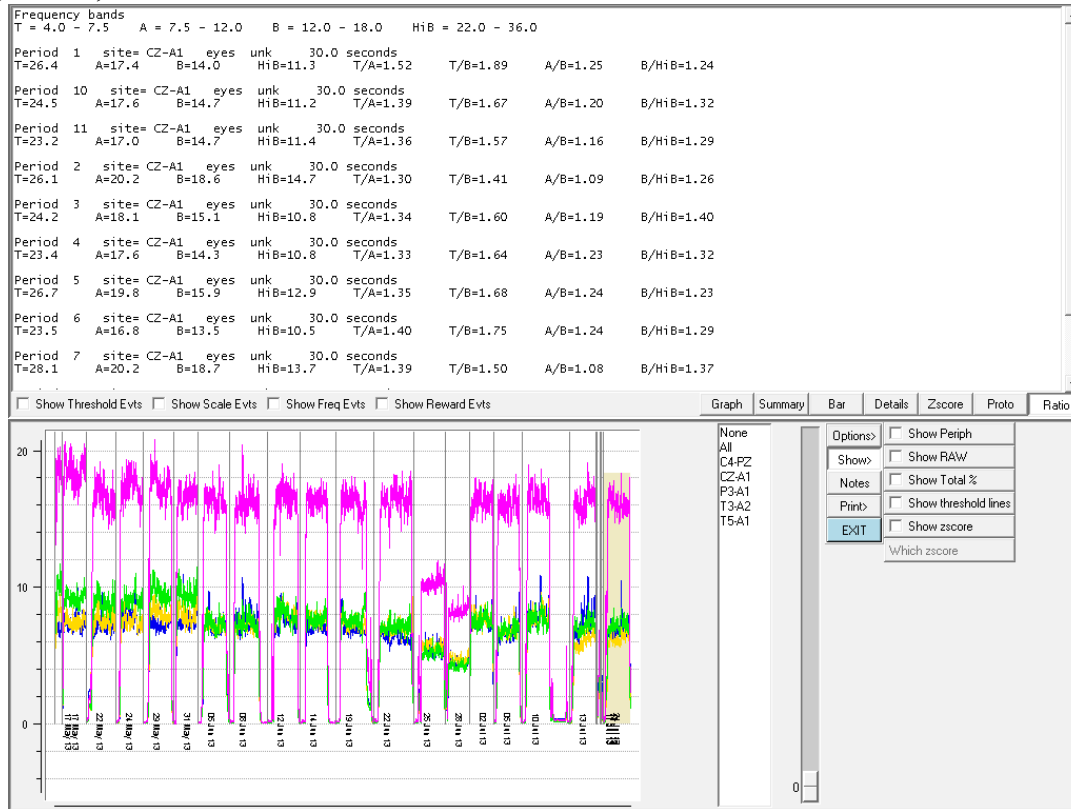
The top part of the window shows the frequencies associated with the letter legends (like T). Below is a listing, by period, of the (moving-average) amplitudes (at the end of the period) for each frequency band and various ratios of those amplitudes.

The values shown are the default values. The method of customizing the frequency bands and ratios is described under the Options menu description.

The **Save Summary** Print button causes two files to be created with the graph display in one and the summary data in the second for later printing (using the Print menu option). If the button says **Print Summary**, the two printouts will be directed immediately to the default Windows printer as two pages.   If the option for a single page is select in the Preferences configuration menu, both printouts will be combined into a single file/printout page. Selection of the button actions is made in the **Configuration**->**Preferences** tab

The **Save Details** Print button causes a file to be created with the currently-selected options (threshold, scale actions) for later printing. If the button says **Print Details**, the printout will be directed immediately to the default Windows printer.

The **Save Trend** Print button causes a file to be created with the trend graph display. If the button says **Print Trend**, the trend graph will be directed immediately to the default Windows printer.

The **Save Protocol** print button causes a file to be created with the protocol summary data (as currently ordered). If the button says **Print Protocol**, the printout will be directed immediately to the default Windows printer. Please note that the line wrapping can make the output hard to interpret. It may be better to use the **Save Protocol** mode and view the print file stored in the Print folder in some external program.

The **Save Ratio** Print button causes a (text) file to be created with the ratio values. If the button says **Print Ratio**, the ratio values will be directed immediately to the default Windows printer.

The Export button allows creation of a zip file containing selected session data. Clicking on the Export button brings up a screen similar to this:
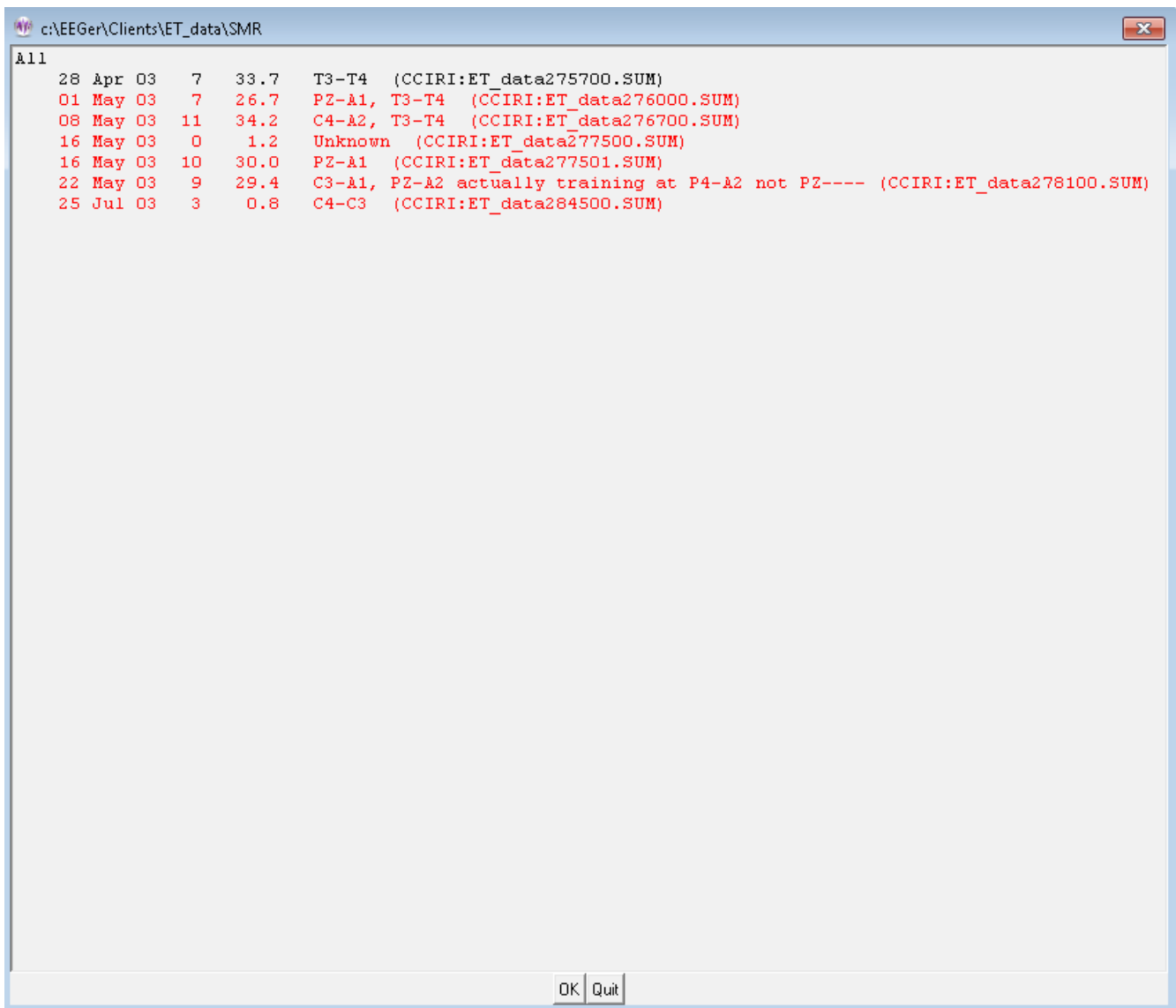
This screen allows selection of zero or sessions to be exported. A trend report/graph is always exported. Only the sessions highlighted in red have reports exported. Clicking on the Quit button brings up an informational message:
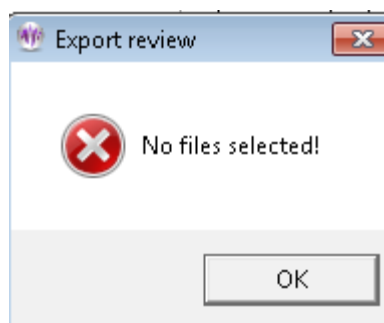
If the OK button is selected, the review process creates a trend output followed by output of the top graphs and the summary data text files to the created zip file. When completed, the following message is displayed:
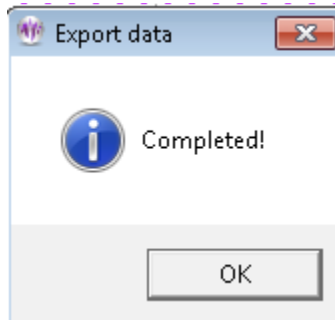
The file is created in the Exports folder and named after the client codename along with a Z and the date. For example, here is the contents of the ET_dataZ2014-03-20.zip file:
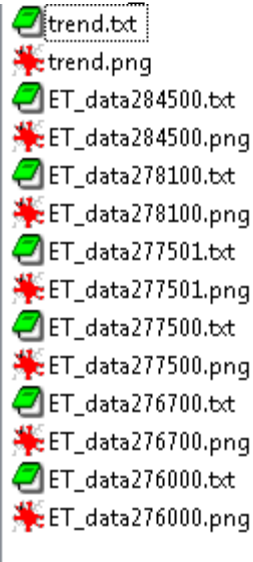
The **Exit** button returns to the top menu.

Client Software

EEGer Game Set

The EEGer Game Set (EGS) comprises a set of Client-computer feedback and display programs which support the Therapist software. The same games are used on single-computer systems.

The feedback programs are comprised of ten displays:
1. Boxlights
2. Highway
3. Island
4. Fixed-dot mazes
5. Variable-dot mazes
6. Jumpbox
7. Theta-down highway
8. 4mation
9. Spectral Mirror
10. Long-Term Display

The support programs are comprised of several displays:
1. Alpha-Theta display/sound generation
2. Main menu

A special directory exists on the computer (**C:\EEGer\PRINT**) which receives screen image files if requested by pressing the appropriate key (Alt-P) on the Client computer. The (color .BMP file) contents of this directory can be printed using any applicable Windows print program when biofeedback programs are not running.

In addition to any key combinations listed below, all the feedback programs respond to the following keys:

Esc exits the program.

ALT-P saves a copy of the current screen to the PRINT directory. If the score screen is displayed (see below), it is saved with a white background for more efficient printing.

Score Screen

Most of the Beta/SMR games are divided into **training** periods generally three minutes long. After 170 seconds (except for Mazes), biofeedback pauses and a bar chart is shown on the client station screen showing the client's performance for each past period. The client is allowed 10 seconds to wiggle, scratch, rest, and assess his performance in the session so far. These times are tailorable for each game.

At the end of each period a scoring screen comes up in the form of a bar graph as pictured here. A red bar is displayed for elapsed time and a blue (SMR) or green (Beta) bar is displayed for the points scored.
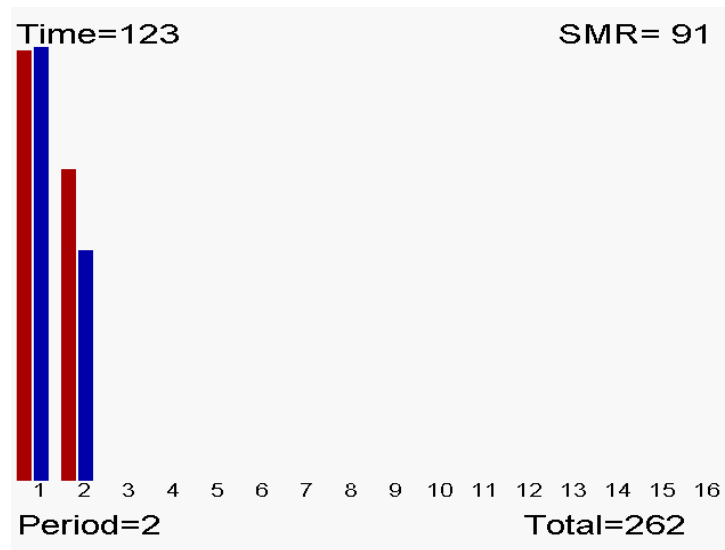
Beta/SMR Protocol Displays

In addition to any key combinations listed below, all the feedback programs respond to the following keys:

Esc   exits the program

ALT-P   saves a copy of the current screen to the PRINT directory. If the score screen is displayed (see below), it is saved with a white background for more efficient printing.

Boxlights

Classic   Modern
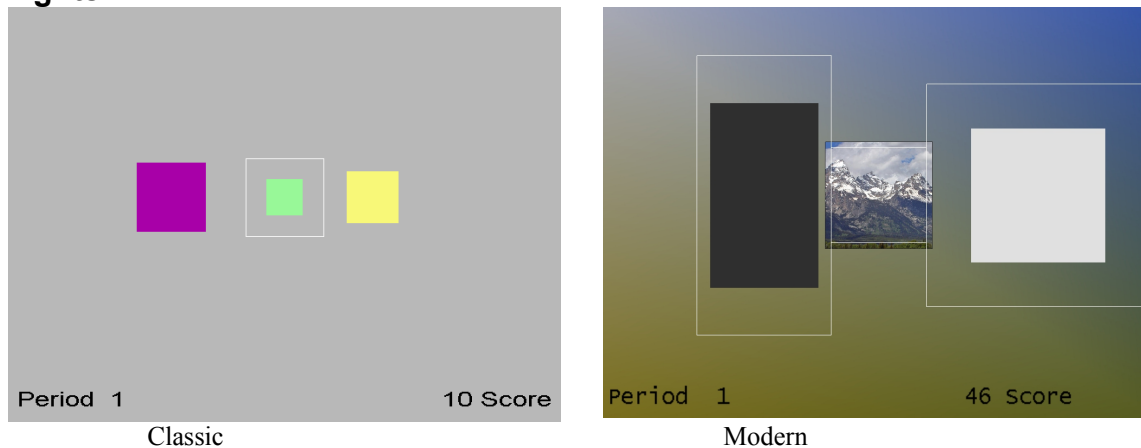
In the Boxlights game screen, pictured here, the left box represents the amplitude of EEG activity within the **low frequency inhibit band**; the right box represents the amplitude of the **high frequency inhibit band** activity. The middle box represents the medium frequency (reward band) amplitude. These boxes correspond directly to the bottom three traces on the therapist's station in 5-trace layouts. A white outline square appears for the reward box. This represents the goal for the band. If the client makes the middle colored box bigger than the white square and keeps it bigger for half a second, while keeping the two outer boxes from touching the white square, they are rewarded with a beep and a score. For 6-trace-with-inhibit layouts, the left box is a rectangle with the horizontal width proportional to the topmost inhibit trace amplitude and the vertical height proportional to the next inhibit trace amplitude. The box edges are matched up with

The colors of the boxes in classic mode are consistent in this and several other games. The low frequency box at the left is magenta; the high frequency box at the right is yellow, and the center box is blue for SMR training and green for beta training (as controlled by the therapist). In the modern mode, the box colors are fixed and the entire background is set based on the current image being displayed in the center box. The image changes at the end of each period.

The goals for the low and high frequency inhibit bands are represented by their distances from the white square. If one of those boxes grows big enough to overlap the white square, rewards are not given. Thus the objective for the client is to make the middle box big and the outer boxes small - that is, to increase amplitude in the selected intermediate frequency (Alpha, SMR, Beta) and reduce amplitude in the outlying frequencies.

The therapist can adjust the relative sizes of the boxes in the Boxlights game by adjusting the scales of the three traces on the therapist station screen.   Classic/modern is selected in the game tailoring options.

Highway

Classic   Modern
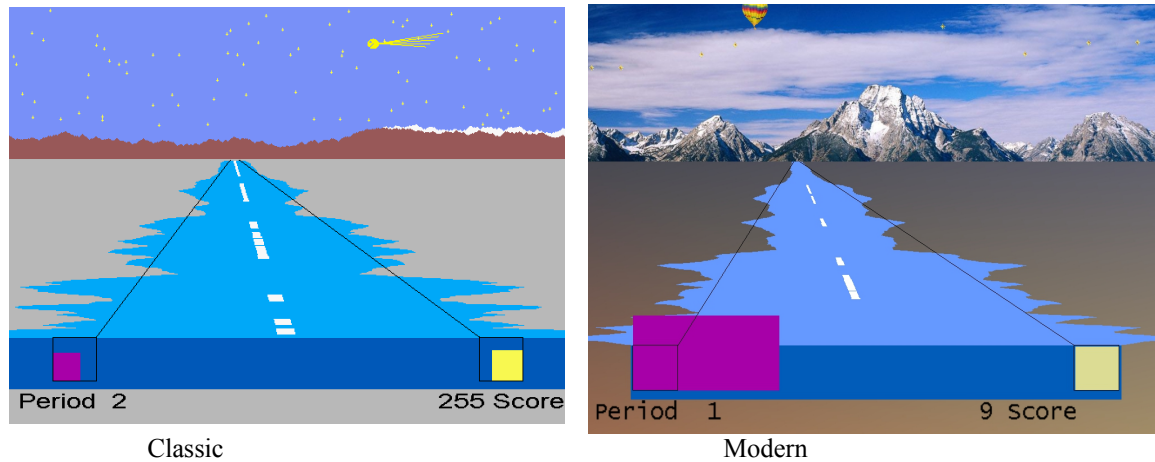
The Highway game simulates the view from the back window of a car driving down a highway, apparently traveling away from a snow-capped mountain range. The width of the blue or green bar at the bottom of the screen represents the amplitude of the **reward frequency band** at the moment, just as the center box in Boxlights. Boxes to the left and right represent the amplitudes of the low and high frequency inhibit bands. The near end of the highway varies in width with the central bar (the sides of the Highway are actually a profile of the EEG), but recedes in the distance showing the amplitude over the last seconds. To add interest, and also to give the client a sense of his scoring performance over previous time, a white stripe appears on the center of the highway each time he scores, accompanying the beep and the count. To extend that sense of performance, a star appears in the sky with each beep and stays there for the duration of the three-minute training period. A special visual reward occurs when the score reaches 500 or 1000 or 1500 points.   Similar to Boxlights, the box sizes are a function of amplitudes driven by which layout is used. In this case, the left half of the highway corresponds to the uppermost reward trace and the right side to the lowermost reward trace.

The therapist **K** key generates a comet (classic) or balloon (modern) reward display.

Classic/modern is selected in the tailoring options.

                           4.3.0

Island

Classic   Modern
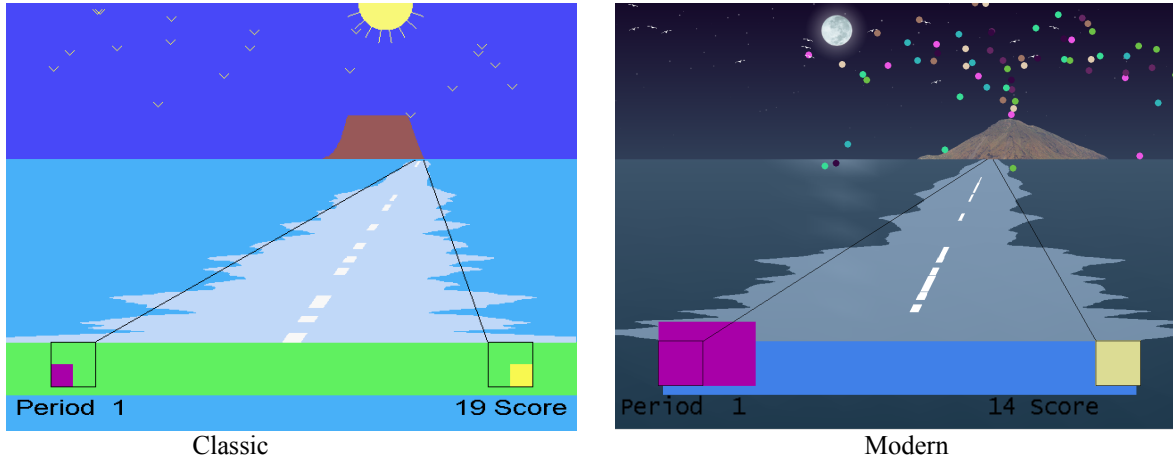
The Island game is a variation on the Highway game except that the mountain range is replaced by a volcanic island, the stars by birds, and it is the wake of a boat (again defined by the EEG) that disappears in the distance. All reward logic is exactly the same as Highway.

The therapist **K** key generates a volcano eruption reward display.

Classic/modern is selected in the tailoring options.

Theta-down Highway

Theta-down Highway looks like Highway, but the green or blue bar is totally determined by the inhibit signals with no input from the reward band. The purple box and green/blue bar are tightly coupled. The reward bar is the inverse of the inhibit signals (mostly low frequency). Some special setups are required for this game.   The reward threshold (beta or SMR) should be set at about 1 microvolt so that you are over threshold 100% of the time (so feedback is not dependent on it). Set the high frequency inhibit as usual. If the client tenses up, he should be over threshold. The low frequency (theta) inhibit is set so that the client is above threshold about 50%, so beeping will occur about half the time. Either a standard filter or the special filters (2-13 Hz inhibit) can be used. The percentages are set a little different typically, because rather than the wide bar meaning beta or SMR, the wide band is the inverse of theta. That is, if you watch the purple box (theta) it will be identical to the wide band painting highway, except inverse. When theta goes down, the purple box gets smaller, and the wide bar gets wider. The theory is that by positively reinforcing decreased amplitude in the theta band in both the purple and the wide bar – the client gets a possible reward for inhibiting theta.

The therapist **K** key generates a reward display

Mazes – Fixed Dots
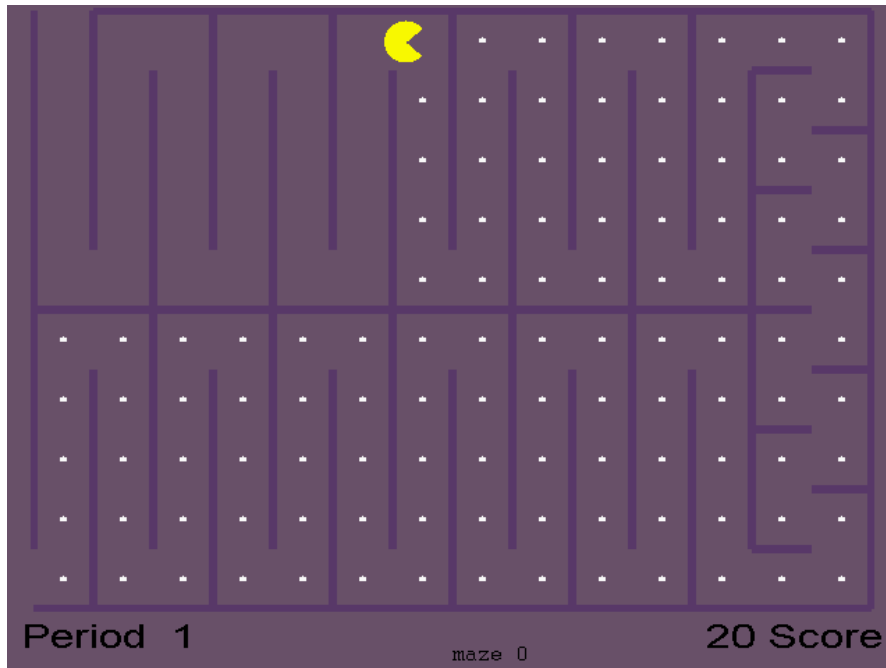
In the Mazes game, an icon moves through a maze eating dots. The speed and color of the icon provide biofeedback information to the client about his brain's accomplishment of goals. Amplitude in the reward frequency determines the color and speed of the icon; it becomes darker and slower when the Beta or other reward frequency is too low in amplitude; as the amplitude in the reward frequency band grows, the icon becomes brighter and faster. When the amplitude equals or exceeds the goal, the icon is at it's brightest and fastest and scores are heard and seen. If amplitude in the low or high frequency inhibit band exceeds its goal, then the icon stops moving and turns black. When the icon reaches the end of the maze, there is a brief rest for the client and a bar graph of his/her progress is shown. Then a new maze starts. There are thirty different mazes; if more than thirty training periods are given, the early mazes are repeated. Scale selection has no effect visually on the Mazes game, but (of course) affects goal and threshold settings.

Mazes is self-timing. A training period ends not on a fixed schedule but when all the dots have been eaten or after 200 seconds, whichever comes first. Therefore the red time bars on the score bar chart will vary in height.

Mazes – Variable Dots
This game is a variation of Mazes in which the size of the dots varies (getting larger) with the amplitude of the low frequency inhibit. In some cases, the larger dot sizes are rewarding (instead of inhibiting) and the fixed-dot version should be used instead.

Jumpbox

Classic   Modern
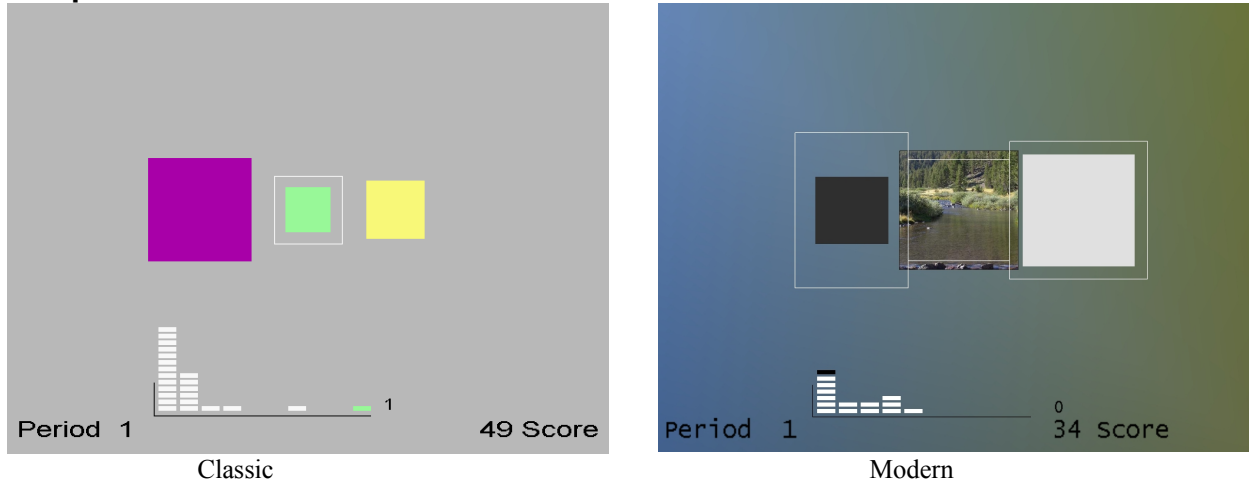
Jumpbox is a more sophisticated version of Boxlights. It has the same three colored boxes and the score and time reports. It also has a marker chip that moves horizontally along the bottom of the screen that jumps every time the client makes a score. If he makes three scores in a row, a chip will jump as far as the third column. If the client reaches ten scores in a row, the chip will reach the last column and turn green/blue. Each chip stops at the point the client fails to maintain all three criteria. Piles of markers further to the right indicate that the client is able to sustain the desired state for longer periods of time. This gives the client added information and an extra challenge. Similar to Boxlights, the box sizes are a function of amplitudes driven by which layout is used.   In Modern mode, whenever a chip reaches the last pile the background picture/color changes just as it does at the end of each period.

The colors of the boxes in classic mode are consistent in this and several other games. The low frequency box at the left is magenta; the high frequency box at the right is yellow, and the center box is blue for SMR training and green for beta training (as controlled by the therapist). In the modern mode, the box colors are fixed and the entire background is set based on the current image being displayed in the center box. The image changes at the end of each period.

4mation

Period 2   52 Score
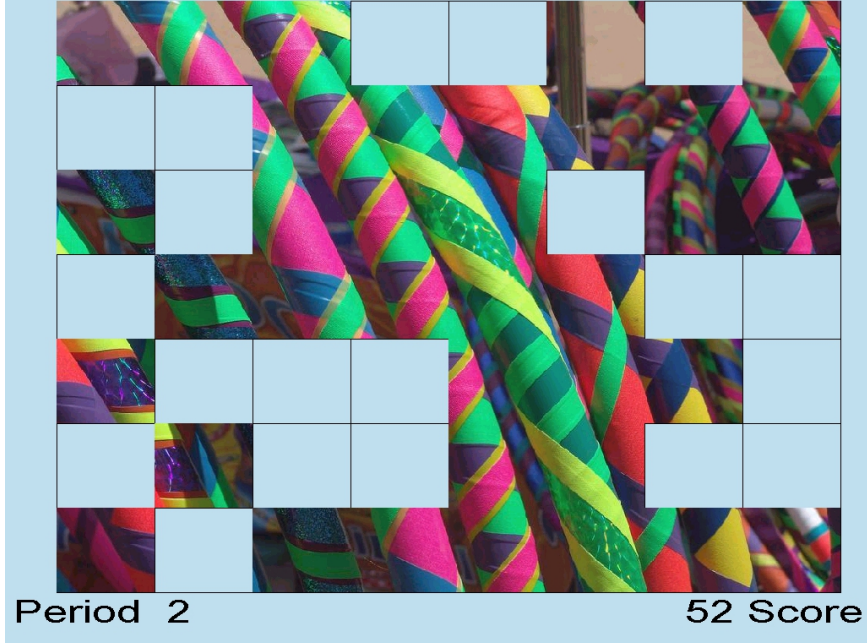
The 4mation game is an image display game where each reward displays another grid in the image. Options are tailorable for grid sizing (x and y dimensions), grid selection (random, ordered, weighted), sounds played, a success sound on filling all the grids, user selection of image directories, etc. A special key option on the game computer (Alt-D) can be used to cycle through the pictures during the time that the credits are shown on the screen (i.e. before pressing F5 for the first time). User pictures can be .BMP , .PNG or JPEG files. Note that many cameras provide files with .JPG extensions that are NOT JPEG files but EXIF files – an attempt is made to translate these also.

Spectral Mirror
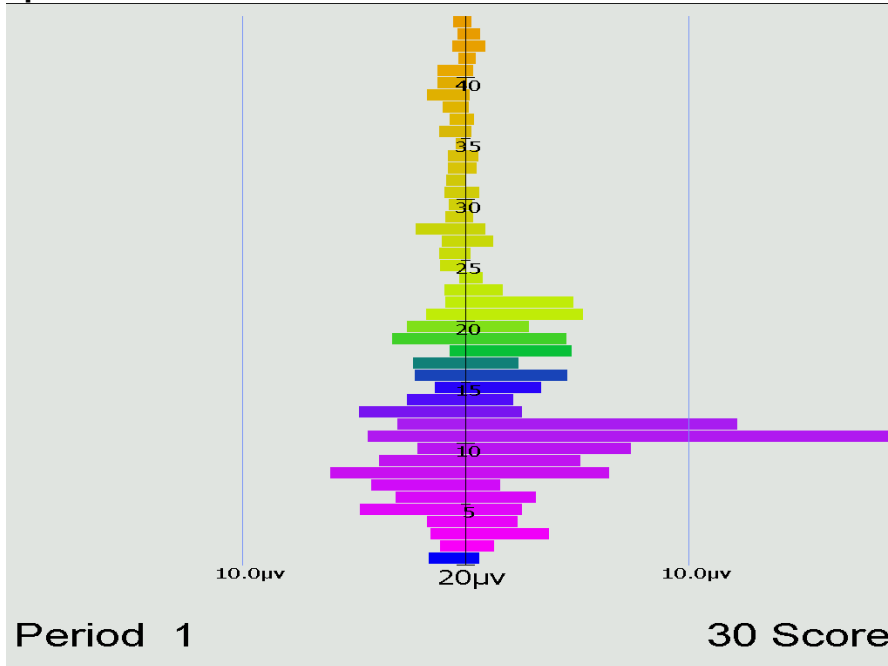
The Spectral Mirror display shows amplitude of the EEG signals at various frequencies. Above is shown the display with two channels of information displayed. Below is a mirrored display showing only one channel but reflected on both sides of the center axis.
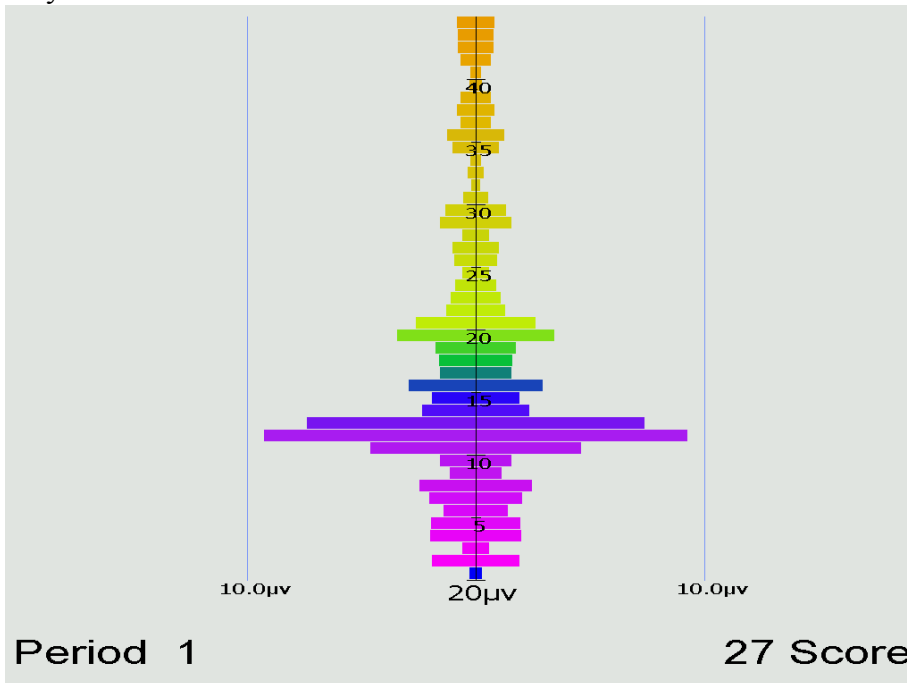
The therapist controls the horizontal scale for this display whose data is the real-time spectral data used for the Therapist displays.

Long-Term Display

The long-term display shows either or both of EEG data and peripheral data.
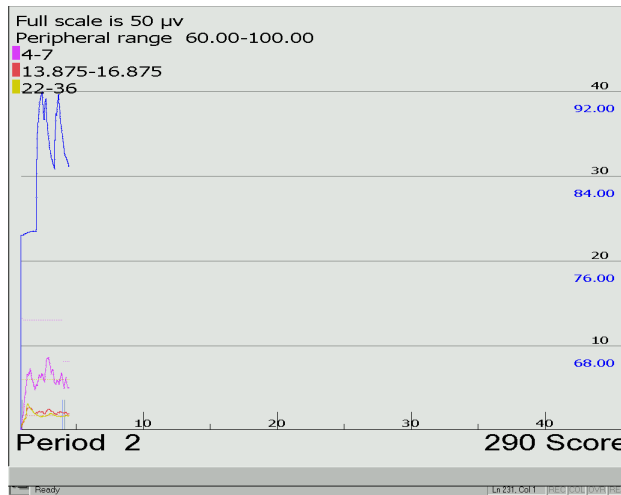
The display above shows both kinds of data in the slow display mode where the entire session width represents the screen width (as shown on the time scale at the bottom). There are different scales for peripheral and EEG data. Notice that the frequency bands are shown with the related color code. Below is shown the display with no peripheral data displayed (in the medium speed , 10 minutes across).

       4.3.0
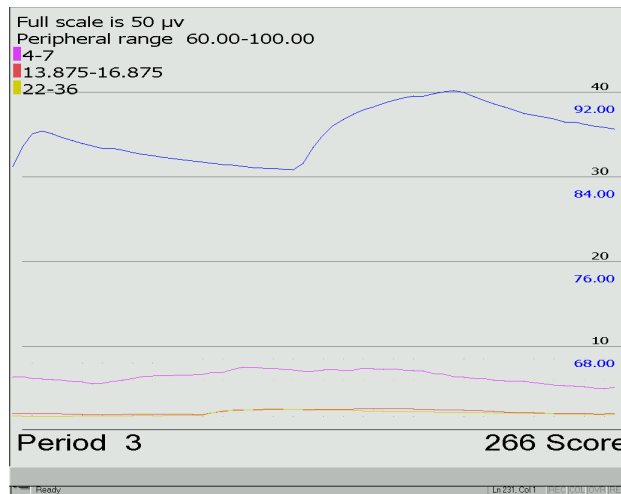
Here is the display shown using the fast speed display (one minute across):
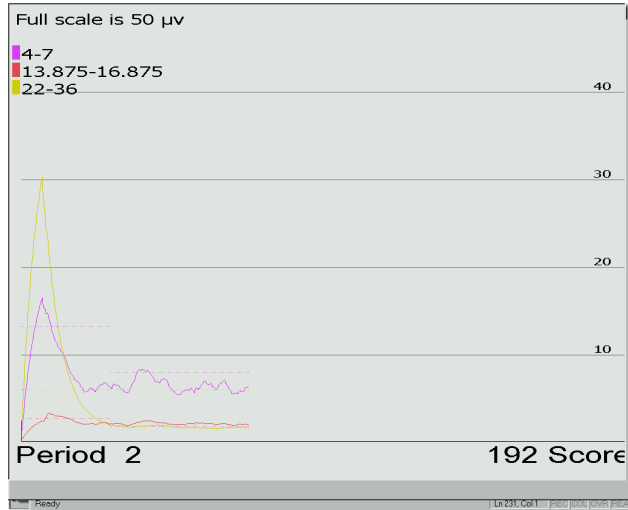
The EEG threshold line displays are also controllable by the therapist.

Iris

The optional Iris feedback display provides a background picture/color masked by one to four elements so that there is a display available for multiple rewards. Background pictures come from a 4mation picture set. The rewards can be driven by normal EEGer reward modes or by various zscore modes. The single reward channel display looks like this picture:
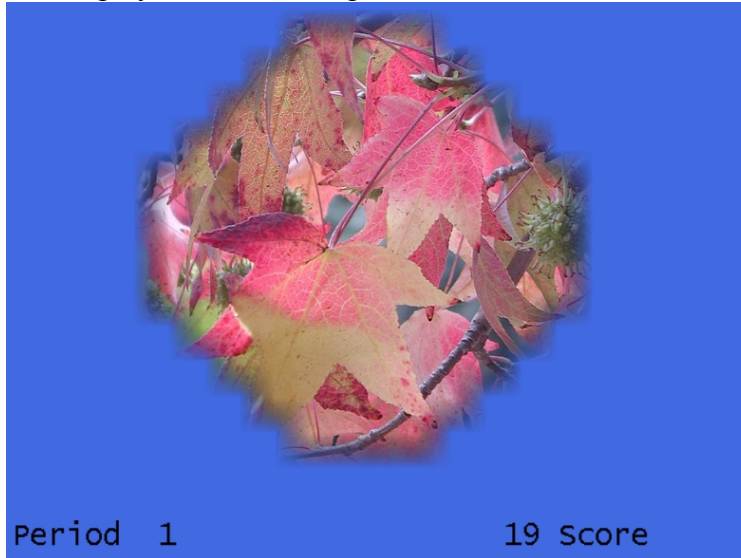
The four channel reward mode looks like this picture:

Each reward channel controls one element, masking the picture behind as the rewardable state changes for each reward stream. Mask colors are controlled by game tailoring options.

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Support Programs
Alpha-Theta Display


```
Show Demo                    AlphaTheta
02/10/02 13:19:10   alpha      theta          ——— inhibit
```

```
Ocean=100 Brook=  0 Step= 5
     10        20        30        40
```
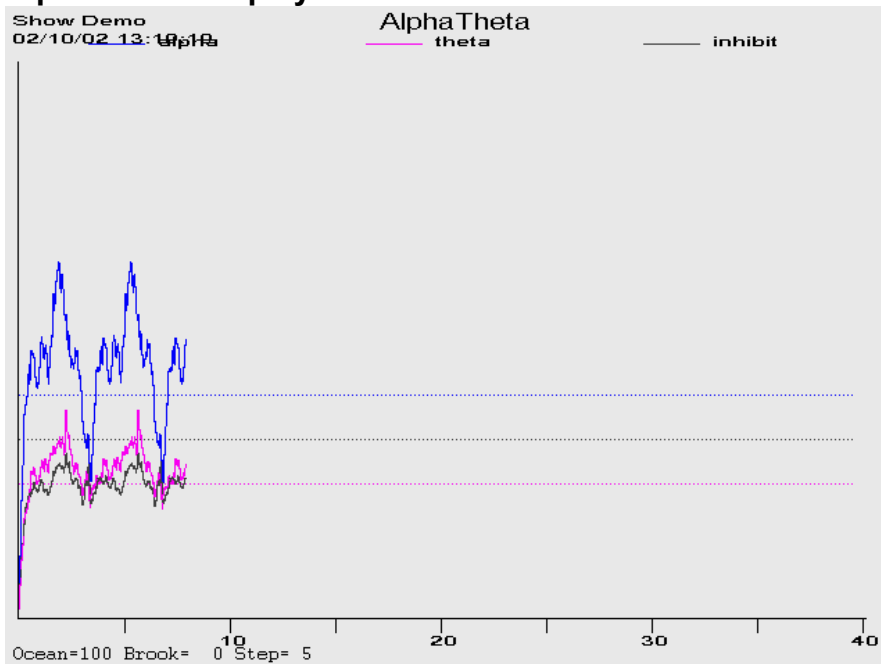
The feedback consists of two environmental tones signaling the general *range* of the client's state-of-relaxation, and tones that signal momentary bursts of EEG in one or the other reward band. The alpha environment (trace 3) is a running stream, and its tone is a high-pitched bell. The theta environment (trace 2) is ocean waves, and the theta tone is a low-pitched bell. As relaxation deepens, the ongoing environmental sound will cross-fade from stream to ocean and low-pitched bell tones will replace the high-pitched tones. In cases where both frequency ranges are over threshold at the same time, the system is biased toward signaling the trace 2 state. If the unbiased option was selected in game tailoring, the trace with the highest above-threshold value is selected.

Since the client station screen is not needed for visual display, it is used to display extra therapist information in the form of a line graph depicting amplitude over time for the two reward traces and the inhibit trace.

Alpha-Theta Volume Controls
The default volume levels for the background sounds and reward tones are set to a percentage value.
> Theta (ocean wave) volume
> Alpha (babbling brook) volume
> Alpha reward (Bell) volume
> Theta reward (Gong) volume

The next-to-last option adjusts the master volume. The last option adjusts the fade or rate-of-change speed used when switching between the wave and babble sounds. The "Edge rate border" controls the percentage of range (near the edges of the transition) where a double fade rate change will be used. At the bottom of the Alpha-Theta display are the "names" of the sounds along with the relative percentage of the two signals (alpha and theta). When a tone is generated, the appropriate "name" for

the tone displays during the playing of the tone. The "Step" value is the current setting of the fade step value which controls how rapidly the environmental sounds transition.

Main Menu

The main menu program monitors communication with the Therapist computer and responds accordingly by dispatching whichever feedback/support program is commanded by the Therapist computer. **F1** brings up/drops a help menu display. **Alt-T** may be used to bring up a tech support menu used to simplify technical support.

```
        EGS Help Screen  (F1 On/Off)

F3 changes communications channel
      COM1 through COM32 are serial ports
      ENET is Ethernet communications mode

F5 calls up a selection menu where the Ethernet
      communication "buddy" can be set.

F9 calls the Game Initialization Tool used to discover
      (and configure) installed games on this computer.


Alt-T   Tech Support Menu
Alt-P   Screen Capture to EEGer\Print directory


Game selection keys (for test only):
H=Highway    I=Island      J=Jumpbox B=Boxlites   D=3D Cubes   L=StarLight
R=SpaceRace C=Chomper   M=Mazes   4=4mation  S=Long-term  F=Spectral
```

A spinning "propeller" is shown in the upper left corner as a confidence factor (reporting that the program really IS running). The display shows installed Beta/SMR games and is updated by saving the result of the game discovery tool.

The **Esc** key is used to exit the menu program back to the Windows Desktop.

The **F3** key is used to change the communications channel used to "listen" to the Therapist computer. Pressing **F3** causes selection of the "next" available channel and the selected channel to be displayed in the upper left corner (in red). Each **F3** press causes the next channel to be selected cyclically. The Ethernet selection is one of the possible communications channels (but needs some extra setup – see the **F5** option).

If the communication with the therapist computer/program is working, the communications channel will be displayed in white. If communication is NOT working, the display will be in red letters.

Alternately, the **F5** key can be used to bring up a menu of channels and Ethernet options.
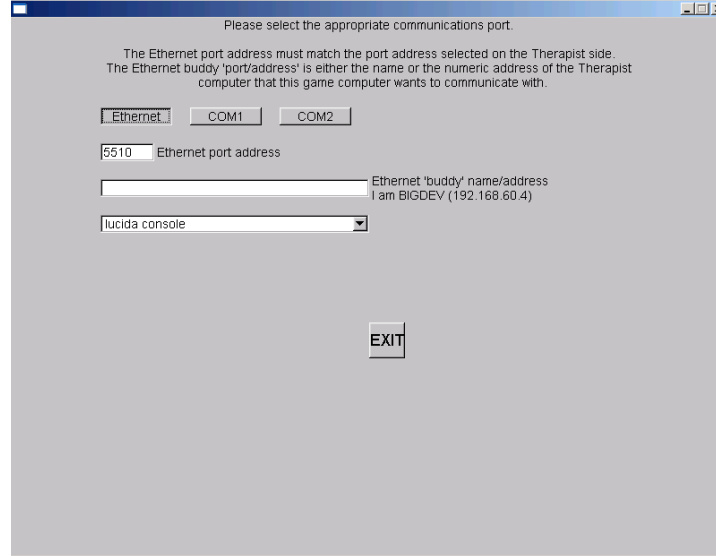
On this menu, the appropriate Ethernet port address (which MUST match the therapist preference setting) can be set.   The EGS font selection (for 2-computer operations) is made on this screen. Selecting the font name popup window gives a selection similar to this:
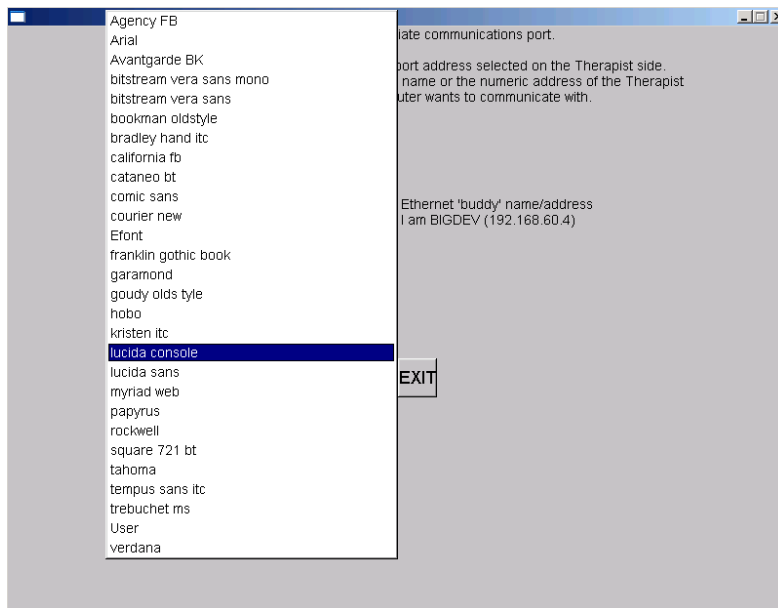
Please experiment with these font selections to find one suitable for you. Not all selections appeal to everyone.

The **F9** key can be used to start the Game Initialization/discovery tool directly from the game menu.

The **ALT-P** key combination saves the current display screen to the PRINT directory.

Appendix 1: How the Feedback process works.

The feedback loop begins with the client. Sensors 'pasted' to the client's head pick up microvolt-level EEG signals which are amplified and converted to digital voltages by the A/D subsystem at a nominal rate (typically 256 Hz).

The samples are converted to equivalent peak-peak voltages. All filters in the software are Infinite Impulse Response (IIR) filters. The raw samples are lowpass-filtered by a 40 Hz filter to remove 60 Hz ambient noise. The clinician adjusts a threshold voltage value to inhibit the data in the presence of muscle (EMG) artifacts. The resulting lowpass signal is fed to a number of 'streams' of processing which are very similar, although some are labeled "Inhibit" and some labeled "Reward".   A typical test run uses two inhibit streams and one reward stream.

In each stream, the lowpass signal is bandpass-filtered into various frequency bands (of the clinician's choice) using IIR digital filters. The filter output is fed to an exponentially-weighted moving average filter which produces a short-term average (peak- to-peak) voltage for further use. The time constant of the averaging filter is selectable but is usually 0.5 seconds. The moving average goes two places: directly to the client (game) computer (for visual stimulus) and to a comparator. The comparator produces a threshold-exceeded signal whenever the clinician-adjusted threshold voltage is less than the current moving average of the stream. This logic is shown in Figure 1.

All the threshold-exceeded signals are processed by the reward decision logic which declares a 'client reward' when all streams defined as "Inhibit" are below threshold and all streams defined as "Reward" are above threshold. The client aural reward rate is further limited to no more than 2 Hz (so that each sound can be separately heard). The client reward command is sent to the client computer to create an aural stimulus.

The visual feedback is independent of the aural feedback (except that they are both based on relative amplitude/threshold values). The client computer plays a prerecorded sound file (usually a short ¼ second beep) whenever a reward is commanded, giving aural feedback to the client that all clinician-specified (amplitude) conditions were being met. The client computer also draws simple graphics images giving a continuous display of the ratio of amplitude to threshold for each stream of data. The client visual display depends on the particular "game" chosen but all act similarly. The simplest presentation is of three boxes as shown in Figure 2. An outline is drawn for each box representing the "threshold" value. A color-filled square is drawn representing the current "amplitude" of the stream of data. Instructions to the client consist of telling them to make the 'inhibit' squares smaller than the outlines and the 'reward' square bigger than the outline.   The 'reward' square is in the center and the inhibit squares on either side of the reward square.

The client's EEG response to the aural/visual signals is then sensed and fed back into the loop.

 4.3.0
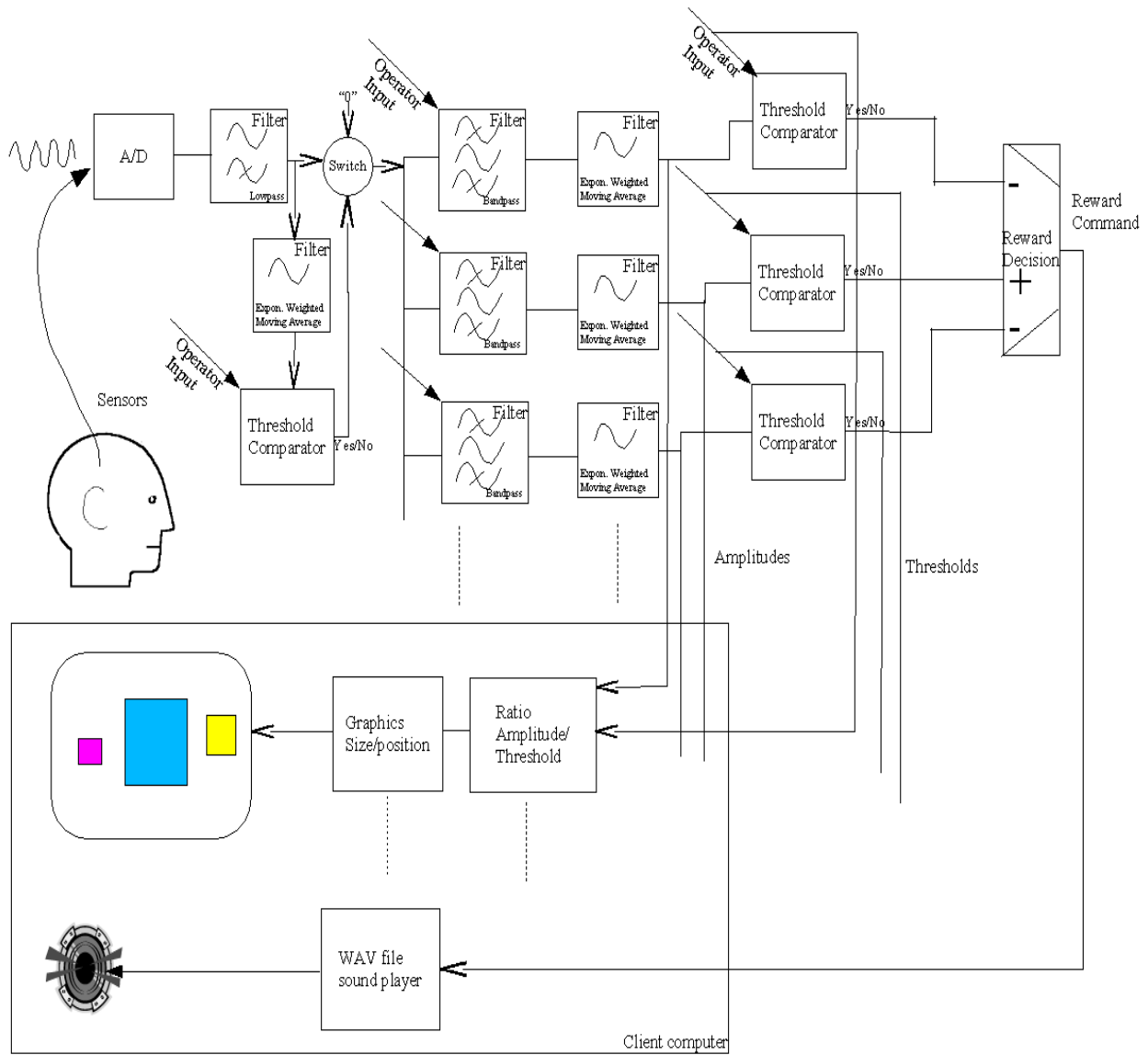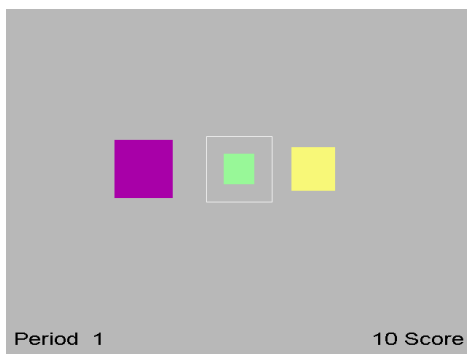
Figure 1.

Figure 2.

Appendix 2: Vocabulary

The terms listed are defined here to minimize confusion over the loose use of previous terminology.

10-10 electrode system A system of electrode placements for acquisition of scalp EEG. The "10-10" title means that the placements are every 10% around the circumference of the head (like a hat measurement) and every 10% of the distance from nasion (front) to inion (back) over the top of the head. Defined by the placement shown in Figure 1
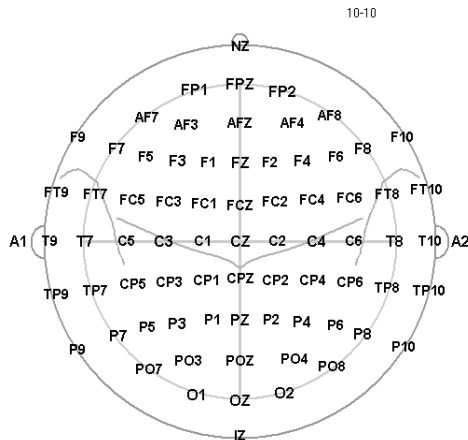
Figure 1. 10-10 modified   *Figure 2. 10-20*
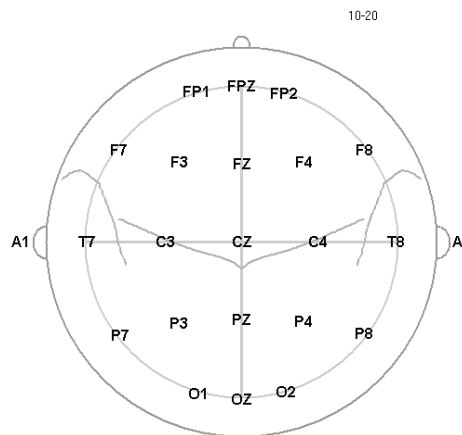
10-20 electrode system of the International Federation– Most widely used electrode placement for acquisition of scalp EEG. Defined by the placement shown in Figure 2.

Activation – Excitation/inhibition; referring to operant conditioning process.

Amplifier – A device that draws power from a source other than the input signal and produces as an output an enlarged reproduction of the essential features of its input.

Analog to digital converter (A/D)– A device that changes an analog signal to a digital signal of corresponding magnitude through discretization.

Artifact – any distortion of the EEG signal from any physiologic source other than the brain or any non-physiologic source that may interfere with the interpretation of the signal.

Average value (P-P) – The "average value" traditionally used in neurofeedback is actually the "equivalent peak-to-peak" voltage value using the assumption that the signal being measured is a sine wave.   The normal method of calculation is to sum the absolute voltage values of each signal sample, divide by the number of samples, and $2*\sqrt{2}$ to get the peak-to-peak equivalent.

Band – see EEG Activity definition. Actual frequency values are recommended instead of names due to the variation in definitions.

Baseline – status of brain activity when not engaged in a feedback/operant conditioning process.

Channel – each physical input measurement is one. It may take several 'connections' to a client for each physical input (such as 3 electrodes). A channel is comprised of the electrode(s), preamplifiers, amplifiers and encoders that make up a measurement path.

Client - Person who is receiving neurofeedback (i.e.,is connected to a neurofeedback system); person from whom EEG signal is being acquired.

Clinician – Person responsible for ordering (prescribing) as well as interpreting and making clinical decisions about neurofeedback; oversees the neurofeedback session. This person is also responsible for the technician.

Coherence – Measure of phase relation of two processes at a specific frequency band.

Component – A major element of a neurofeedback system (acquisition, software, etc.)

Corner frequency – Frequency designating the meeting between the transition band and passband; frequency at which gain crosses -3dB (typically).

DC level – The average value of the zero-crossing points of a periodic wave. If not zero, this means that there is a steady-state offset of the signal from its "ground" reference point. It is computed by summing each sample and used to move the incoming signal to a point where positive and negative excursions occur around a "zero voltage" point.

Digital filter - A linear computation or algorithm performed on a selected series in the form of an input signal that produces a new series as output.

EEG activity / frequency bands (Alpha, Theta, Delta, SMR, Beta, Gamma, etc.) -
There are many definitions for naming EEG data bands. Actual frequency values are preferred but typical names/ranges (from Spehlmann) are:

> DC-EEG: < 0.1 Hz
> Delta: 0.1-<4Hz
> Theta: 4-<8Hz
> Alpha: 8-13Hz
> Beta: >13-30 Hz
> SMR (sensorimotor rhythm) – rhythm seen in signals over the sensorimotor cortex;
>> usually considered in the range 12-15Hz
> Gamma: > 30 Hz (particularly 36-44Hz)

Another typical set of names/values is :

Delta	0.1 to 4 Hz
Theta	4-7.5 Hz
Alpha	7.5 – 13 Hz
Beta	13-30 Hz
Gamma	30-50 Hz
SMR(low beta)	12-15 Hz
Beta(mid beta)	15-18 Hz
High Beta	> 18 Hz

Electrode – the flat or cupped piece of metal used to sense electrical energy;
also has a wire on it to attach to an amplifier or preamplifier.

Electroencephalograph (EEG) – instrument for recording the electrical potentials produced by the brain by the use of electrodes.

ERP (Event Related Potential) – evoked activity of the brain related to a sensory stimulus; derived by averaging EEG activity with respect to stimulus onset.

FFT (Fast Fourier Transform) – computational technique that reduces the number of mathematical operations in the evaluation of the discrete Fourier transform (DFT) to N log2N; where DFT is a transform for Fourier analysis of finite-domain discrete-time function; used to convert the input signal from time domain to frequency domain.

FIR (Finite Impulse Response) – An FIR filter is a non-recursive method for extracting frequency information from a time-sampled input. FIR filters typically have good phase accuracy but poor amplitude fidelity. FIR accuracy is a function of the number of samples used.

 4.3.0

Frequency response –
- The portion of the frequency spectrum that can be sensed by a device within the specified limits of amplitude error.
- The range of frequencies over which an amplifier responds within the defined limits of amplification or signal output.
- Range or band of frequencies to which a unit of electronic equipment will offer essentially the same characteristics.

Ground – The "ground" is an isolated current-limited input used to provide a "zero voltage" point with respect to the signal being measured against its reference.

Haptic – of or pertaining to a sense of touch; tactile.

Hertz – The measurement unit of cyclic activity, abbreviated as Hz.

IIR (Infinite Impulse Response) – An IIR filter is a recursive method for extracting frequency information from a time-sampled input. IIR filters typical have poor phase accuracy but good amplitude fidelity.

Impedance– opposition to the flow of a cyclic (alternating current) current through the interface between an electrode and the scalp. If measuring, must be at least 500 ohms and less than 10,000 ohms between any two electrodes.

Layout– arrangement of traces with implied connections of data to game display

Operant conditioning – a form of learning or modifying behavior during which an individual modifies its own behavior due to the consequences of that behavior. Neurofeedback uses responses based on EEG data as the stimulus for the desirable rewards (consequences).

Passband – range of frequencies, or frequency band, for which a filter passes the frequency components of the input signal.

Peak – Highest (voltage) amplitude of a signal

Peak-Peak Voltage – The peak-peak voltage is the difference between the most positive and negative values of a cycle of a (sine) wave. All EEG amplitudes are reported in peak-peak voltage.   For complex EEG waves, an average value is computed and the peak-peak voltage is inferred from that result.

Phase – angular relationship between two waveforms.

Reference – Depends on usage (see Signal).

Ripple - variation in amplitude of frequencies passed through a filter

Smoothing – a method of limiting the effect of short term excursions of data samples. The method used in EEGer is Exponentially-Weighted-Moving-Average filtering.
    All EEGer smoothing is :
        SMOOTHED=CURRENT_SAMPLE*(k) + SMOOTHED*(1-k)
          where k is something like
        k= 1/(time_constant*samples_per_second)

Spectral – A frequency versus (power) amplitude display of data. The frequency data is generated from a moving FFT computation.

Stage – one piece of the session process, usually a particular action/operation.

Stopband – range of frequencies attenuated by a filter with some specified attenuation.

Stream– each processed entity is one; may be made up from one or more channels

Technician - Operator of neurofeedback system while the client is connected to a neurofeedback system..

Threshold – term used to describe the setting of a point at which a transformed value is acted upon (such as artifact detection).

Trace– a graphical display (strip chart display) of a stream.

Appendix 3: EEGer Computer Performance Settings

EEG Education & Research Technical Support recommends the following steps to optimize the performance of EEGer Neurofeedback Software.

PERFORM THESE STEPS ON COMPUTERS WITH PERFORMANCE PROBLEMS:

- **Windows XP Video Settings:**
  - Click Start. Right-click on My Computer in the menu and select Properties from the menu. System Properties should be displayed.
  - Click the Advanced tab, then the first Settings button for Performance Settings.
  - On the Video Settings tab. Select "Adjust for best PERFORMANCE" and click OK.
  - This will cause other changes, such as the Control Panel will be Classic view. You can change it back when not running EEGer if you wish.
- **Windows 7 Video Settings:**
  - Click Start. Right-click on Computer in the menu and select Properties from the menu. System properties should be displayed.
  - Click on Advanced System Settings
  - Click the Advanced tab, then the first Settings button for Performance Settings.
  - On the Video Settings tab. Select "Adjust for best PERFORMANCE" and click OK.
- **XP Video Resolution:**
  - Click Start and select Control Panel.
  - Double-click the Display Control Panel.
  - Click the Settings tab.
  - Screen area/resolution minimum requirement is 800x600 with 16-bit color. The best setting depends on the computer equipment, but we generally stay at or below 1024x768 pixels, 32-bit color. Note: If your system is already set to 800x600, 16-bit color, you may need to upgrade your desktop video card or laptop system.
  - If you make a change, click OK. Be sure to respond to any prompts to confirm the change or the system will automatically revert to the previous setting (It does that in case you couldn't see with the new setting.)
- **Windows 7 Video Resolution:**
  - Click Start and select Control Panel.
  - Select Appearance and Personaliation

For <u>EVERY</u> "USB Root Hub entry", follow these steps:

   Double-click USB Root Hub

   Click the Power Management tab at the right.

   Click the checkbox so it is Unchecked.

   Click OK.

Close all windows.

Virus Protection and Firewalls:

   Follow the manufacturer's instructions to disable virus protection and configure your firewall to avoid interference during a neurofeedback session. If you access the Internet with the system, disable virus protection only when actively running a session.

   Currently, Microsoft Security Essentials may be used as an antivirus program since it does not appear to degrade performance during neurofeedback sessions.

Wireless Internet Devices

   We recommend that you disable Wireless access to your computer when running a neurofeedback session. Some computers have a switch to do so. For others, go to the Windows Device Manager under Network Adapters. Right-click the Wireless adapter and select Disable.

System Memory

   If the system has the minimum requirement of system memory to run the operating system, you may wish to add additional memory. If the system uses Integrated Video or an AGP video card, the video may share the system memory. Increasing the system memory may be necessary for optimal performance.

Appendix 4: EEGer Remote-Use Client Instructions

Remote Use Systems are similar to clinical systems in their use of the same hardware and software to perform the neurofeedback functions. They are designed for remotely supervised use in a client's home.

You (or the caregiver) must first be trained by your therapist in the operation of the Remote Use system. The client training screens and software are identical to the therapist's Clinical machine. On a Clinical system, the therapist establishes a treatment period and number of sessions for each remote user by creating a Remote Use Client Disk (your personalized USB Flash drive). Each client is limited to a number of sessions to be run in a given time period using the kind of training (Alpha-Theta or BetaSMR) established on the Clinical system. Updates for the Remote Use Session Plan are obtained from the supervising clinician.

The functions of the Remote Use system are almost identical to those in the Clinical system. The only differences in operation are the restrictions on changing the session plan and the application of date or session count control to the use of EEG biofeedback. Some menu options will NOT appear on a Remote Use system, while it includes some that do not appear on a clinical system.

How to Run a Session

- Insert the Remote Use Client Disk (personalized USB Flash drive) you received from the supervisor in a USB port. The EEGer Dongle (bright green USB key) must also be attached.

- Prep and attach the sensors (electrodes) as instructed by your supervising clinician.

- On the Remote Use Therapist machine, double-click the EEGer icon. *(Two-computer systems: start EGS on the game computer first.)*

- Click **Select Client** then click the large "button" for the drive letter of the Remote Use Flash drive. Select the Client ID/Protocol to use for the session.

- Note the Dongle and Remote Sessions remaining and if there is a warning about an expiration date on the main display.

- Click **Begin Session**.

- Select a game and click **OK**.

- Confirm the game selection and turn on the amplifier, if necessary.

- At this point you can still back out without counting a session by pressing **Esc**.

- Adjust the scale on the raw trace, if necessary.

  - Press **PgDn** to highlight the raw trace (*e.g., Channel A is the first line on the EEG screen*).
  - Press **F9** to move to the Scale value field.
  - Press + or – to adjust the scale. (Increasing the scale value decreases the size of the wave.)
  - Press **Enter** twice to complete.

- Observe brainwaves. Blink or clench teeth to see how the "artifact" is displayed in the raw EEG trace. Adjust the thresholds on the raw trace, if necessary, to keep the artifact out of the training, but not too closely that they remove real EEG.

  a. Press **PgDn** to highlight the raw trace.
  b. Press + or – to adjust the threshold boundaries.
  c. Press **Enter** once to complete.

- Set the scales and thresholds for the lower traces. With no lines highlighted, press **F9** to auto-adjust the scales. Then, press **F11** if adjustment for goals is needed. Follow the steps above to set scale or goal threshold for any individual trace.

- Press **F5** to start feedback. (Single-monitor: Press the **Space Bar** to switch to the Game display.)

•Enjoy the Game.

•Press **Esc** when finished.

EEGer Remote Use Updates

How do I know when I need an update?
How do I get an update?
- Insert both the EEGer Dongle *(bright green key)* and Remote Use Client Disk *(personalized USB Flash drive)* into the appropriate USB ports of your EEGer Therapist system. Open the EEGer program.

- Click **Select Client**. Click the large button that appears to load the EEGer client information from the Remote Use Client Disk.

- Select the client name (and protocol) from the client list.

- Note the information displayed on the main screen (Figure 1). Yellow messages are "warnings" that one of the controls is about to expire. Red messages mean you are not able to run a live session until you update.

- If you see that either Dongles Authorizations or Remote Use Sessions/Days are about to expire, contact your supervising clinician to request the appropriate update(s).
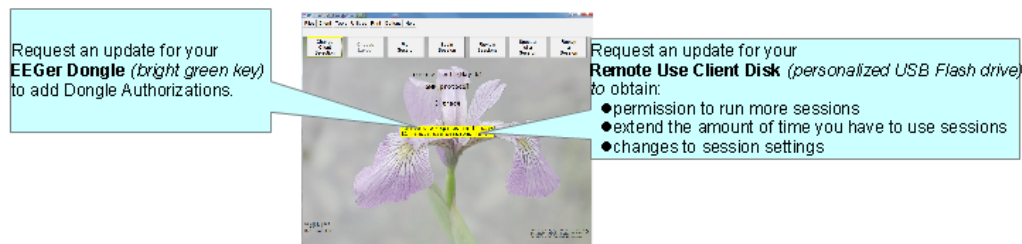
Figure 1. Remote Use Expiration Details

- **Updating EEGer Dongle Authorizations**

Authorizations are added to the EEGer Dongle by installing a special keyfile obtained from EEG Store (*supervisor's permission is required for purchase*). You may receive the keyfile on CD or as an email attachment.

- **Updating the Remote Use Client Disk**

You can either have the Remote Use Client Disk updated in the clinician's office or you may receive an update file via email.

Email Attachments for Updates:
For either type of update, save the attached update file to your Windows Desktop or to a disk (DO NOT OPEN the attachment). If your email computer is not your Remote Use system, copy the file to a disk to move it to the EEGer Remote Use computer (e.g., use your Remote Use USB Flash drive or burn to CD). Update files must be installed using the appropriate selection from the Files menu in EEGer and cannot be installed by double-clicking the file.

Installing Dongle Authorizations or Remote Use Update Files:
- Attach your EEGer Dongle and Remote Use Client Disk (USB Flash drive) to the EEGer Therapist computer.

- Double-click the EEGer icon.

- If you are installing a Remote Use Update from your supervisor, click **Select Client** and choose the correct USB Flash drive by clicking the large "button" displayed. Choose the Protocol Class (AT/SMR/EXP) and ID to be updated.

- To install the Dongle Authorization update from EEG Store, go to the **Files** menu and select **Read EEGer keyblock file**.

- To install a Session/Protocol update from your clinician, go to the **Client** menu and select **Remote-use Options->Read EEGer remote user update file received from clinician**. If prompted again, click the large "button" to select the correct drive for the Remote Use Flash Drive update.

- Use the Windows Open dialog (Figure 2 or Figure 3) to locate the update file on the Desktop or other disk (e.g., Click Desktop or "Look In" to choose your removable drive that contains your dongle update from the list of drives on your computer).
- Click the name of the update file so it is highlighted and click **Open** to install the update.
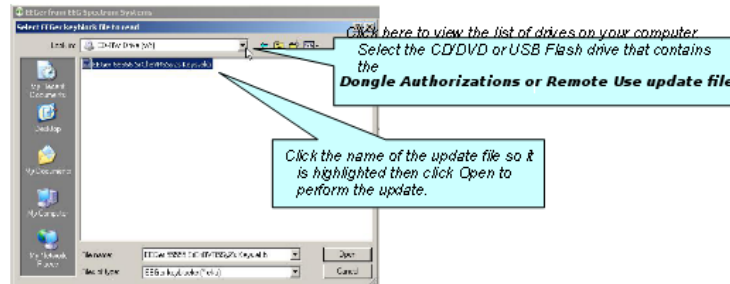
Figure 2. Windows XP
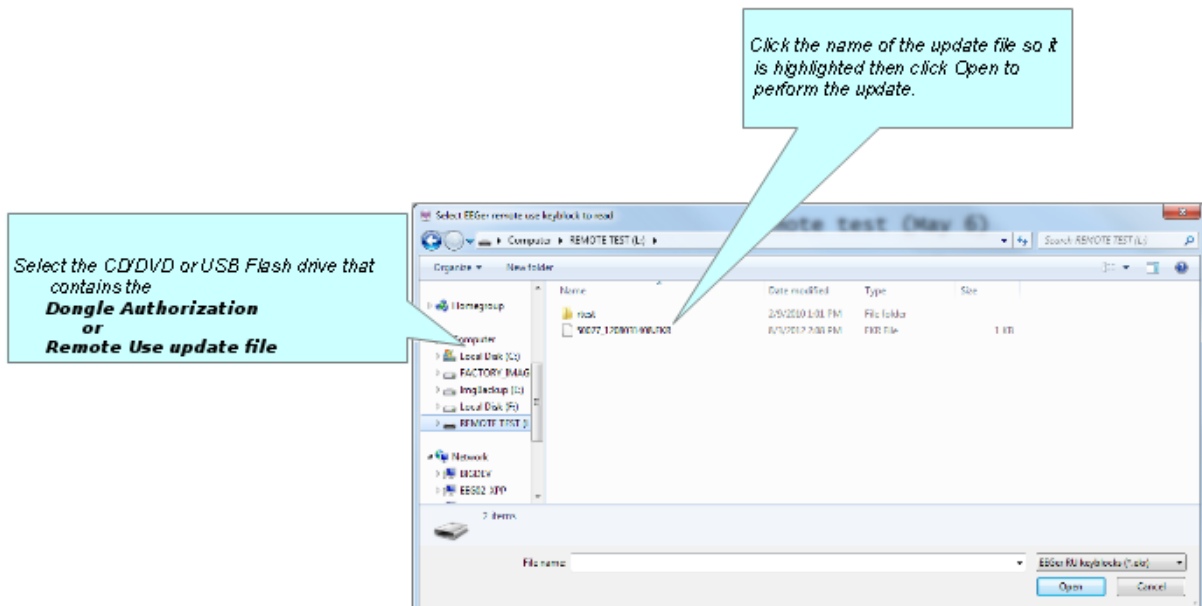
Figure 3. Windows 7

Appendix 5: EEGer Remote-Use Clinician Instructions

Before the client can use the system, **it is the clinician's responsibility** to train the client (or caregiver) in the operation of the Remote Use system. You must also provide a client disk (utilizing a USB Flash drive) that contains the training plan and expiration data. This Remote Use Client Disk must be initialized on a Clinical Therapist machine using EEGer version 4.1.0 or greater.

Remote Use System Requirements

Provided by EEG Store
- EEGer version 4.1 or later
- EEGer license dongle with programmed Dongle Authorizations
- EEGer Remote Use license keyfile

Provided by You – the Supervising Clinician
- Remote Use Client Disk containing the training session plan(s), number of Remote Use Sessions permitted, & expiration date.
- Training in the operation of the EEGer system; including sensor placement, confirmation of the amplifier connection, how to read the EEG and adjust training parameters.

Requirements to Run a Remote Use Session

- EEGer version 4.1 or later.
- EEGer Dongle Authorizations available on the EEGer license dongle
- Remote Use Sessions available on the Remote Use Client Disk as specified in the Remote Use Session Plan
- Date must be prior to the Expiration Date for Remote Use Sessions as specified in the Remote Use Session Plan

Session counts and expiration dates for individual clients using the Remote Use system are controlled by **YOU**, through the purchase of Dongle Authorizations and creation (initialization) of the client's Remote Use disk (utilizing a USB Flash drive). The Remote Use Client Disk (USB Flash drive) conveys expiration, session count, and session plan information to the Remote Use computer. The EEGer license dongle contains the number of sessions available to be accessed by the Remote Session Plan.

Clinician Procedures

The recommended procedure for a client who has acquired a Remote Use system is for the client to continue to be seen in the office periodically. The client should bring the disk for each office visit. You may want to review the data before updating the training session plan. We strongly recommend that you create a new disk on every visit, alternating two or more storage devices. If the client should fail to bring the disk, make a new one and instruct the client bring both disks on the next visit.

When training clients who are unable to visit the office, you can create update files to keep their remote system active. However, you must still initialize the Remote Use Client Disk (USB Flash drive) using your CLINICAL system before they can begin training. Clients can either export and email session data or exchange their Remote Use Client Disk by mail for you to be able to review the session details and progress.

STEPS FOR SETTING UP REMOTE USE TRAINING

1. **Order** the EEGer system from EEG Store with a specified initial number of Dongle Authorizations. If the system is shipped to the client, they may set up the system prior to coming to the office for training. Clients who purchase a "kit" will have to do all of the installation and setup.

2. **Create** the ClientID and custom Plan Session for the desired training of each client who will

use the remote system using your CLINICAL system.

3. **Create/Initialize** a Remote Use Client Disk for each client who will use the Remote system. Be prepared to enter the number of sessions allowed and expiration date for the session plan (Default is 45 sessions in 45 days. You can change the number of sessions or expiration based on your treatment plan.)

4. **Train** the client in the use of EEGer and provide them with the Remote Use Client Disk(s) for home use.

5. **Review** data on the Remote Use Client Disk.

6. **Update** the Remote Use Client Disk to permit additional sessions, change the session plan, or extend the expiration date for the Remote Use Plan by re-initializing the USB Flash drive or creating an update file that can be installed by the user.

7. **Update** the EEGer dongle by requesting additional Dongle Authorizations from EEG Store as necessary.

Initialize the Remote Use Client Disk

IMPORTANT: This step must be performed *before* the EEGer Remote Use System can be used for the first time. The drive is first **erased** and then the necessary EEGer files are copied to the drive.

The same procedure can be used to provide updated plans for the client when the Flash drive is available. After initial setup, creation of update files to email is an alternative method to renew plans when the Flash drive is not present.

A.   SET UP THE CLIENT AND SESSION PLAN

      1.   On the **CLINICAL** Therapist system, go to the **Client** menu and select **Create Client**.

           o   Follow prompts to enter a Client ID, full name, and birth date. Click **OK** after each.

           o   Select protocol class for the client: **BetaSMR**, **Alpha-Theta**, or **Experimental**.

      2.   If desired, create additional protocol classes using **Add Protocol Class to Existing Client** from the **Client** menu.

      3.   Click **Select Client** and choose the Client ID/Class entry for the Client ID to set up session details.

      4.   Click **Choose Layout** then click the button to select the number of EEG traces for the training display.

      5.   Click **Plan Session** to set up protocol details.

      6.   Repeat steps 3-5 if you want to add another protocol class to the client's training plan.

B.   CREATE/RESET THE REMOTE USE CLIENT DISK

      1.   Insert the USB Flash drive into a USB port.

      2.   From the **Client** menu, select **Remote Use Options-Initialize EEGer remote-use USB memory stick**. *(NOTE: Versions prior to EEGer 4.3 have slightly different menu options text)*

      a.   Select the client name from the list of clients.

      b.   Click the BIG button labeled "Use drive _: for remote user storage" to choose the device drive where you want to write the client's session plan(s) to disk. *(If there is no button, please exit and check My Computer (or Computer) to be sure the drive is recognized by the computer.)*

      NOTE: *If there is EEGer data on the disk, you are prompted to copy the session history to your Clinical system before the disk is reset.*

3.	Create the Remote Use Plan

a.	Select the client Class.

b.	Select the desired Layout.

c.	Set up the session count and expiration. You must know the client's EEGer dongle number for proper setup.

▪	Default settings are 45 sessions and 45 days. Adjust the Remote Session count and expiration date as you see fit based on your treatment plan. Make a note of the allowances in preparation for future updates to the Remote Use Plan.

4.	The system returns to the initial dialog to allow creation of other Class Session Plans on the drive (You can include one of each type.) Repeat step 3 for another class type.

5.	Click **FINISH** to complete the setup. (Note: If you select the Class again, the Remote Session Plan details default back to 45 sessions in 45 days.)

Additional clients (presumably from the same family) can also be assigned to the same Remote Use System. Follow the same process as listed above to create a separate Remote Use Client Disk for each user. Remember, the clients will *share* the Dongle Authorizations available.

Updating the Remote Use Client Disk - Renew or Change the Session Plan and Count

a.	*How do we know when I need an update?*
b.	*How do I provide the update?*
1.	Ask the client to insert both the EEGer Dongle *(bright green key)* and Remote Use Client Disk *(personalized USB Flash drive)* into the appropriate USB ports of the REMOTE EEGer Therapist system. Open the EEGer program.

2.	Click **Select Client**. Click the large button that appears to load the EEGer client information from the Remote Use Client Disk.

3.	Select the client name (and protocol) from the client list.

4.	Note the information displayed on the main screen (Figure 1). Yellow messages are "warnings" that one of the controls is about to expire. Red messages mean you are not able to run a live session until you update.

5.	If either Dongles Authorizations or Remote Use Sessions/Days are about to expire, process the appropriate update. Repeat steps for additional Remote Use Client Disks used on the same system.
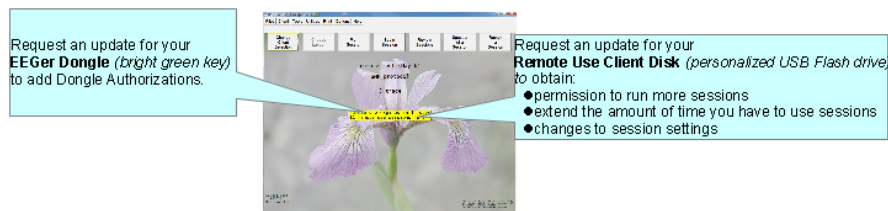
Figure 1. Remote Use Expiration Details

To Renew The Client's Session Data

**METHOD 1:	Create an update file**

●	On your CLINICAL system, select **Client->Remote-use Options->Create EEGer remote use update file for emailing**.

- Complete the same steps used when initializing a disk.

- When you click Finish, a file is saved on your computer's Desktop.

- Attach the file to an email to send to the client or copy to a disk. The file is then loaded onto the Remote Use Client Disk on the client's computer by selecting **Client->Remote-use Options->Read EEGer remote-use update file received from clinician** on the Remote Use system.

*   Updates ADD Remote Use Sessions to the remote plan but reset the expiration date as opposed to initializing the device which resets both the Remote Use session count and expiration.

You must create a separate update for each Class (Beta, Alpha-Theta, or Experimental) used for training.

The filenames do not contain client information. If you update more than one client for the same dongle, we suggest renaming the files as created so it is easier for the client to know which Remote Use Client Disk corresponds to the file. Be sure to keep the file extension. (e.g., 55555_AU091808.ekr or 55555_BU091808.ekr)

To retrieve history from the client for review, instruct the client how to use Files – Consultation Import/Export options in EEGer.

METHOD 2:   Re-Initialize the USB Flash drive on your Clinical Therapist system.

- Use the process described in step B above (**Client->Remote-use Options->Initialize EEGer remote-use USB memory stick**).

When the device is re-initialized, the data is erased from the USB Flash drive, but is still available to the client since it is also stored on their system. This process RESETS the Remote Use Session count and expiration date.

Retrieving and Reviewing Stored Data

When you choose **Remote-use Options->Initialize EEGer remote-use USB memory stick** from the **Client** menu, you are prompted to select the drive letter for the USB Flash drive. The next step is to copy the historical data from the drive to your Clinical system. (You may terminate the disk initialization if you wish to review the data before updating the patient's session plan or proceed with the session controls update at this point.) You can then do any appropriate interviews, testing, and run a training session in the office. There are three options for reviewing patient data:

Click **Select Client** and choose the correct class and patient ID. Click the desired option to review session history.
- *Review*: Displays the trend graph as well as individual session data.
- *Replay Stored Data*: Choose a session to replay (select Entire File or select Partial File to specify the beginning and end of the data to review). This runs the normal EEG program but without selection of game and electrode sites and filters.
- *Spectral*: Choose a session to replay (select Entire File or select Partial File to specify the beginning and end of the data to review). Press **Pause** or **C** to being playback on the spectral display. (Press F1 for Help to see other options.)

Troubleshooting:

Errors below 100 have to do with reading the data from the flash drive (**expiry**).
Errors 100-199 have to do with the update file from the therapist.
Errors 100-299 have to do with the resulting updated file on the flash drive.

ORDERING DONGLE AUTHORIZATIONS FROM EEG STORE

The main control settings (overall expiration and authorization count) for the EEGer Remote Use license key can only be reset by EEG Store. Contact Customer Service (888) 521-9803   or email **info@eegstore.com** to arrange to update the EEGer license dongle or license keyfile.

Please supply:

•Name of Licensee: _____

•Dongle #:   _____

•Number of Sessions for Renewal

•Contact Information

•Method of payment

•Method of distribution: a) Email Supervisor and/or Client
                                          b) Ship CD to Supervisor/Client

Appendix 6: Identifying COM Ports

SERIAL PORTS

Usually desktop computers have 1 or 2 Serial 9-pin ports. Laptops and newer desktops might not have <u>any</u> 9-pin Serial ports. If there is one 9-pin port, it is generally identified as COM1. If two, the upper- or left-most port is usually COM1 and the other COM2. If a 9-pin Serial port is not available, you can use a USB-Serial adapter to connect the amplifier or cable to the computer. USB port numbers are generally a higher number than COM2 and usually a different number is assigned each time a device is attached.

Note: You cannot substitute a USB-USB cable for the Serial null modem cable. If you're using a ProSB and only one 9-pin port is available, it is preferable to use that port for the amplifier.

IDENTIFYING COMMUNICATIONS PORTS
COM port settings can be determined by viewing the Windows Device Manager. For systems using USB ports, especially with XP, unplugging or moving devices can cause the COM port number to change.

To confirm the COM port being used in the Device Manager.
<u>WINXP</u>:
- Click Start.
- Right-click My Computer and select Properties.
- Click the Hardware tab.
- Click the Device Manager button.
- Click the + next to "Ports (COM & LPT)" to expand the list. (List is alphabetical).
- Write down the numbers of the COM ports available. (USB-Serial adapters appear as under a brand name. For example, "Prolific USB-to-Serial Comm Port")
  Note: If you have more than one device, you can unplug one to see which is removed from the list. Then plug it back it to make sure the list is refreshed with both devices.

COMMUNICATION PORT LIMITATIONS:
For EEGer, the connections must be COM32 or lower.

To FORCE the port setting for the USB-Serial adapter (ADVANCED USERS!):
1. Find the adapter in the Device Manager.
2. Right-click on the device and select Properties.
3. Click the Port Settings tab.
4. Click the Advanced button.
5. Change the COM port setting to the desired number. CAUTION: Change to a number you are certain is not in use by another device.
6. Click OK and respond to prompts to complete.
7. Set the correct port in EEGer software:
   a. Therapist: Return to EEGer, Preferences | Configuration to change the appropriate COM port to the forced number.
   b. Game: On the game list menu, press F3 until the correct port is displayed in the upper-left corner of the menu display.

Appendix 7: Fixed color codes

This chart shows the fixed colors associated by stream/trace number:

Fixed-color mapping by stream number

■	Stream 0
■	Stream 1
■	Stream 2
■	Stream 3
■	Stream 4
■	Stream 5
■	Stream 6
■	Stream 7
■	Stream 8
■	Stream 9
■	Stream 10
■	Stream 11
■	Stream 12
■	Stream 13

Appendix 8: Feedback and Reward Modes

EEGer has both "feedback modes" and "reward modes". "Feedback modes" describe (control) the signal routing and processing of inputs, displays, and (game) outputs. Various modes are available depending on the specific layout (screen configuration). Details on all modes can be found in the Technical Manual.

Commonly available feedback modes:

SingleA   - Input data comes from channel A; reward is SMR reward
SingleB   - Input data comes from channel B; reward is SMR reward
Sum   - Input data is sum of A and B; reward is SMR reward
Differ   - Input is A lowpass value minus B lowpass value; reward is SMR reward
Psync   - Input is A & B lowpass/bandpass values; reward is SMR reward
Async   - Input is A & B lowpass/bandpass values; reward is SMR reward
GAsync   - Input is A & B lowpass values; reward is SMR reward
AminusB   - Input is A & B lowpass/bandpass values; reward is SMR reward
BminusA   - Input is A & B lowpass/bandpass values; reward is SMR reward
PDelta   - Input is A & B lowpass/bandpass values; reward is time-sample deviation
                of phase difference between A & B
RatioA   - Input is A; reward is ratio of reward trace to inhibit trace just above reward trace
RatioB   - Input is B; reward is ratio of reward trace to inhibit trace just above reward trace
RatioAB   - Input is A & B; reward is ratio of A amplitude to B amplitude.
RatioBA   - Input is A & B; reward is ratio of B amplitude to A amplitude.
D/S-Ratio   - Input is A & B; reward is ratio of (A-B) amplitudes to (A+B) amplitudes
Unity   - Input is A & B; reward is1- ratio of absolute value (A-B) amplitudes
                to (A+B) amplitudes
Dual   - Input is A & B lowpass values (A feeds 3 traces, B feeds 3 traces);
                reward is SMR
MonitorA   - Input is A lowpass value; No rewards or game outputs
MonitorAB   - Input is A & B lowpass values; 6 traces from A, and 6 from B;
                No rewards or game outputs
MonitorB   - Input is B lowpass value; No rewards or game outputs

If the zscore option is available, additional reward modes are possible. See the zscore appendix (Appendix 12) for a discussion of these modes

There are approximately 160 modes.

Available reward modes (assuming there ARE some reward outputs):

Rwrd   - Reward condition is integral value at or above target threshold.

Down   - Reward condition is integral value at or below target threshold.

Cntr   - Reward condition is when difference between current value and average value is less than target threshold.

Elev   - Same as Rwrd but game output value is limited to threshold value.

DevU   - Deviation is absolute difference between average and instantaneous integral. Reward is when this smoothed value is at or above target threshold.

DevD   - Deviation is absolute difference between average and instantaneous integral. Reward is when this smoothed value is at or below target threshold.

Band   - Reward condition is signal value within offsets from threshold setting. Limits are set using the Band Control popup.

Appendix 9: Sound controls

This appendix describes the kinds of sound controls EEGer allows with the EEGer Game Set (EGS)games. Third party games in general do NOT support these modes, which are set during the Game Initialization or tailoring phases.

There are three categories of sounds: discrete rewards, strand-related sounds, and special.

Discrete reward sounds are generated whenever the therapist computer issues a "reward" command. These sounds are intended to be short (shorter than the reward interval!) and indicate a successful "state" to the client. The games have two reward sound possibilities: "Reward" and "Success". The "Success" sound is only used for those games that have some success criteria associated (completing a maze, filling a picture, reaching the end of the jumpbox display). Discrete reward sounds have controls for which channels the sound is played through. Normally BOTH is the selection. It is possible to select either LEFT or RIGHT also. The ALTERNATE selection alternates between LEFT and RIGHT for the number of seconds specified as the limit, then defaults to BOTH. Again, the reward sound is only generated when triggered by the therapist computer. Certain games respond to spike-triggered sounds as specified in the tailoring files.

Strand-related sounds are associated with particular processing bands and generally relate to amplitudes, ratios, etc., of the data in those bands. There are six separate sound possibilities defined although you can only use as many sounds as are driven by the therapist computer (which in turn is controlled by the current layout). All six sound options work identically (using the individual options, of course). It is possible to select BOTH, LEFT, or RIGHT channel for the sound output.   The mode of operation for the sound is one of the following:

CONTINUOUS	The sound plays during feedback
ENABLED	The sound plays during feedback but ONLY if all inhibits are below threshold and all rewards are at or above threshold.
NOTENABLED	The sound plays during feedback but if any inhibits is above threshold or any rewards is below threshold.
PROPORTIONAL	The sound plays during feedback and the volume is proportional to the ratio of amplitude and threshold. The higher the signal is over threshold, the louder it is.
ENABLEDPROP	A combination of ENABLED and PROPORTIONAL
OVER	The sound plays during feedback only if the amplitude is over the threshold
UNDER	The sound plays during feedback only if the amplitude is under the threshold.

The clinician must select which game strand drives each sound. Each layout and feedback mode has a discrete mapping of stream/trace to strand. The commonly-used tables are as follows:

Layout: 5

Trace	Strand
2	0
3	1 or 2
4	3

Layout: 6,inhibit

Trace	Strand
2	0
3	4
4	1 or 2
5	3

Layout: 6,reward

Trace	Strand
2	0
3	1 or 2
4	5 or 6
5	3

Layout: 8

Trace	Strand
2	0
3	1 or 2
4	3
5	4
6	5 or 6
7	7

The complete set of mappings is contained in the Technical Manual.

Special sounds are those unrelated to specific strands. The only category of these are those sounds controlled by the overall reward %. A separate tailored value is the RWVALUES variable with contains 6 (comma-delineated) percentage values. Modes used with these settings are :

RWOVERn	The sound plays only when the overall reward % is greater than or equal the nth percentage specified in the RWVALUES setting.
RWUNDERn	The sound plays only when the overall reward % is less than the nth percentage specified in the RWVALUES setting.

Appendix 10: EIOTEST

The EEGer Input-Output test program was designed to test the interface between the amplifier/encoder devices supported by EEGer. It uses the identical interface software used by the realtime processing but with no filtering or user adjustments. A typical screen looks like this:
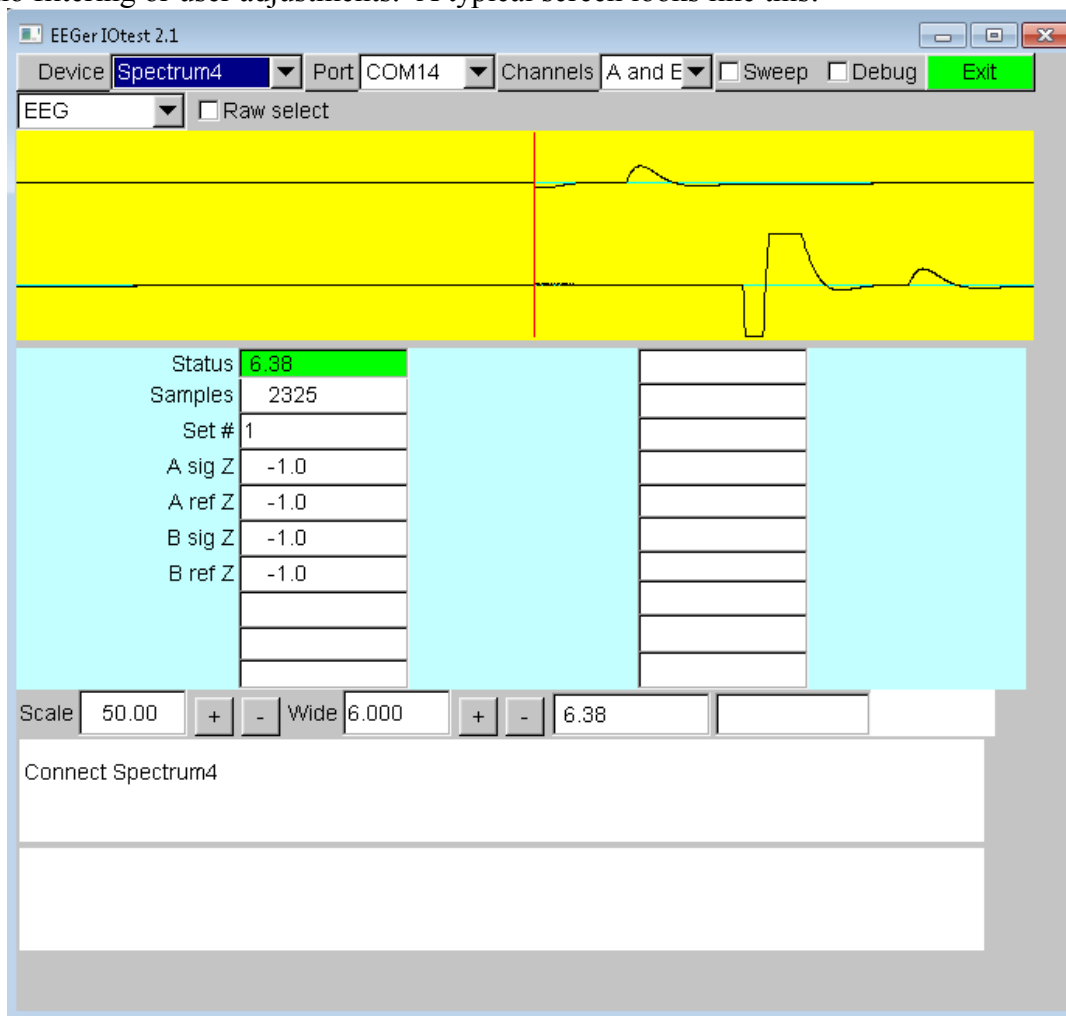
The EIOTEST program automatically decodes the current EEGer options set on the configuration pages as the startup settings. Changes made during the EIOTEST program do **NOT** alter the EEGer configuration settings. Error information or successful connection information is shown in the bottom boxes. The yellow area is an updated display of the raw data from the device. The columns of numbers mean different things for each device. In general, numbers changing in the right-hand column mean bad things. The top left value in the middle blue area represents the status of the device. Green means everything is OK. Yellow or red means errors in communication or device data. This field is the same value as displayed in the status bar at the bottom during live sessions. Values on the left are informational. Values with pink backgrounds are error counters/values. The **Scale** setting controls the scale value for the yellow display. The **Wide** setting control how many seconds wide the display represents.

On the top rows are selection options.

Device – this allows selecting a different device for testing

Port – this allows selection of serial port for testing for those devices requiring a serial port. Only ports COM1 through COM16 are allowed and only initially-detected ports are active. Undetected ports at EIOTEST startup are inactive (grayed out).

Channels – selects which raw data channels will be displayed.

Sweep – Selects if swept or scrolling display mode is to be used.

Debug enables display of the debug information for the device (as shown on the realtime debug display).

Exit – exits the IOTEST program. The ESC key also exits the program.

The next row of options controls other settings. This row is different for every different kind of amplifier/encoder. The option showing **EEG** is actually an option selector that allows other operations on devices capable of them. The other choices are **Impedance** and **Calibration**.
The **ProComp2** checkbox allows changing the commanded mode between ProComp2 and other Thought Technology devices since the TT software cannot inherently detect a ProComp2 (so the battery voltage is correctly displayed).
The **Biograph** or **Spectrum** checkbox allows switching between Thought Technology interface modes. Spectrum is the default mode for ProSB interfaced devices while Biograph is required for TTUSB interfaced devices. This setting must match the switch settings in the device.
Bypass is an internal test mode.
Raw select determines if J&J devices use the standard filtered input or the unfiltered raw input.
A/D Base controls which A/D card number is used.
24-bit mode selects 24-bit instead of 16-bit mode on Atlantis devices.
Link refs links references internally to the amplifier/encoder.
Max value sets the maximum scale value for the esiPro/A200/A400 devices.
4-channel forces Wiz devices in 4-channel mode.
Turn off electrode monitoring disables Wiz monitoring of electrode status

For ProComp testing, the columns of numbers assist in divining the current device settings.

Here is an example of the IO test reporting some failures:
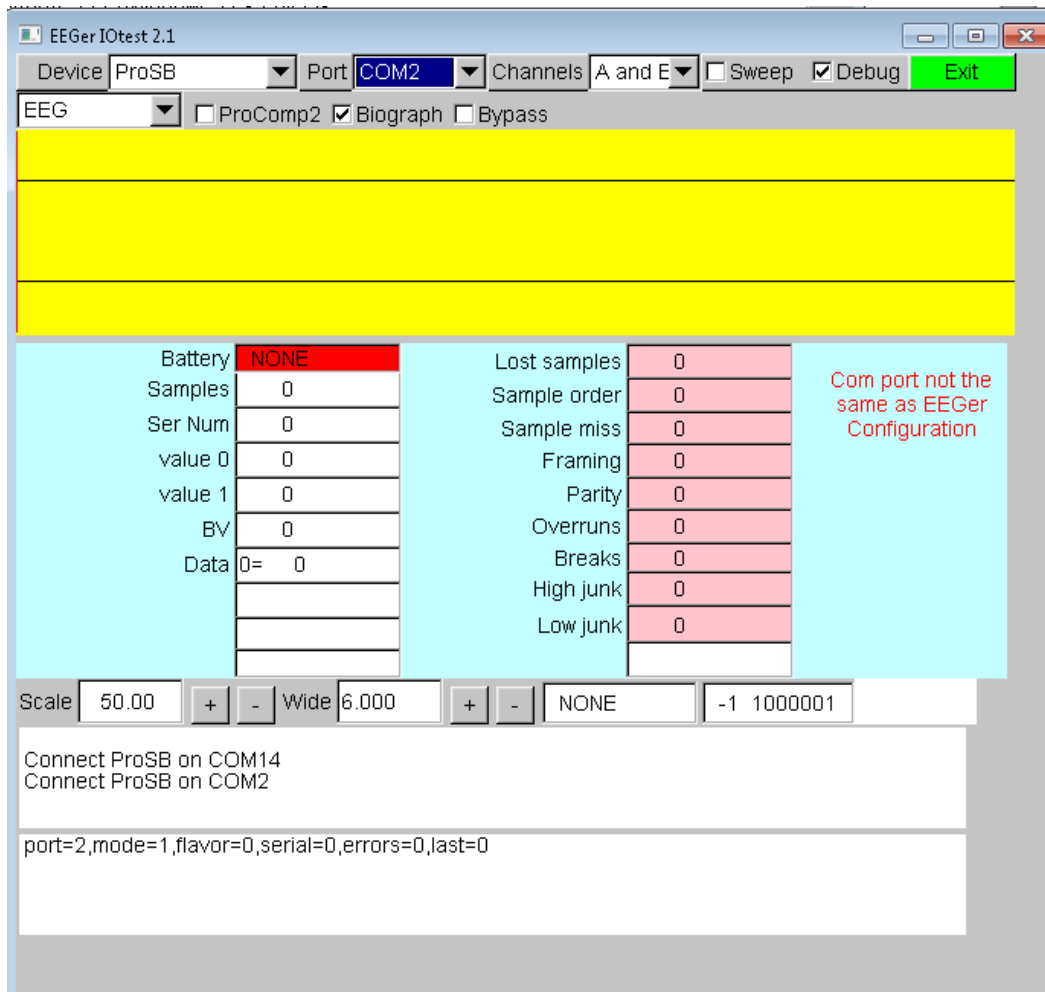
Numbers changing in the pink boxes and lack of updates to the yellow data indicate a settings issue.

If no numbers were changing and no connect error was reported, this would indicate some communication error between the device and the computer - usually a fiber connection or battery problem.

In any event, error messages at the bottom of the screen mean that the software was unable to communicate with the device. Please contact Technical Support for assistance in resolving the issue.

Appendix 11: Game Initialization Tool

The game initialization tool is the tool which searches the user computer for the special files which identify a "game definition".   A list of all the games discovered is then presented to the user for establishment of "option possibilities". By this, I mean the set of sound/picture/video files which the therapist will (later) be able to select from.

```
EEGer Game Discovery/Configuration Tool                          _|□|×|
4mation          830D (4mation)
skil             8350 (Games for adults)
alphatheta       830b (AlphaTheta)
boatrace         8312 (Boat Race)
boxlights        8309 (Boxlights)
chomper          8311 (EEG Chomper)
fmazes           830E (Mazes)
highway          8305 (Highway)
island           8306 (Island)
jumpbox          8308 (Jumpbox)
skil             8351 (Games for Kids)
longterm         8303 (Long Term)
skil             8352 (Morph Games)
spacerace        8310 (Space Race)
spect            8304 (Spectral Mirror)
tdhighway        830A ()
vmazes           830C ()
skil             8353 (Wanda)
skil             8354 (Word Games)




      Reset to base configuration    Delete highlighted entry    Done-Save Configuration
```

The "Reset to base configuration" button removes any user selections and reverts the definitions to the delivered base settings. Clicking this loses any user file/directory settings that may have been made.

The "Delete highlighted entry" button removes the currently highlighted game from showing on the game selection screen (and from use).

Double-clicking on a game line will give the specifics of each game definition.
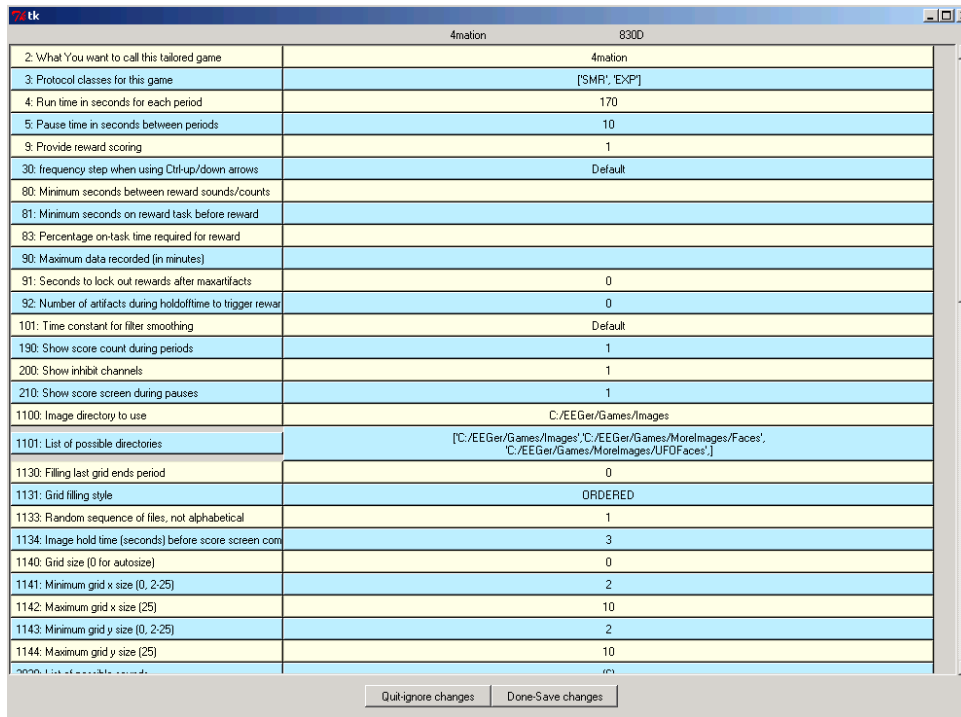
The user can add additional sounds, etc. to each definition using various browse/selection menus.

Selecting Done-Save Changes saves the specified selections for that game. Selecting Done-Save Configuration at the top menu saves ALL the game specifications for later transmittal to the therapist computer. The user can entirely delete games from ever being a choice on the therapist computer (until the next memory scan). During therapist setup, the saved specifications are sent to the therapist machine for "tailoring".

Appendix 12: Zscore

Support for Applied Neuroscience, Inc. (ANI) Z Score training is available in EEGer version 4.3 and later. These instructions provide directions to set up and activate the Z Scores feature in EEGer.

For Z Scores to function in EEGer, the following items must be valid:
- ANI biofeedback software must be installed **by the EEGer installer in the EEGer-specified location**.
- A valid EEGer license for Z Scores must be installed.
- A valid ANI passkey must be installed.
- A valid birth date must be entered for the client prior to training (since the ANI software needs client age).
- Valid site(s) and frequency ranges must be entered in the client's session plan prior to training.

● **Install EEGer4 software**
EEGer version 4.3 and subsequent program updates are available on CD from EEG Store or can be downloaded from the EEGer website: support.eeger.com. Follow instructions provided with the CD or on the website to install.

Be sure to check the option to *INSTALL THE ANI ZSCORE FILES* on the *Select Additional Tasks* display during the installation process.

● **Install the EEGer Keyblock File:**
1. Insert the *EEGer Keyblock File CD* in your CD/DVD drive.
2. If the contents of the CD are displayed automatically, close the window. You must load the key using EEGer.
3. Start the EEGer program. From the **Files** menu, select **Read EEGer Keyblock Files.**
4. Select the CD/DVD drive for the *Look In* field.
5. The updated keyfile is displayed on the Open dialog. Click the filename to select/highlight and click **Open**.

● **Obtain the Z Score Security Key from ANI**
- Start the EEGer program, if necessary.
- From the **Options** menu, select **Create ANI Biofeedback 2-Channel Key** or **Create ANI Biofeedback 4-Channel Key.** Accept the License agreement and the key screen appears:
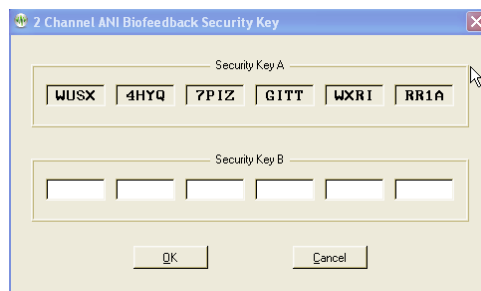
- **Contact ANI**.
    - Email **Security Code A** as it displays on your EEGer screen to **qeeg@appliedneuroscience.com** and cc: **rwthatcher@yahoo.com** (If you do not have access to email, please call EEG Store for assistance at **888-521-9803**)
    - Repeat steps 1 and 2 to enter the code they provide for **Security Key B**. Click **OK** to activate the new feature.

Applied Neuroscience, Inc. / 228 176th Terrace Drive / St. Petersburg, FL 33708
PHONE: (727)244-0240 / FAX: (727) 319-1027 / EMAIL: qeeg@appliedneuroscience.com

NOTE: The ANI Z Score Security Key is computer specific. If you install EEGer on another computer or have to recover after hard drive failure, you must contact ANI to obtain a new Security Key.

EEGer REWARD MODES FOR Z SCORES

In **Plan Session**, for the Z Score Setup stage, click the **Feedback** button to choose the desired mode. The mode can also be changed on the EEG training display by pressing **Shift+F3** to select a different reward mode.

ZComposite - reward is some combination of computed data as set during the options settings.

ZAsymm -   reward is standard deviation of absolute asymmetry for designated frequency band (2 channels)

ZCohere -   reward is standard deviation of coherence for designated frequency band (2 channels)

ZPhase -   reward is standard deviation of absolute phase for designated frequency ban (2 channels)

ZAbsPwrA - reward is standard deviation of absolute power from A site for designated frequency band

ZAbsPwrB - reward is standard deviation of absolute power from B site for designated frequency band

ZRelPwrA - reward is standard deviation of relative power from A site for designated frequency band

ZRelPwrB - reward is standard deviation of relative power from B site for designated frequency band

ZPRatioA - reward is standard deviation of power rations from A site for designated frequency band

ZPRatioB - reward is standard deviation of power rations from B site for designated frequency band

NOTE: For Z Score training, enter a second training site (Input ChB) even if using a single-channel feedback mode. If only one site is entered, a "site error" may appear on the EEG training or replay

screen. EEGer checks for a valid two-channel setup in case of a change to a two-channel mode while on the EEG training display.

NOTE: For 4-channel setups, channels C and D are also available.

EEGer automatically adjusts frequency bands when entering/exiting a Z Score feedback mode to match the closest standardized Z Score band.

Frequency bands	Enter this Reward Frequency Range in EEGer Plan Session (Hz)	Power Ratios	Enter this Reward Frequency Range in EEGer Plan Session (Hz)
Delta	1.0 - 4.0	Delta / Theta	1.0 - 4.0
Theta	4.0 - 8.0	Delta / Alpha	4.0 - 8.0
Alpha	8.0 - 12.0	Delta / Beta	8.0 - 12.0
Beta	12.0 - 25.0	Delta / High Beta	12.0 - 25.0
High Beta	25.0 - 30.0	Theta / Alpha	25.0 - 30.0
Beta 1	12.0 -15.0	Theta / Beta	12.0 -15.0
Beta 2	15.0 - 18.0	Theta / High Beta	15.0 - 18.0
Beta 3	18.0 - 25.0	Alpha / Beta	18.0 - 25.0
		Alpha / High Beta	35.0 - 37.0
		Beta / High Beta	37.0 - 39.0

Valid sites :

FP1	F7	C4	O1	T5
FP2	F8	Cz	O2	T6
F3	Fz	P3	T3	Pz
F4	C3	P4	T4	

 4.3.0

Review Options:

EEGer **Review** includes additional options for viewing data from sessions recorded using a Z Score reward mode.
Files can be exported in EDF+ format for analysis in ANI's NeuroGuide or other software that can import EDF+ format.

Site and Frequency Settings: When a Z Score feedback mode is selected for training, EEGer checks the selected site(s) and frequency against the available Z Score options. A message is displayed for invalid site(s). There must be two channels of EEG data for some of the options. For frequency, the Reward band is adjusted to the closest valid Z Score range.

Feedback Mode: To change the feedback mode, press **Shift+F3**. Use the arrow keys to move to the desired mode and press + to activate. EEGer must confirm the sites and frequency again if a Z Score mode is selected.

Appendix 13: Editor

EEGer contains a primitive text editor to allow notes and observations to be recorded during a feedback session (live or replay), client data review, and spectral data review. A typical screen looks like this:
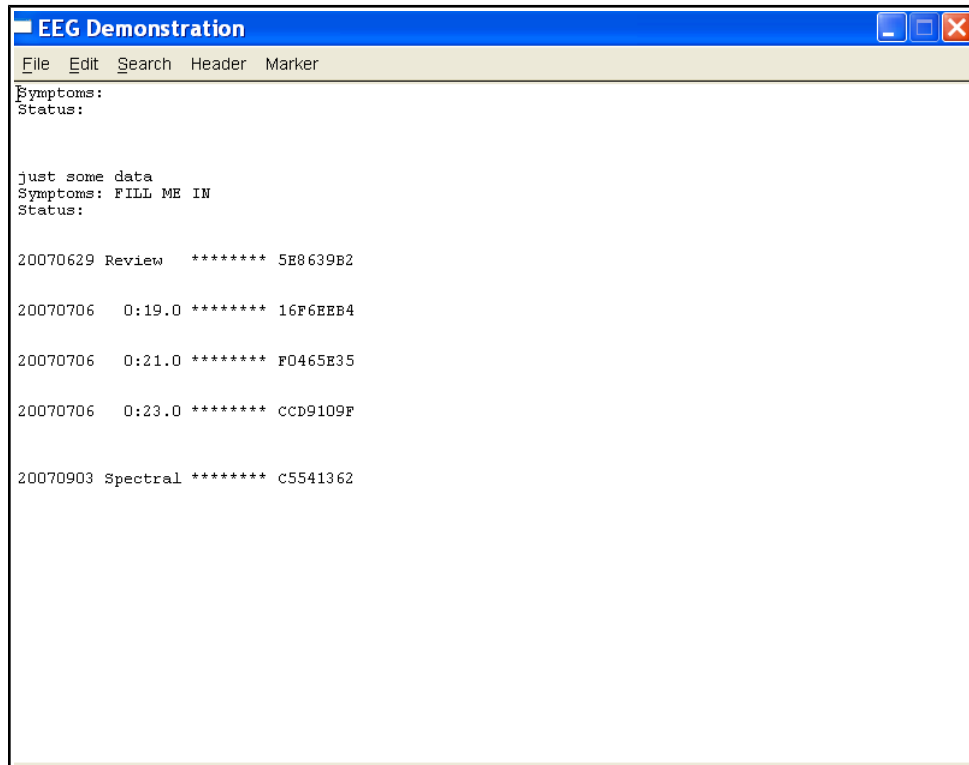
The client "name" is shown on the top line (subject to HIPAA settings). The "Header" button pastes in the boilerplate file (specified by editing it from the "Preferences" menu) at the current cursor location. The "Marker" button pastes in a line of text with the date/time information. Also on the marker line is the relative session time (for live/replay sessions) or "Review" or "Spectral" to show when the marker was inserted. The remaining information (those letters/numbers on the marker line) are encoded information as to when the marker was "actually" created so that annotations can be forensically determined. However, the marker and header data is just text and can be deleted like any other text.

The editor is commonly started using F8 from wherever possible. It can be closed (and data saved) using F8, File->Exit, or clicking on the "x" in the upper right corner. The data is ALWAYS saved when the editor is closed. It is not possible to abort saving the data.

Appendix 14: (Manual) Alternate Images for 4mation

Technical Support
Installing Alternate Images for *4mation*

This is the "manual" procedure for adding images to 4mation. There is also an added utility (Image Installer) now available which is simpler. Please see that appendix for instructions.

You can customize your game setup to use different **Bitmap** (.bmp) ,**JPEG** (.jpg) , or **PNG** (.png) format images with the *4mation* Neurofeedback Game. These instructions describe how to use copy & paste commands to make the images available and how to tailor the game options to take advantage of the new images.

NOTE: The Game computer is the one you use to run games. It can either be your single-computer system or the Game/Client computer of a 2-computer system.

There are methods for adding images to *4mation*:

METHOD	DESCRIPTION	STEPS TO FOLLOW
1	Add images to those installed by the EEGer/EGS installation to display along with the original pictures.	● COPY IMAGES ● PASTE IMAGES (Method 1)
2	Create separate image folders on a local hard drive or mapped network drive to display different sets of pictures.	A. COPY IMAGES B. PASTE IMAGES (Method 2) C. CUSTOMIZE D. CHOOSE CUSTOM IMAGES
3	Use a removable USB Flash drive that contains images. (NOTE: You cannot use a CD for optional images since the pictures cannot be accessed quickly enough when the game is running.)	● CUSTOMIZE ● CHOOSE CUSTOM IMAGES

Game Customization Options
When you have images in separate folders on your hard drive or on a removable USB Flash drive, there are additional options for using the alternate images. Directions for each option are detailed in Step D.
   Option 1: Change images for the current session only
   Option 2: Change images for all sessions of *4mation*
   Option 3: Create separate game definitions to choose images when you run a *4mation* session

A. COPY IMAGES FILES TO PLACE IN AN IMAGE FOLDER
   For both Method 1 and Method 2, to add image files or use a different set of images from the hard drive, you must first select the files to copy to the hard drive.
   1.   Insert an image CD or USB Flash drive into the Game computer.
   2.   Double-click the My Computer icon on the Game computer's Windows Desktop (or select Start-My Computer).

EEGer4 Operator Manual

3.   Double-click the CD or USB Flash drive letter to display the contents of the drive.
4.   Disk contents are usually displayed by Icon. From the View menu, select Details to list the files by Name. You can click on any "Header" above the columns to sort by Name, Type, etc.
5.   Left-click on the first file you want to copy to highlight the name.
6.   Hold down the Shift key and left-click on the last file you want to copy. This will cause all files in between to be selected. (Note: Ctrl + left-click will select/deselect individual files, in case there are certain files you don't want to copy).
7.   Go to the Edit menu and select Copy (or press Ctrl+C).
8.   Click the Back button in the toolbar to return to the list of drives on the computer.
9.   Follow the instructions for the appropriate Method in Step B to make the make the files available for *4mation*.

B. PASTE IMAGE FILES INTO AN IMAGE FOLDER

Method 1: Add Images to the Original *4mation* Pictures
1.   Double-click the C: drive, which is often named "Local Disk".
2.   Double-click the EEGer folder (c:\eeger).
3.   Double-click the Games folder inside the EEGer folder (c:\eeger\games).
4.   Double-click the Images folder within (c:\eeger\games\images).
5.   Go to the Edit menu and select Paste (or press Ctrl+V). This will copy the Bitmap (.bmp) or JPEG (.jpg) files you've selected to add to the original *4mation* images.
6.   Repeat Step A and Step B until you have all of the desired images in the new location.

Method 2: Copy Images to a New Folder for Customized *4mation* Displays
e.   Double-click the C: drive, which is usually displayed as "Local Disk (C:)".
f.   To create a new folder on the C: drive, go to the File menu and select New, then choose Folder.
g.   When the New Folder is created, simply type the name you would like to use for the folder. For example, create a folder named "EEGerImages".
h.   At this point, you can either proceed with the steps to place the images in this folder, or create a sub-folder to separate images for multiple choices.
For example:
    i.   Double-click the EEGerImages folder you just created.
    ii. Go to the File menu and select New, then choose Folder again.
    iii. Type in the name of the sub-folder. For example, "Animals" or "Cartoons".
d.   Once you've created the folder where you want the files, double-click that folder to display the empty contents. (For example, double-click either c:\EEGerImages or c:\EEGerImages\Animals).
e.   Go to the Edit menu and select Paste (or press Ctrl+V). This will create a copy of the Bitmap (.bmp) or JPEG (.jpg) files you've selected to use when customizing the *4mation* images.
f.   Repeat Step A and Step B until you have all of the desired images in the new location.
g.   Next, you must perform Step C to customize the image sources for the *4mation* game.

C. CUSTOMIZE *4mation* TO ADD OPTIONAL IMAGE SOURCES
To configure *4mation*, the image folder must exist prior to customizing game options. Either create the folder (refer to Step B) or insert a USB Flash drive, so that the correct image location is available for customization. (You can use any USB Flash drive to configure the software; it is not necessary to have valid image files available at the time you perform these steps.)

●   On the computer that will display the games, open the **Game Initialization Tool**. [Select *Start-All Programs*. Choose the *EEGer* folder, then *Game Initialization Tool*.]
●   Double-click *4mation*.
●   Locate the entry for "***List of possible directories***". Click either the left or right column to select the "button" to edit the directory choices.
●   Click the button labeled *"**Add**".*

- Select the correct drive letter under ***Drives:*** (For example, c: or e:)
- Enter or select the correct pathname to display for ***Directory name:*** (For example, C:\EEGerImages\Animals or E:\)
- Click **OK** to save the directory to the list of available choices.
- Repeat steps 5-7 until you've selected each possible image location.
- Click **Done** when finished adding directories.
- Click **Done-Save changes** to finalize the available choices for *4mation*.
- Click **Done-Save Configuration** to complete the changes for game setup.
- Finalize the changes for the Therapist software.
    - i. Single Computer: Select **Tools-Tailor Installed Games** and click **SAVE All Games**.
    - ii. Two-Computers: Select **Tools-Retrieve Installed Games** then select **Tools-Tailor Installed Games** and click **SAVE All Games**.

D. CHOOSE CUSTOM IMAGES

Option 1: **Change images for the current session only**
- Select the client and click **Begin Session**.
- On the game selection screen, click the **Edit** button next to ***4mation***.
- Scroll down to find "***Image directory to use***" in the left-hand. Click either the left or right column to select the "button" to edit the directory choice.
- Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).
- Click **OK** to save.
- Click ***Use these changes for this game run*** to confirm your choice.
- Select ***4mation*** to start the session.

Option 2: **Change images for all sessions**
1. Select **Tools-Tailor Installed Games**.
2. On the Edit Game Definitions screen, click the **Edit** button next to ***4mation***.
3. Scroll down to find "***Image directory to use***" in the left-hand. Click either the left or right column to select the "button" to edit the directory choice.
4. Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).
5. Click **OK** to save.
6. Click ***Replace Selection with changes*** to confirm your choice.
7. Click ***SAVE all games***.
8. Choose ***4mation*** when you run a session.

Option 3: **Create a separate game definition with different images**
1. Select **Tools-Tailor Installed Games**.
2. On the Edit Game Definitions screen, click the **Edit** button next to ***4mation***.
3. The first line is "***What You want to call this tailored game"***. Click either the left or right column to select the "button" to edit the name.
4. Enter a name that will help you identify the choice (e.g., "4mation Animals" or "4mation on USB") then click **OK** to save.
5. Scroll down to find "***Image directory to use***" in the left-hand. Click either the left or right column to select the "button" to edit the directory choice.
6. Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).
7. Click **OK** to save.
8. Click ***Create a new selection*** to create a copy of the default game setup.
9. Click ***SAVE all games***.
10. Choose the ***4mation*** name you just created when you run a session.

Other Items to Note:

1. If there are no Bitmap (.bmp) or JPEG (.jpg) or PNG (.png) files in the chosen directory, the *4mation* game will not run.

2. Take care when setting up to use different directories and customization if you use different game computers. If you run both single and two-computer setup, you may need to create image folders on both systems and it's easier if you use the same folder name to take advantage of custom settings.

3. When customizing the image source, look over the other game options you can use. For example, you can fill in the grid with Ordered or Random squares when displaying images.

Appendix 15: Game Tailoring Options

All tailoring options have a unique number (prefix). Each unique number refers to a specific function which is common to all games which have that option. Not every option is present or available for every game.

2: What You want to call this tailored game

This is the text that appears on the Therapist selection screen and NOT what appears on the client Game Menu.

3: Protocol classes for this game

Selects which protocol classes this game is available for. Usually SMR and EXP since there is only one Alpha-Theta game.

4: Run time in seconds for each period

The length of each run period. Note that mazes and 4mation (among others) have the option to terminate a period when the 'game' completes. Default is 170 seconds.

5: Pause time in seconds between periods

This is the rest time between run periods. Default is 10 seconds.

9: Provide reward scoring

This option allows reward scoring (beeps) to occur.

30: Frequency step when using Ctrl-up/down arrows

Selects the frequency step size when changing reward frequencies. Note that this only works if you have selected a filter set in the Setup settings that supports the step size.

80: Minimum seconds between reward sounds/counts

Sets the minimum time between possible reward counts/beeps.

81: Minimum seconds on reward task before reward

Sets the minimum time that a rewardable state must be maintained before a reward/beep is commanded. Setting this too long will make rewarding very difficult since the measure is CONTINUOUS rewardable state. This action can be turned on/off during a session using the Ctrl-F2 option.

83: Percentage on-task time required for reward

Sets the minimum overall reward percentage to be maintained before a reward/beep is commanded. This action can be turned on/off during a session using the Ctrl-F2 option.

90: Maximum data recorded (in minutes)

Specifies how much storage is reserved for a session. Only this much data will be recorded. The maximum time is 90 minutes for a session. This time starts when the realtime session begins and ends when the realtime session exits.

91: Seconds to lock out rewards after maxartifacts

This specifies how long to monitor for artifacts and how long to inhibit rewards when the artifact count is exceeded. Intended to keep clients from artificially increasing the number of points scored by deliberately causing artifacts.

92: Number of artifacts during holdofftime to trigger reward lockout

Sets how many artifacts during the above specified time triggers the artifact reward inhibit.

101: Time constant for filter smoothing

Selects filter smoothing time constant. Usually 0.5 seconds. Larger values slow down reward/inhibit responses.

190: Show score count during periods
Display/not display the score count DURING a period.

200: Show inhibit channels
Display/not display inhibit data (if game supports this). In any case, no inhibit data will be sent anyway to the game is this is set to 0.

210: Show score screen during pauses
Show/not show score screen during pauses.

1080: Colorset to use for game frequency-specific colors
Specify which user-configured color set to use. Only spectral mirror and long-term displays use this at the current time.

1090: Mode used for spike detection
One of the spike detector modes. Available modes are:

>   Disabled
>   In Period   - display on therapist display, sound triggered on game if in feedback
>   Always   - display on therapist display, sound triggered on game at any time
>   Just Show - display on therapist display

1091: Seconds to wait after spike to see if its really artifact
How long to wait after spike to see if its really an artifact.

1100: Image directory to use
Specify which image directory to get pictures from.

1101: List of possible directories
(Game Initialization Tool) Selection of possible directories to use at tailoring time.

1130: Filling last grid ends period
Option to end a period when the grid/picture completes.

1131: Grid filling style
Select grid fill mode – Ordered (left to right, top to bottom), Random, Weighted (random first grid selection then fill adjoining grids).

1133: Random sequence of files, not alphabetical
Specify random ordering of files.

1134: Image hold time (seconds) before score screen comes up
Specify how long a completed image is displayed before (possible) score screen appears.

1140: Grid size (0 for autosize)
A non-zero value forces a MxM rectangular grid for every image. Zero value picks random width/height sizes between specified limits below.

1141: Minimum grid x size (0, 2-25)
1142: Maximum grid x size (25)
1143: Minimum grid y size (0, 2-25)
1144: Maximum grid y size (25)
1145: Show first element of reveal at beginning
(dkgames) Shows first piece of a grid before the first reward.

1146: Show game rule conditions
(dkgames) Displays rule conditions during menu display.

1150: Seconds needed to remain on task
(Jumpbox) Maximum seconds allowed between rewards to keep chip moving.

1164: Swap alpha and theta sounds
(Alpha-Theta) Swaps water/ocean sounds.

1165: Transition rate for alpha/theta state change
(Alpha-Theta) Selects transition rate for state change. This can also be changed during A-T sessions using the volume control popup.

1166: Option to use highest reward percentage instead of Theta bias
(Alpha-Theta) Use highest reward percentage to choose reward sound rather than Theta if both bands are in rewardable state.

1167: Optional transition percentage from edge for faster transition rate
(Alpha-Theta) Allows selection of faster (doubled) change rate when within selected percentage of either extreme of alpha or theta state.

1170: 1 for classic game appearance, 0 otherwise
(Boxlights, Jumpbox, Highway, Island)

1171: 1 for warm, 2 for cold, 0 for color dependency
(Boxlights, Jumpbox, Highway, Island)

1172: 1 for frog image instead of boring black bars
(Jumpbox)

1173: Number of peripheral thermometers to display
(Jumpbox, Boxlights, Highway, Island)

1180 : Use random point for iris center
(Iris) Use random point for Iris center instead of screen center.

1181 : Color to use for reward 1
(Iris) Select color of mask to use for first reward.

1182 : Color to use for reward 2
(Iris) Select color of mask to use for second reward.

1183 : Color to use for reward 3
(Iris) Select color of mask to use for third reward.

1184 : Color to use for reward 4
(Iris) Select color of mask to use for fourth reward.

1190 : Use a fixed color background instead of pictures
(Iris)

1191 : Select color of fixed background
(Iris)

1200: Timer for expected reward rate
(dkgames) Seconds allowed between rewards before previous image pieces are UNdisplayed. This action can be toggled on/off during a session using the S popup menu.

1301: Not show happy face at completion of maze
(Mazes)

1302: Starting maze index
(Mazes)

1303: Use mazes in random order instead of sequential
(Mazes)

1402: Draw longterm display lines double-high
(longterm)

1403: Time width of long-term window
(longterm)

1410: Smoothing factor
(longterm,Iris) Smoothing factor for data changes

1411: Scale factor for Iris
(Iris) Controls relative sizing of iris.

1700: Which artwork to use as overlay (0-3)
(DVDGame) Which overlay image to use for overlay mode.

1701: What kind of video control to use
(DVDGame) Options are OVERLAY, BLUR, BLACK, WHITE

1702: Time (seconds) to go from worst to best video
(DVDGame) How long to transition from complete obscuration to completely clear video when in a rewardable state.

1703: Time (seconds) to go from best to worst video
(DVDGame) How long to transition from completely clear to completely obscured when NOT in a rewardable state.

1704: Minimum worst video percentage
(DVDGame) Worst obscuration percentage (video will never be obscured more than this percentage).

1706: Percentage of border size
(DVDGame) (not currently used)

1707: Pause video during pause
(DVDGame) Pause DVD playback when ever in PAUSE or STAGE state.

1708: Enable feedback sounds in addition to DVD soundtrack
(DVDGame) Provide normal EEGer sound feedback in addition to DVD sound. This includes reward sounds as well as all the other sound modes.

1709: Action to take if DVD is not playing (time running)
Decide to pause/not pause feedback if DVD reports not running.

2020: List of possible sounds
(Game Initialization Tool) List of possible sound files to select during tailoring.

2021: Pathname of reward sound
Full path of selected reward sound.

2023: Which L/R speaker the reward sound comes from
Sounds can come from the Left/Right/Both/Alternating speakers.

2024: Pathname of success sound
Full path of success sound for games which have a "success" condition.

2025: Which L/R speaker the success sound comes from
Sounds can come from the Left/Right/Both speakers.

2026: Maximum seconds for alternating reward sounds
If Alternating sounds was selected, specifies how many seconds from beginning of period that the alternation continues. After that time, sounds come from Both speakers.

2029: Sound channel for spike sound
Sound channel number for spike sound.

2030: Pathname of sound 3
Full pathname of a sound file

2031: Sound 3 play mode
Sound play modes are described in the Sound Controls appendix of the documentation.

2032: Which L/R speaker sound 3 comes from
Sounds can come from the Left/Right/Both speakers.

2033: Which strand feeds sound 3
Specifies which data path controls the sound action. This is described in the Technical Manual.

2034: Pathname of sound 4
2035: Sound 4 play mode
2036: Which L/R speaker sound 4 comes from
2037: Which strand feeds sound 4
2038: Pathname of sound 5
2039: Sound 5 play mode
2040: Which L/R speaker sound 5 comes from
2041: Which strand feeds sound 5
2042: Pathname of sound 6
2043: Sound 6 play mode
2044: Which L/R speaker sound 6 comes from
2045: Which strand feeds sound 6
2046: Pathname of sound 7
2047: Sound 7 play mode
2048: Which L/R speaker sound 7 comes from
2049: Which strand feeds sound 7
2050: Pathname of sound 8
2051: Sound 8 play mode
2052: Which L/R speaker sound 8 comes from
2053: Which strand feeds sound 8
2060: 6 comma-separated overall percentage enable points
2160: Sound file for alpha reward
Pathname of Alpha-Theta alpha reward (high-pitched bell)

2161: Sound file for theta reward
Pathname of A-T theta reward (low-pitched gong)

2162: Sound file for alpha state

Pathname of A-T alpha state (running stream)

2163: Sound file for theta state
Pathname of A-T theta state (ocean waves)

3000: Maximum number of strands to use
Reserved

3001: Maximum number of inhibit channels to use
Reserved

3002: Maximum number of reward channels to use
Reserved

3003: Maximum number of sounds to use
Reserved

4888: (GTOOL ONLY) Game name title order
Controls display order on the Client game menu

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Appendix 16: Coherence

These instructions provide directions to activate and configure Coherence training modes.

For Coherence training, the following items must be valid:
- A valid EEGer license for Coherence training must be installed.
- All modes use two channels: Channel A and B or C and D; 2 signal, 2 reference and either 1 shared ground or 2 ground electrodes (dependent upon amplifier model). *ProComp/Infiniti amplifiers: An additional part, the FlexPro pre-amplifier, is necessary to utilize Channel B.*

Note: All recent versions of EEGer support the coherence modes automatically. If using some early version that does NOT have coherence enabled, please contact Customer Support for the enabling keyblock.

A. Select a Coherence training mode in Plan Session
- **Select Client** for Coherence training.
- Click **Choose Layout** to choose the number of traces for the EEG display, except 8-trace Layout (Dual mode training layout).
- Click **Plan Session**.
- In the **Setup** stage, enter the sites for Input **Chan A** and Input **Chan B**.
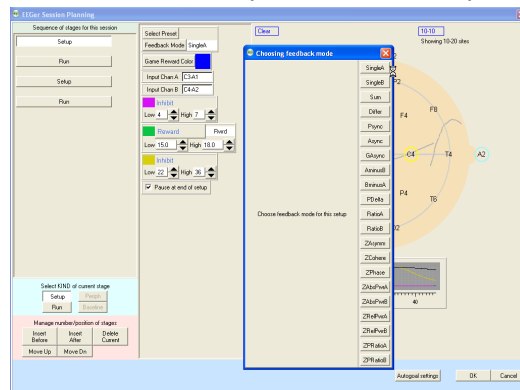
- Click **Feedback Mode** at the top of the middle column to display a menu of options. Click the appropriate button to select the Coherence mode. Common modes are :
  - **Psync** Comparison between filtered A and B envelopes (formerly Synchrony)
  - **Async** Comparison between filtered A and B envelope slopes (formerly Comodulation)
  - **GAsync** Comparison between lowpass A and B envelope slopes (formerly Global Comodulation)
  - **AminusB** Difference between filtered A and B envelopes
  - **BminusA** Difference between filtered B and A envelopes
  - **PDelta** Comparison of phase difference between A and B signals
  - D/S-Ratio Ratio of (A-B) to (A+B)
  - **Unity** Compute 1-|(A-B)|/(A+B) similar to **D/S ratio** except absolute value

- Enter other relevant details for Setup and Run stages and click **OK** when finished.

B. Begin Session
- Apply sensors to the appropriate sites and connect to ChA and ChB of the amplifier.
- Set scales and thresholds and press **F5** to run the session.
- To change the Coherence training mode during training, press **Shift+F3** for a menu of choices.
  It is suggested that you make changes to the session plan prior to the arrival of your client.

SET UP A COHERENCE TRAINING SESSION

- Once EEGer is launched, select your client and go to the **Plan Session** screen.

- Click **Feedback Mode**. You should get a long vertical list of choices.

- Choose **Psync**. Make sure that Psync is what now displays in the box directly next to the Feedback Mode box.

- Coherence training requires input from 2 channels so make sure that you set up both Channel A and Channel B on your amplifier. While on the Plan Session screen enter the site in the Input Chan A box (for example C4-A2) and the site in the Input Chan B box (for example C3-A1). These sites should be derived from a qEEG report.

- Using the bandwidth information provided in the qEEG report; enter the numeric values for the frequencies that need coherence training in the REWARD band (for example "increase coherence in the 8-11 Hz range").

- Click the button labeled **Reward** to select the appropriate mode for the type of coherence training to be performed. If you wish to <u>INCREASE</u> coherence, choose **Rwrd**. If you wish to <u>DECREASE</u> coherence, select **Down** and the box next to the REWARD box changes to Down.

NOTE: Coherence training is performed using the REWARD frequency band(s). Any Inhibit bands in the selected layout can be set to values based on your training or according to information in the QEEG report. The inhibit frequencies may overlap the reward/coherence frequencies to any degree.

- Set the RUN time for the length of time you wish to do coherence training.

RUN A COHERENCE TRAINING SESSION

1. Go to **Begin Session** and select a game.

2. At the bottom of the Therapist screen you should see the word **Psync**. This confirms that you set up the training mode correctly and are properly licensed to run coherence training.

    - Press the **Page Down** key until you highlight the Reward band.

    - Once the Reward band is highlighted press **F9**; the Scale number in the Reward band should now be highlighted.

    - Use the **–** or **+** keys to change the scale to **2**. Press **Enter** twice to de-select.

NOTES:

    - While running a coherence session, the signal in the Reward band does not look like a typical EEG signal, it is a smoother line that goes UP when the two signals (Channel A and Channel B) are MORE coherent and DOWN when they are LESS coherent. The number next to the AVG under the Reward band now represents the numerical value of coherence, not amplitude. Perfect coherence shows as 10. (While increased coherence may be the goal, perfect coherence is not necessarily ideal for achieving optimal performance.)

    - Typically you can set the % Above numbers in the Reward band (now functioning as the coherence band) at 70%-80% to provide adequate information about the level of coherence. Set the inhibit band % Above numbers based on previous sessions or in a way that gives enough information about the frequency you are choosing. (This is a clinical judgment issue.)

Instructions prepared and reviewed by Joy Lunt, R.N., BCIA-EEG Fellow; Harold Burke, Ph.D., BCIAC; Gary Schummer, Ph.D.

 4.3.0

Appendix 17: Protocol Transfer Utility

Purpose of the utility

This utility program exists to allow transfer of EEGer Session Plans and Presets between clients and between clinicians.

Session plans are comprised of a series of setup stages (setting frequencies, electrode sites, modes, etc.) and run stages (time to run at the previous setup).

Presets are comprised of single setup stages that can be entered into a session plan from a selection menu. They have all the same settings/values that a setup stage in a session plan can have and are intended to speed up creating custom session plans for a client. Presets are organized by protocol class and by layout.

Session plans can be packaged (by the utility) into tiny compressed files. These files can then be (re)loaded as either default session plans or session plans for specific clients. They can also be transmitted via email or downloaded (from some TBD site) and installed on any clinician's system (and then installed wherever). The limitation is that the plans are "Layout-specific" meaning that you cannot load a 5-trace layout plan into a 6-trace layout (but I handle that internally).

Presets can be gathered up and packaged (by the utility) into tiny compressed files. The presets can then be added to existing presets, either for the same protocol class or for a related class (AT presets NOT allowed in SMR, for example). They can also be transmitted via email or downloaded (from some TBD site) and installed on any clinician's system (and then installed wherever).

Installation
The utility is available from support.eeger.com (Click on the Downloadable Files and Updates page). It may already be preinstalled with EEGer.

The utility is installed just like other installation programs – start it and acknowledge the prompts. The only option during installation is whether or not a desktop icon is created for the utility.

Starting the utility

Click on Start->All Programs->EEGer->Protocol Transfer Utility or Double click on the desktop icon. Recent EEGer versions also have a start option under the Utilities menu.

Usage

There are six option buttons on the main screen:

Install Session Plan for a Client
Install Session Plan as a Default Session Plan
Install Presets
Create Installable Session Plan from Existing Client
Create Installable Presets from Existing Presets

I would like to believe they are self-explanatory but the detailed procedures are described following.
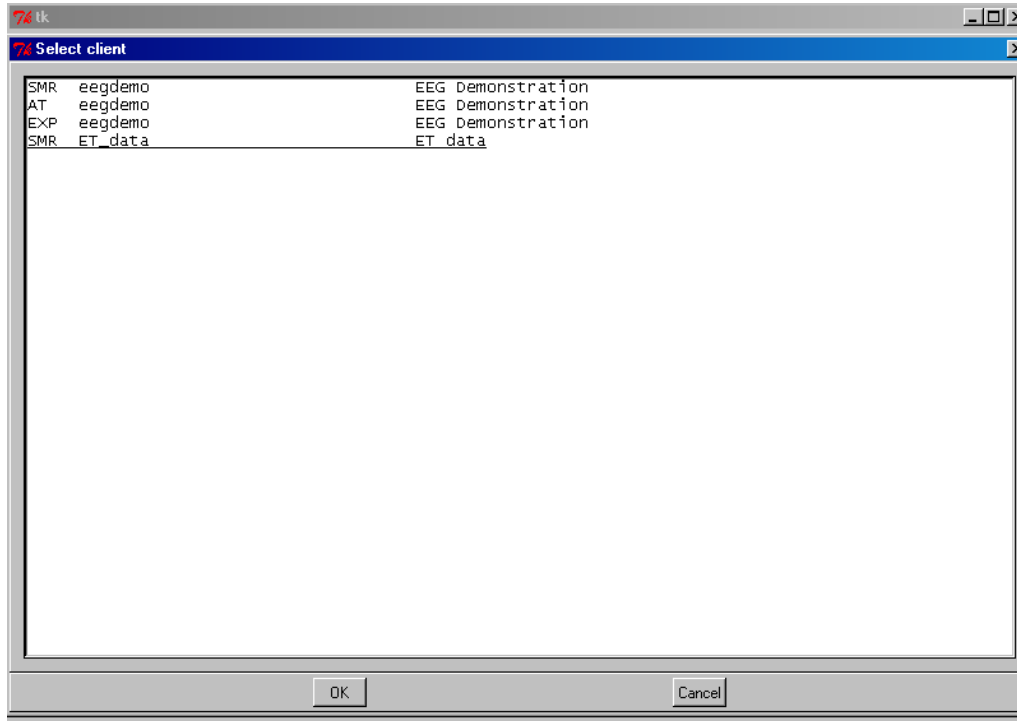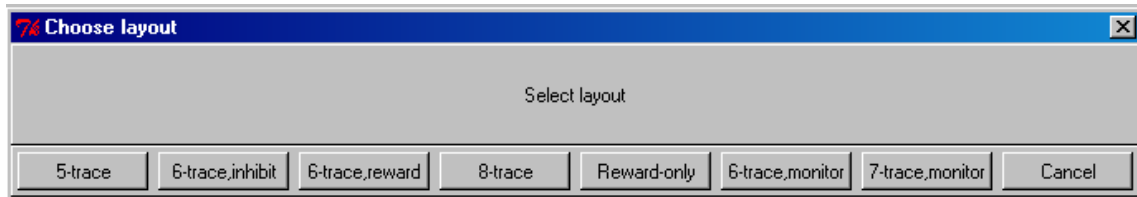
The main menu looks like this:

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The first process to discuss is creating an installable session plan to use.

Clicking on "**Create Installable Session Plan from Existing Client**" brings up a client selection screen just like in EEGer:

At this point select the client/protocol class you want to draw a session plan from. The next screen

lets you select which layout the session plan is drawn from. The plan itself is unmodified – only a copy is made. Then, you enter a descriptive line (such as why this is a great session plan):
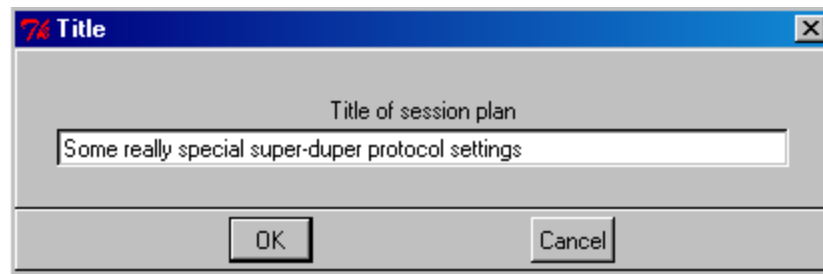
Now you select a file name for the file (which should help in selecting such a file later):
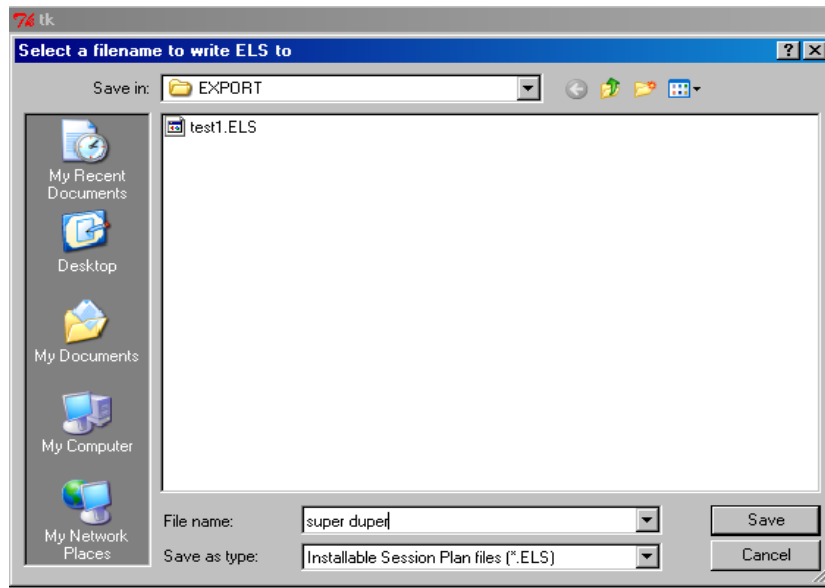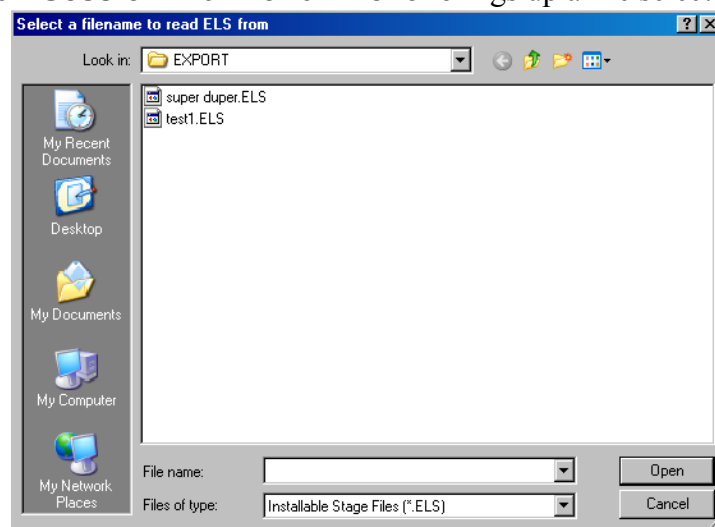
The default location for these files is C:\EEGer\Export but you can save them anywhere you like.

Next -

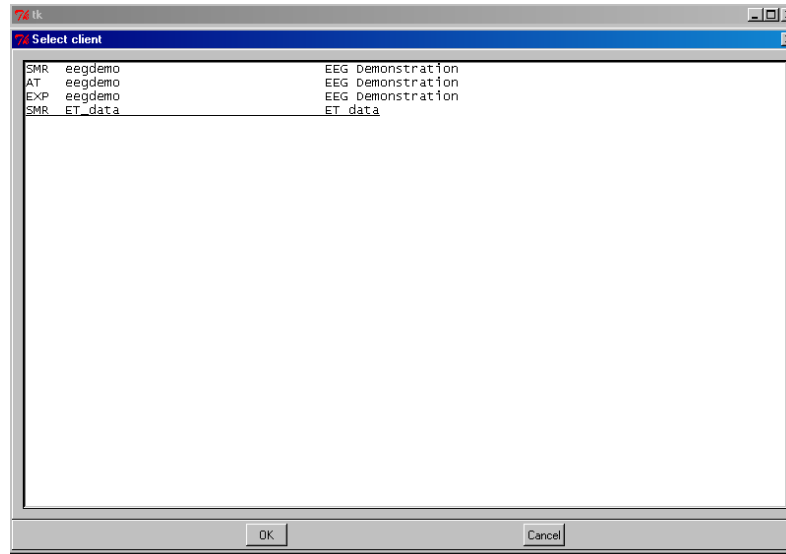Now that we have an installable session plan, let's install it.

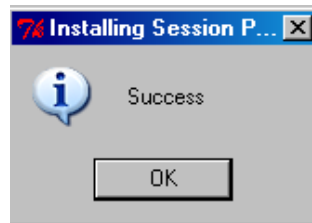Clicking on "**Install Session Plan for a Client**" brings up a file selection menu:

Selecting (double click or select and click on Open) a file lets the utility validate that it IS a valid session plan and then brings up a client selection menu for you to select the **recipient** client for the session plan.:
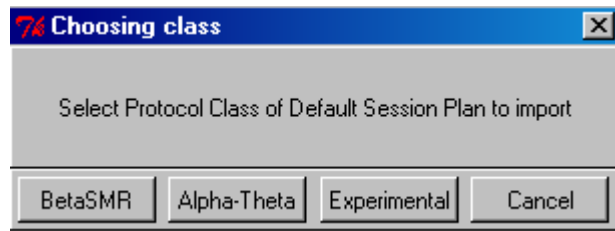

After selecting the client -

If you want to install a session plan as the "default" plan, click on "**Install Session Plan as a Default Session Plan**". This brings up the plan selection screen:
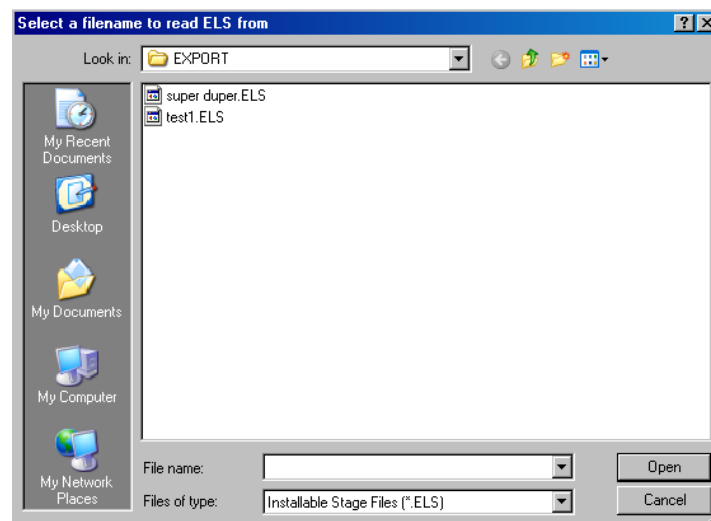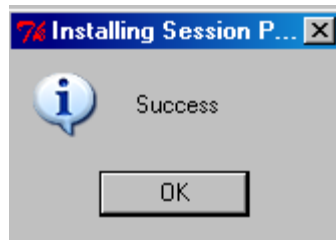
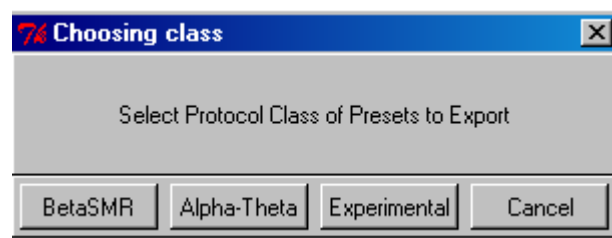After selecting a plan, the default destination selection screen comes up:

After picking the desired compatible protocol class -

To create an installable presets file, click on "**Create Installable Presets from Existing Presets**" from the main menu.

Then choose the protocol class to export from.

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You then get a list of the layouts for that protocol class:
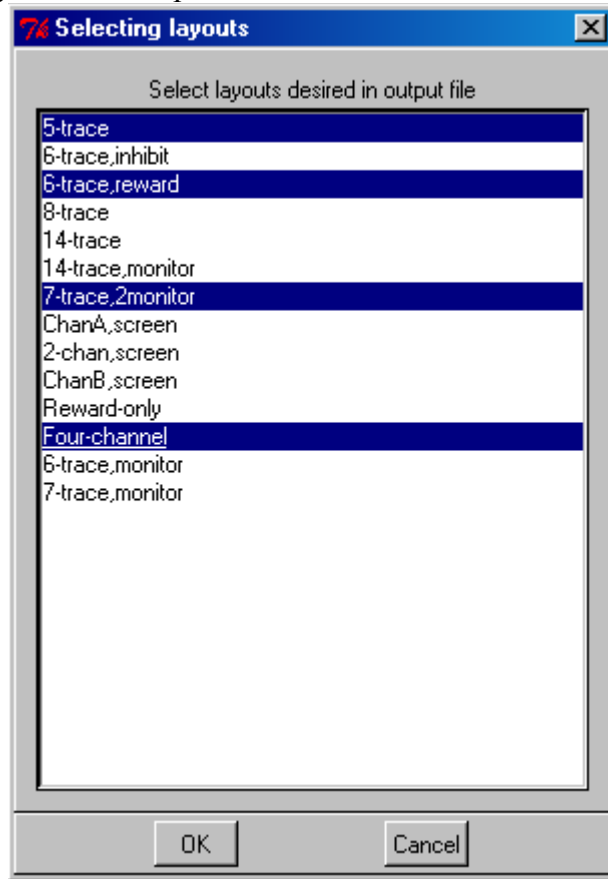
You can select one or more of the layouts to export presets from (Ctrl-click for more than one).

When done selecting layouts, click OK and the following screen comes up:
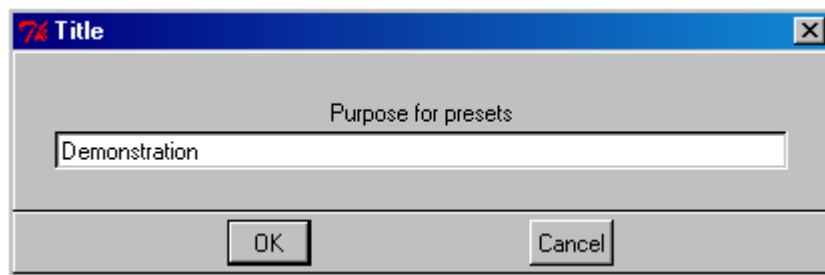
Enter something useful as a reminder.

Clicking on OK brings us to the export file naming screen:
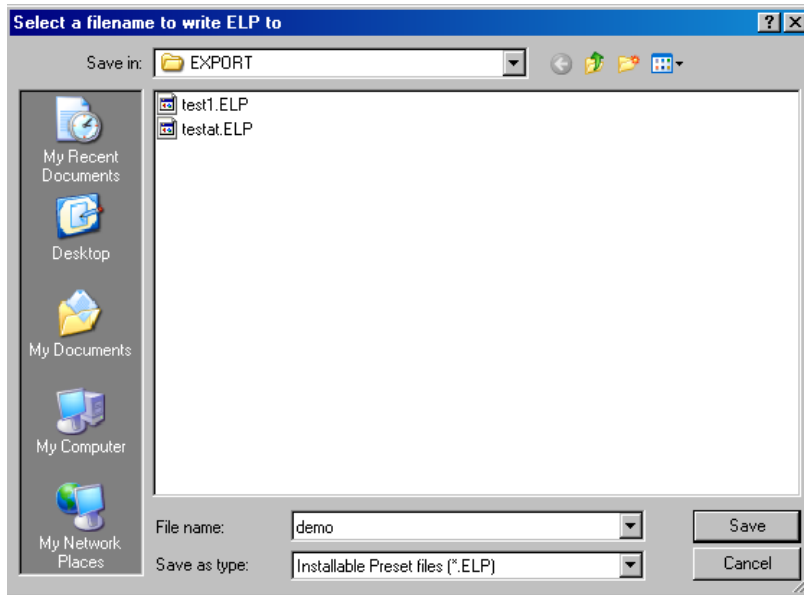
It is usually better to pick a (short) descriptive file name so you can recognize it later.

Then, of course:
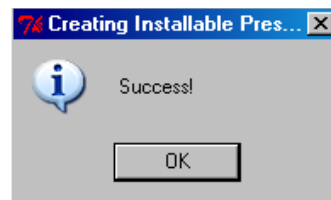
To actually install presets, click on "**Install Presets**" from the main menu. A file locator screen appears:
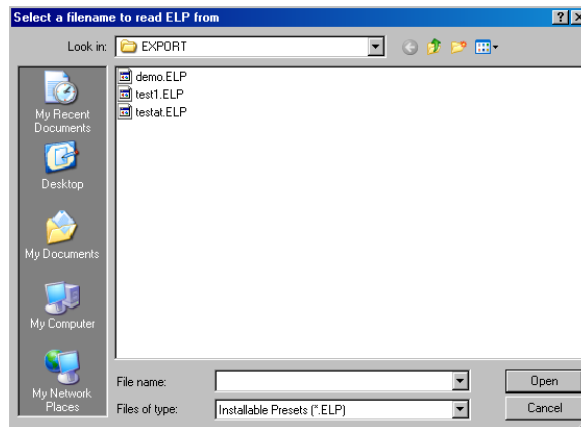
After selecting a presets file, the following choices are available:

Normally, you will then get :

You may also get :

This means you had all the presets in the file already existent in your presets for that protocol class.

Appendix 18: Image Installer Utility

Instructions for the Image Install Utility for 4mation

This utility program copies images (for 4mation to use) from **YOUR** folder of pictures to someplace that 4mation can find/use them. It also adds the new folder (location) into the choices of picture folders for 4mation (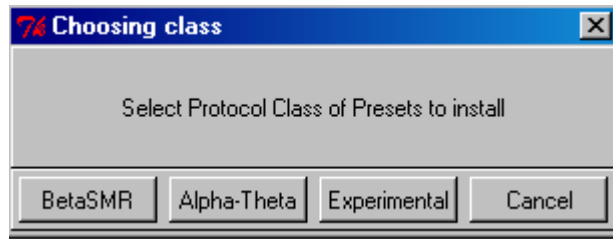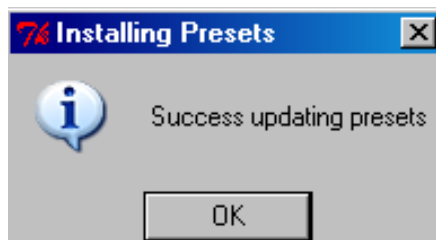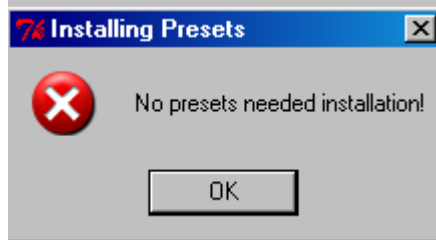so they can be selected at tailoring time). It is not completely automatic (you have to specify from/to locations and still run the EEGer Game Initialization Tool and such) but you only need to click the Done/Save buttons. Also, remember that the pictures need to be installed on the computer that has the game screen attached (on a 2-computer system, that would be the game computer).

The utility is available from support.eeger.com (Click on the <u>Downloadable Files and Updates</u> page). It may also be pre-installed in EEGer.   Once installed, the utility itself can be started from the Start menu (EEGer->Image Installer). Recent EEGer versions also have a start option in the Utilities menu. Once the install utility is started, you get a screen like this which lets you pick where the pictures are that you want to install for 4mation.
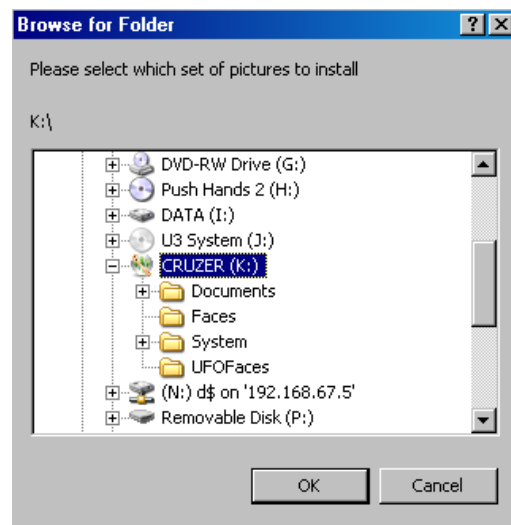
Select a folder and click on OK. The utility will examine the folder contents and report how many valid pictures are available.
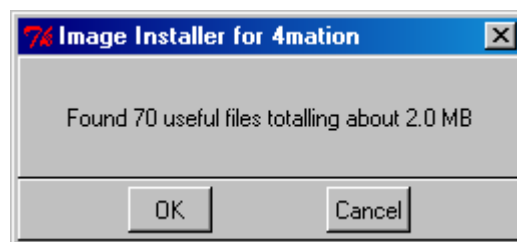
Please note that the utility will NOT copy pictures larger than 1600x1200 pixels since that requires too much time/video memory for 4mation.

Now you are prompted to select a destination (on your computer) for the pictures to be copied.
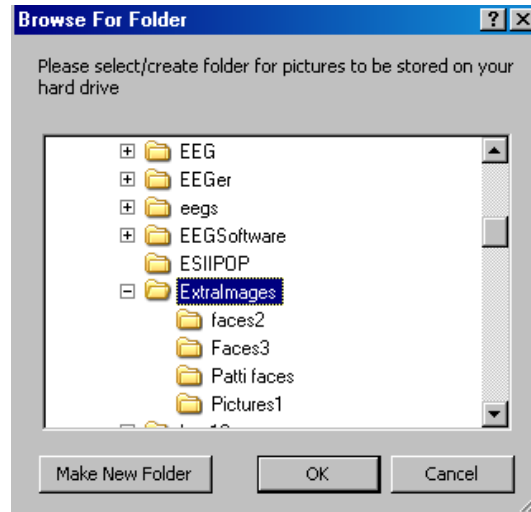
The default location is a folder called "C:\ExtraImages". You should select or "Make New Folder" a recognizable folder name for the destination. "New Folder" is only a "good" name once.
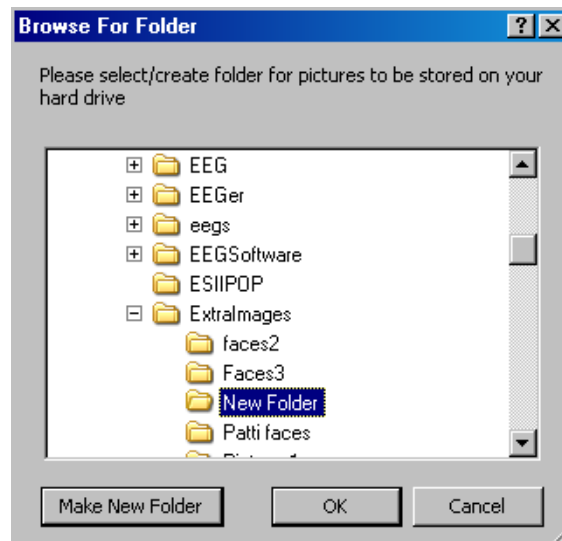
The utility will check to see if the folder is empty:
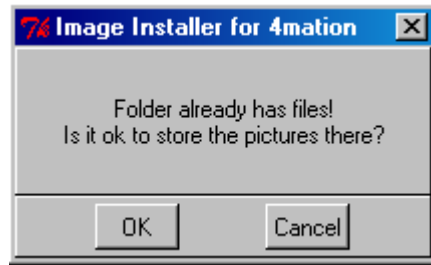
Then the files will be copied from the source you specified to the destination you specified. The utility will update the game definition file for 4mation to include the new folder.

Then, you get a reminder that EEGer will NOT know about these new folders until the Game Initialization Tool is run.
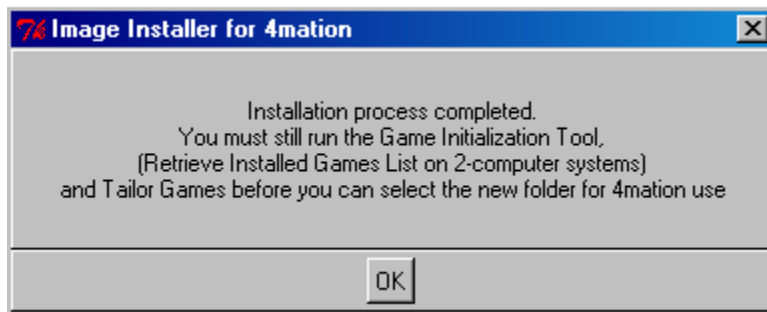
You can repeat the installation process for multiple folders before running the Game Initialization Tool.

CHOOSING CUSTOM IMAGES
Option 1: **Change images for the current session only**
- Select the client and click **Begin Session**.
- On the game selection screen, click the **Edit** button next to *4mation*.
- Scroll down to find "*Image directory to use*" in the left-hand (numbered 1100). Click either the left or right column to select the "button" to edit the directory choice.
- Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).

- Click **OK** to save.
- Click *Use these changes for this game run* to confirm your choice.
- Select *4mation* to start the session.

Option 2: Change images for all sessions

1. Select **Tools-Tailor Installed Games**.
2. On the Edit Game Definitions screen, click the **Edit** button next to *4mation*.
3. Scroll down to find "*Image directory to use*" in the left-hand (item 1100). Click either the left or right column to select the "button" to edit the directory choice. (See image above.)
4. Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).
5. Click **OK** to save.
6. Click *Replace Selection with changes* to confirm your choice.
7. Click *SAVE all games*.
8. Choose *4mation* when you run a session.

Option 3: Create a separate game definition with different images

1. Select **Tools-Tailor Installed Games**.
2. On the Edit Game Definitions screen, click the **Edit** button next to *4mation*.
3. The first line is "*What You want to call this tailored game*". Click either the left or right column to select the "button" to edit the name.
4. Enter a name that will help you identify the choice (e.g., "4mation Animals" or "4mation on USB") then click **OK** to save.
5. Scroll down to find "*Image directory to use*" in the left-hand (item 1100). Click either the left or right column to select the "button" to edit the directory choice. (See image above.)
6. Select the image source you want to use by clicking the radio button next to the pathname. (The default is c:\EEGer\Games\Images).
7. Click **OK** to save.
8. Click *Create a new selection* to create a copy of the default game setup.
9. Click *SAVE all games*.

10.   Choose the *4mation* name you just created when you run a session.

Appendix 19: Add 4mation selections

This utility makes Therapist game selection screen entries for all 4mation image options (found after running the Game Initialization Tool) that do not already exist.

The utility is available from support.eeger.com (Click on the Downloadable Files and Updates page). It may also be pre-installed in EEGer.   Once installed, the utility itself can be started from the Start menu (EEGer->Add 4mation selections). Recent EEGer versions also have a start option in the Utilities menu.

Starting the utility gives the option of NOT running it:
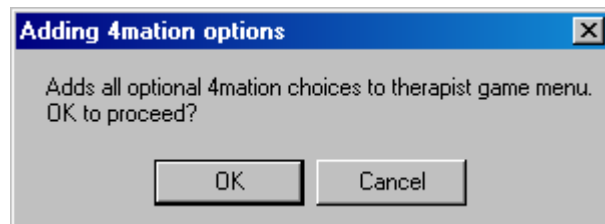
Otherwise, there are no operator interactions. Undesired entries can be deleted using the Tools-Tailor Installed Games options. Menu entries are added for both single computer and two computer menus if they exist.

Appendix 20: Remote Flash Utility

The Remote Flash Utility is a tool to allow remote re-creation of a Remote User flash drive. It is intended for rare occasions where a remote client flash drive has become corrupt and cannot be used. The normal case if for clients to return flash drives to clinicians so they can review and properly evaluate the treatment protocol. However, the client is sometimes too far away to make the extra trip for a new flash drive.

Basically, the tool works as follows:

The Therapist creates a remote user flash drive just as always done (onto a flash drive in the Therapist's office).

The Therapist starts the Remote Flash Utility and the following screen comes up:
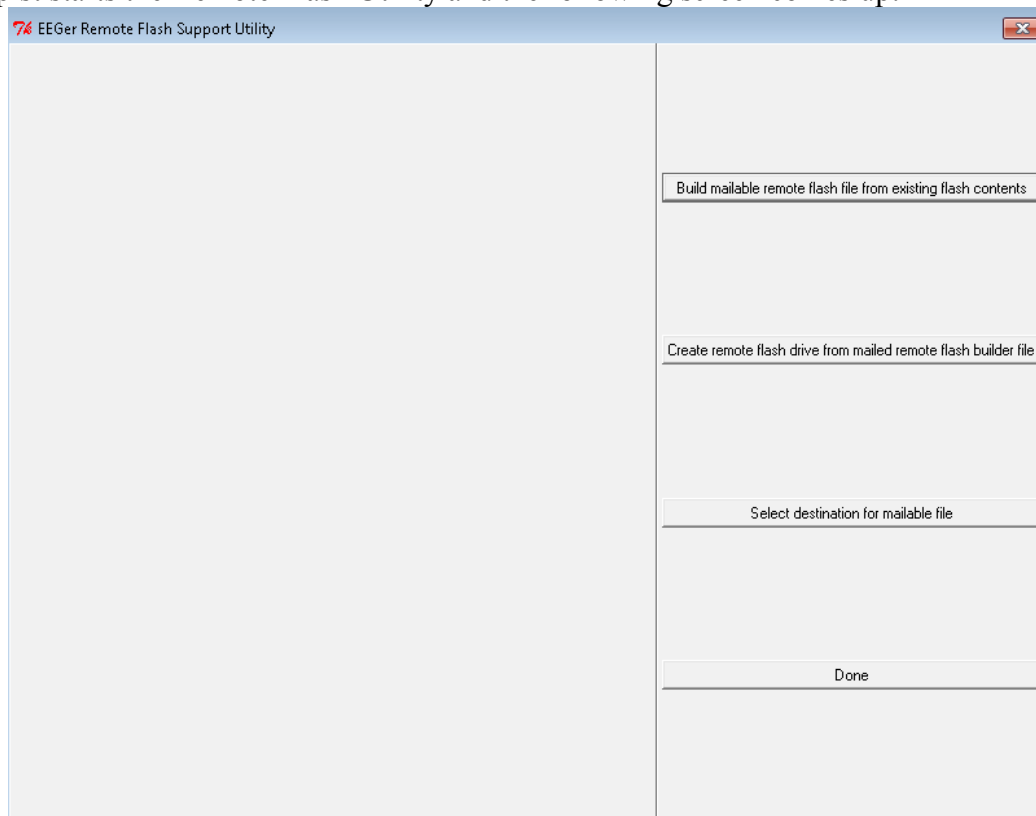
The Therapist selects the top option ("Build mailable remote flash file from existing flash contents").

The Therapist is prompted to select the flash drive just created:

Selecting Storage Drive for remote user

Click here to use drive J: to read existing flash data

Cancel   Rescan
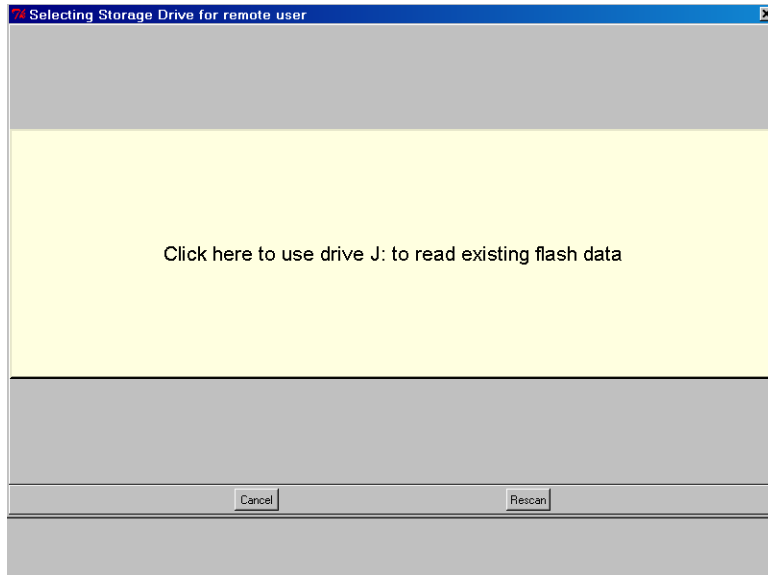
The utility builds an email-suitable file and places it on the desktop:

Info

Please email the 50024*.EFD file on the desktop to the client

OK
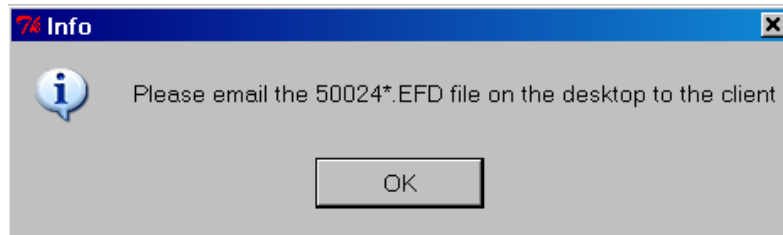
Note: some versions of Windows or Windows-logons will not permit writing the file to the desktop. In that case, used the option "Select destination for mailable file" from the menu options (first) and select some other option.

The filename of the file is the dongle number (of the destination dongle), some letters, and the extension .EFD (meaning something like EEGer Flash Drive).

The Therapist emails the .EFD file to the eagerly waiting client.

When the client receives the email, it must be copied to the client's therapist computer. That file must remain readable while installing the contents onto a flash drive. It is possible to copy the EFD file onto the DESTINATION flash drive.

The client starts the Remote Flash Utility and sees the main screen:
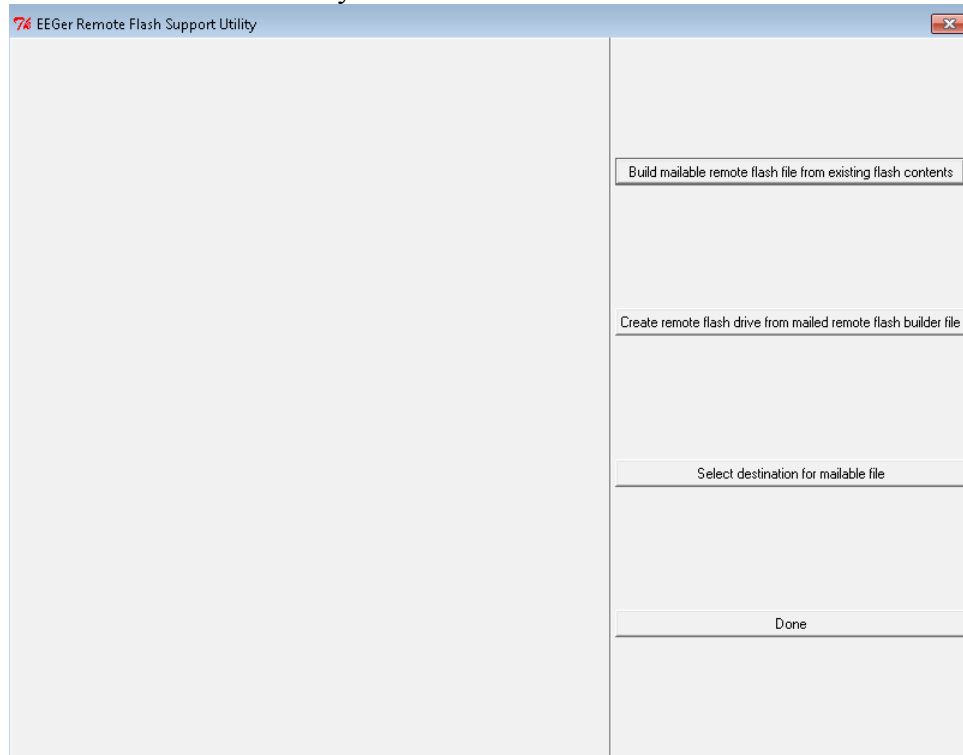
The client selects the middle button ("Create remote flash drive from mailed flash builder file").

The client is then prompted to select the mailed (.EFD) file:
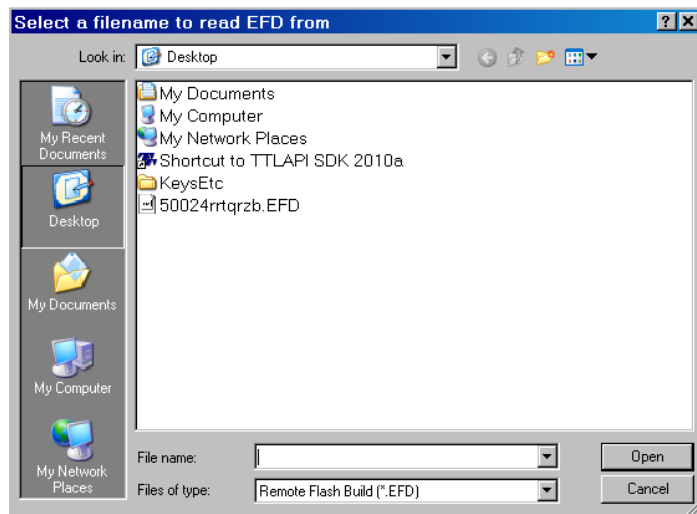
After verifying that the file is a valid remote flash file, the client is prompted to select the destination flash drive:
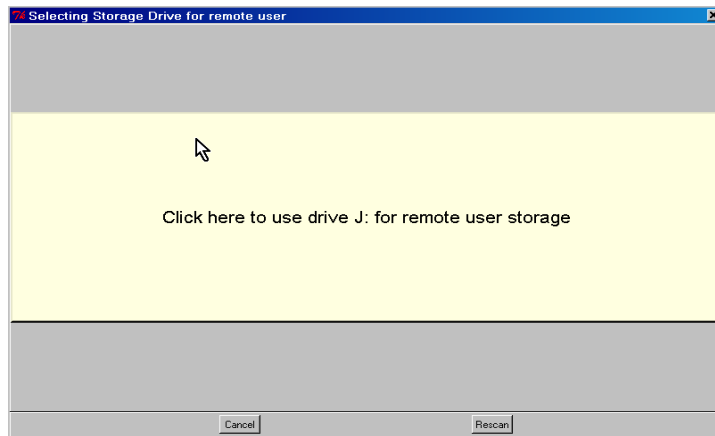
Some checks are made on the flash drive. If it was previously a remote flash drive, the following prompt is given:
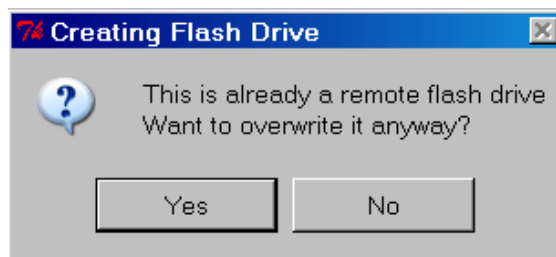
If "Yes" is selected, a check will be made for enough room (at least 30 MB). If not, the process will make the client select another flash drive:

When the flash is done writing:

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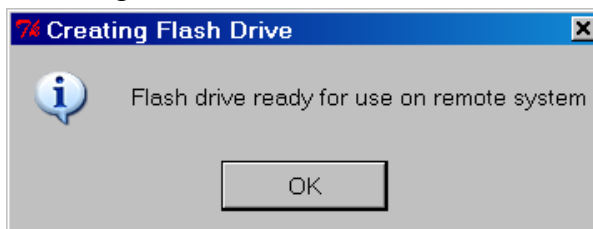
Appendix 21: Special Startup Options

There are some special startup options that can be used only at the time that EEGer is started. They were originally intended as debugging options but have shown some utility for other uses. The user-available options are listed below.

To use these options, they must be manually added to the startup shortcuts on the desktop. To do this:
1. RIGHT-click on the EEGer startup option on the desktop
2. LEFT-click on the properties item on the popup menu
3. Click on the Shortcut tab
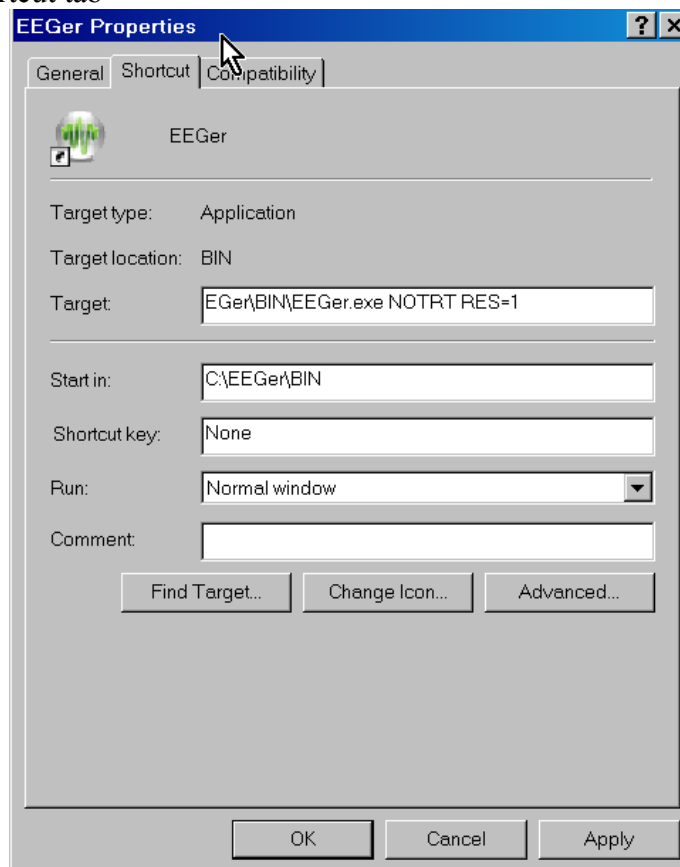
4. Add the desired options to the END of the target line, making sure to leave space(s) between each item.
5. Click on OK

Now whenever EEGer is started using that shortcut, the applicable options will be used. It is possible to have several shortcuts with different options (as long as you name them so you can remember what they are).

WARNING: REINSTALLING EEGER DOES NOT ERASE ANY OPTIONS MANUALLY SET IN THE SHORTCUT!!!

Available options:

RES=1
RES=2
These options force the EEGer (or EGS) screen size to be either 800x600 (RES=1) or 1024x768 (RES=2) no matter what size the screen graphics resolution is set for. Normally (or any other RES values), EEGer (and EGS) size themselves to the current screen resolution(s).

NOTRT
This option forces EEGer to NOT set realtime priorities. Some machines may function adequately with this option set but some may not. Your mileage may vary.

FORCEREMOTE
This option forces EEGer into being a remote user no matter what the license/dongle may be set for. It is intended for testing remote operations but may be used by a clinician for training clients to use the remote menus.

NOREMINDER
This option turn off the yellow reminder messages that appear at the bottom of the status window (LOST KEYBOARD, NOT RUNNING, etc.). Used normally by people smarter than EEGer and annoyed by the 1-second flashing messages.

NOOVERRUN
EEGer no longer aborts on graphics overruns and does not put up those annoying messages. This option turns the messages back on but EEGer still does not abort on graphics overruns (it just runs slower).

NOFREEZE
This option tells EEGer to NOT lock the position of the EEGer windows but allows them to be dragged around. Note that you cannot drag the realtime graphics screens since there is no border.

NOFOREGROUND
This option tells EEGer not to try forcing itself as the foreground window (so it can get keystrokes).

Appendix 22: Tech Support Menu

This program was provided as an aid to technical support. It displays certain crucial pieces of information and provides shortcuts to the various Windows programs needed to resolve issues.

From the therapist screen, it can be started from the Help menu (Help->Run tech support menu). From either the therapist screen or the EGS game list screen, it can be started using Alt-T (hold down the Alt button and press the T key momentarily). EEGer or EGS will minimize itself and show the following screen:
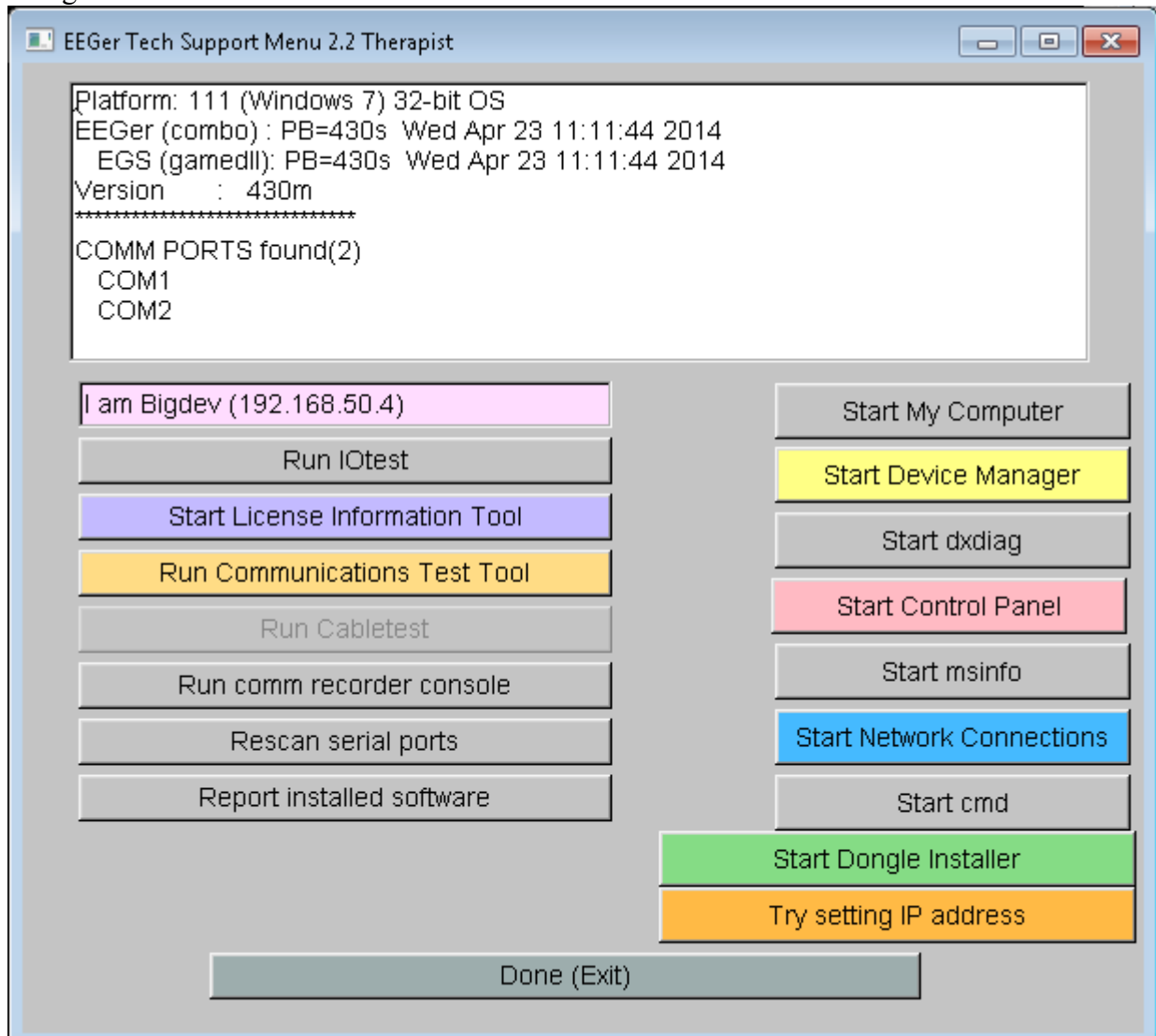
Besides reporting software versions, it also reports the current serial ports (below the line starting with COMM PORTS FOUND) and the current computer name and IP address. The buttons start various programs (when instructed to by Technical Support). The Rescan serial ports button rebuilds the information contained in the recessed display areas in case the attached serial ports or computer IP

address have changed. The "Try setting IP address" brings up a window allowing semi-automatic setting of the ethernet addresses.
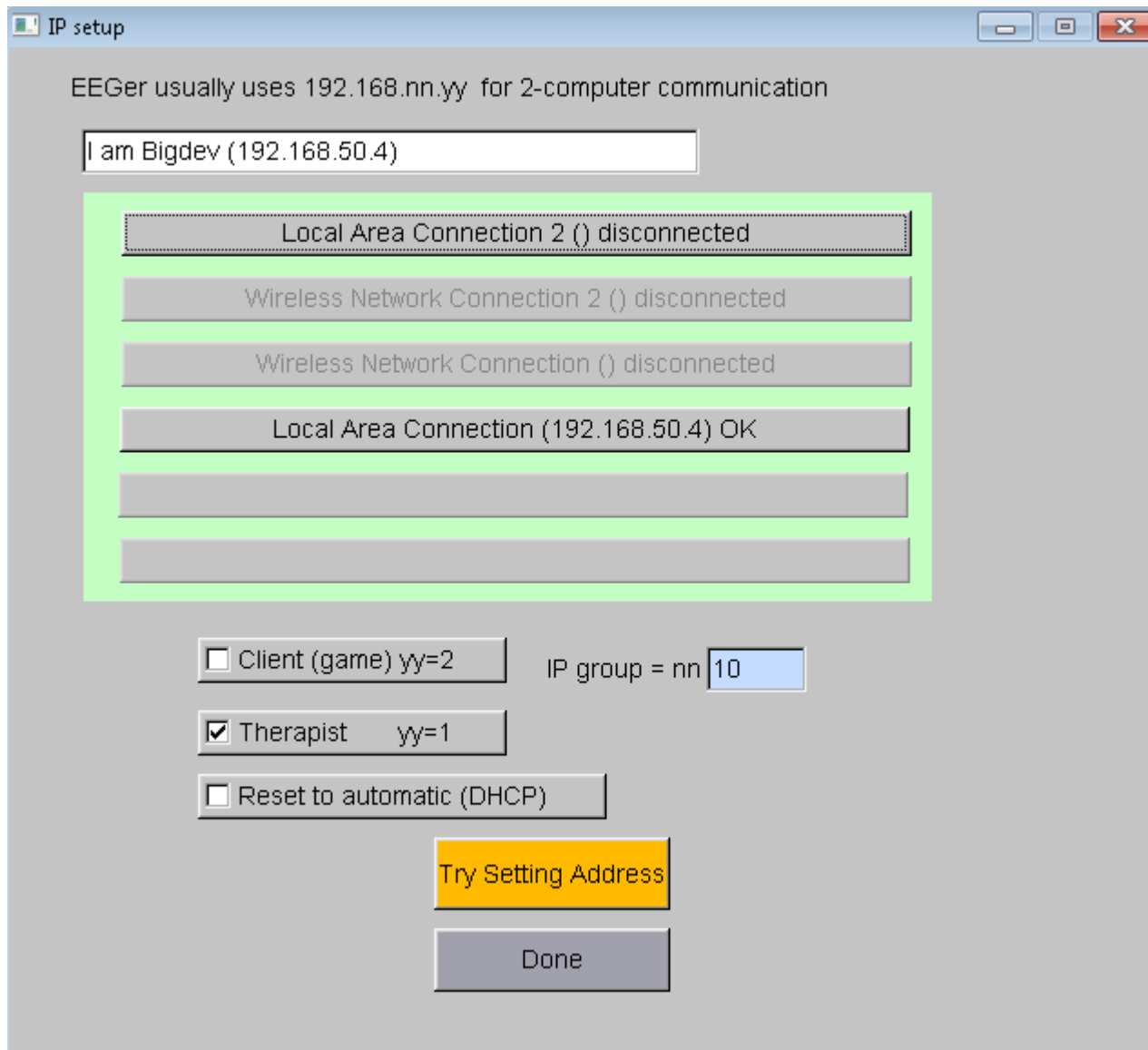
Clicking on the Done button closes the SetIP page.

Clicking on the Done button of the EEGer Tech Menu closes the program and restarts EEGer or EGS.

Appendix 23: Study Manager

EEGer supports a double-blind study mode with the Study Manager feature. In this mode, selected clients are fed prerecorded data from files rather than using the client live signal data. All other actions and controls are the same as using live data and the technician controlling the feedback cannot differentiate between live and simulated data.

How this works is summarized here:
- The manager for the study selects previously-recorded (by EEGer) raw data files (or parts of files) using the password-protected Study Manager interface. These files are specified for the three EEGer classes (SMR, EXP, AT). A pool of 10 to 20 files needs to be selected so data "repeat" is minimized.
- The manager designates already-existing clients as "simulated data subjects". At that time, a list of data files is created to be used during simulated sessions. The files can be pre-ordered or randomly ordered.
- When a simulated study client session is started (BEGIN SESSION), the next prerecorded file is selected as the "input".
- ***EEGer monitors the actual live data during the session.***
    - If the amplifier is not operating correctly, the file signal is set to zero.
    - If the live data from each channel is less than the threshold (currently set at TBD), the corresponding file channel signal is set to zero (as if the electrode is unconnected or has fallen off).
    - If the live data from the channel is greater than the live threshold, the **file** signal value is multiplied by a value determined by computing how much the live signal exceeds its average value, triggering an artifact condition. The live signal is never seen.
- The actual live data is recorded in a hidden client file.
- The data from the session (from the prerecorded file) is saved as though it was a live session (both raw and summary data).

    There is no visible indication before, during, or after a session that the study subject IS a study subject (except that the "results" may differ from actual live feedback).

Caveats:
A. An experienced clinician may be able to recognize that the feedback doesn't seem to be having a "normal" affect on brain activity. However, the goal of the study logic was to "fool" a technician and not a clinician.
B. The artifact adjustments made by the technician will not exactly match the live data characteristics so the seeming-artifact file data waveshapes may not exactly match what a live artifact waveshape would be. However, the short-term averages should correspond and correctly drive the artifact controls (which inhibit rewards).
C. It is the study manager's job to select "suitable" playback files for the pool of files. This must be done BEFORE any clients are selected as "study subjects" (the ordered file list is predefined at selection time). If including 2-channel training for any of the study subjects, it is recommended that ONLY 2-channel recordings be used for control data.

D. A study subject has ALL three protocol classes in simulated state. You cannot have live data in one class and simulated data in another. Be observant in case the simulated feedback leaves a client in a "bad" state.

E. An experienced computer user could browse around and find the "hidden" client storage folders but would only be able to correlate a client "ID" by further browsing inside some files.

Access to the study logic is password controlled (so you can't accidentally set this state on someone).

These instructions provide directions to activate and utilize the Study Manager in EEGer.

For Study Manager to function in EEGer, the following items must be valid:
- A valid EEGer license for Study Manager must be installed.
- EEGer4 4.3 or later must be installed.

To Install the EEGer Keyblock File with the Study Manager option:
- Insert the ***EEGer Keyblock File CD*** in your CD/DVD drive.
- If the contents of the CD are displayed automatically, close the window. You must load the key using EEGer.
- Start the EEGer program. From the **Files** menu, select **Read EEGer Keyblock Files.**
- Select the CD/DVD drive for the ***Look In*** field.
- The updated keyfile is displayed on the Open dialog. Click the filename to select/highlight and click **Open**.

Use Review/Replay/Spectral to choose recorded EEG sessions from your existing clients to use for the control sample(s). (10 to 20 control files are recommended)

ACCESS THE STUDY MANAGER MENU

To access the Study Manager from the main EEGer display, press **Ctrl + Alt + Right-Mouse Button** at the same time and the **Debug** menu becomes visible (or not visible if already visible).
From the **Debug** menu, select **Study Manager**.
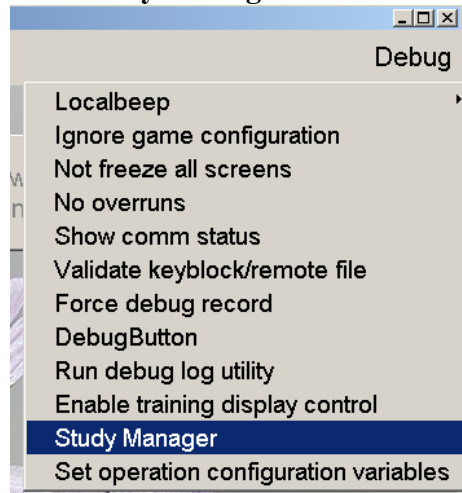
Enter the Password provided to access the Study Manager dialog.
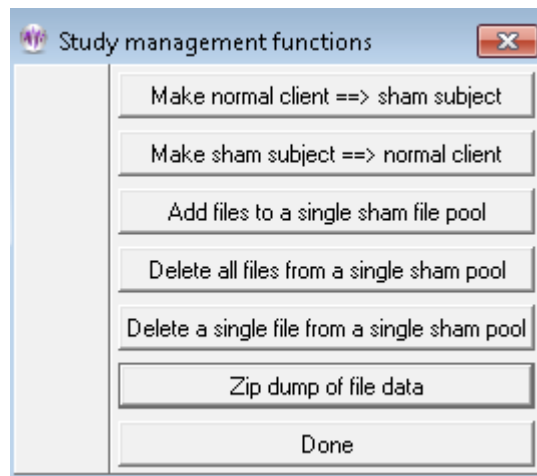
SET UP CONTROL SAMPLE FILES

To set up control data samples, select **Add files to a single sham file pool**.

Select the desired sham study pool folder:
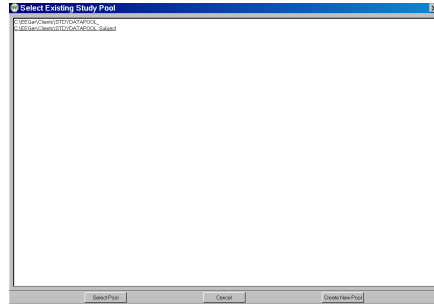
If desired, a new study pool can be created. Clicking on "Create New Pool" brings up a box where the new pool 'name' can be entered.
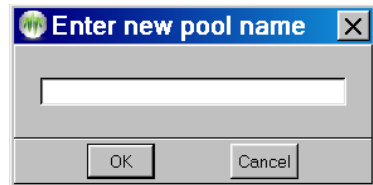
Select Client IDs that contain the desired samples (double-click or click once to highlight and click OK).
Select the desired session(s) from the client's data (Entire or Partial).
Repeat steps until you have selected the sample set.

SELECT STUDY CLIENTS

Click **Make a normal client ==> study subject**.
1. Select the Client ID to convert to a study subject (double-click the ID or click once to highlight and click OK).
2. Select the desired sham study pool folder.
   NOTE: Changing a client to a study subject converts ALL protocol classes for the Client ID to use study control samples.
3. Choose whether to randomize the order that the study pool files are used or leave them in the order specified by their 'name' (sequential within a particular pool).
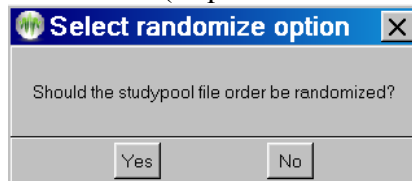
4. Repeat steps 1-3 to select all study participants.

RESTORE CLIENT TO LIVE STATUS

Click **Make sham subject ==> normal client**
Select the Client ID to convert (double-click the ID or click once to highlight and click OK).
Repeat for each client.

DELETE ALL FILES

Click **Delete all files from a single sham pool**
Select the desired sham study pool folder.
Confirm the deletion.

DELETE A SINGLE FILE

Click **Delete a single file** from a single sham pool
Select the desired sham study pool folder.
Select the filename to be deleted.
Repeat as desired.

Note: Take great care in deleting files that may still be selected by a sham subject.

Zip dump of file data
 This option allows creating a zip file of study data. The file will contain the live subject data, the sham subject data, and the sham subject live data CSV dumps for each selected client.

The client selection screen is typical:
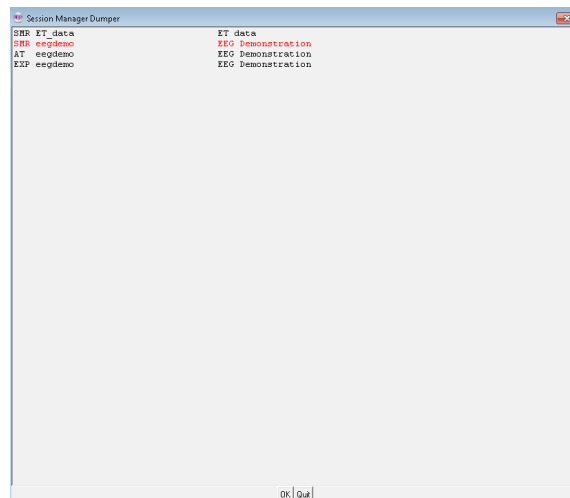
Some options available to the study manager:

Minimum signal to zero sham value (nom=3)	◄ 3.0 ►
Artifact amplitude which forces sham artifact (nom=70.0)	◄ 70.0 ►
Scale factor for max sham artifact (nom=3.0)	◄ 5.0 ►
Average values time constant(seconds) for live data	◄ 30.0 ►
How much bigger artifact is than n-sec average (nom=1.5)	◄ 1.5 ►
Fast integral time constant (seconds) for live data	◄ 0.5 ►
Force Record fast amplitudes (VERY LARGE RAW!)	☐
Display Sham Debug data	☐

The study manager can specify the lowest average voltage for a signal to "be there" (currently 3 microvolts Peak-Peak). This is usually dependent on the desired electrode placements (and the expected typical readings there).

The study manager can set an absolute amplitude at which an "artifact" condition will be detected. Default value is 70 microvolts peak.

The study manager can determine the scaling of the sham signal when in full artifact (default is 5 times the sham signal). This makes the artifact look "real".

The study manager can set the time constant for measuring the average Peak-Peak amplitude of the live signal. This is usually 30 seconds (using a moving window).

The study manager can determine the scale factor for NON-max artifacts. The data looks 'real' with a nominal scalar of 1.5 times the live signal average value.

The study manager can specify the fast integral time constant. This controls how fast EEGer tracks the live artifact and how sharp the edges of the artifact are.

The study manager can force recording of fast amplitude data independent of the user selection on the Special option configuration tab.

The study manager can enable certain debug options for sham studies but actual display of values requires an additional command-line option to fully enable the debug mode.

 4.3.0

Appendix 24: Common Problems and Fixes

Problems sometimes arise on working systems for no apparent reason. This appendix is a list of some common issues and corrective actions. As always, please contact Technical Support if you are unable to correct the problem.

Dongle not found message on EEGer main screen

This message means that EEGer cannot locate the EEGer dongle (the bright green one). This typically happens if the dongle is plugged in before the software is installed or if a computer goes into "hibernation" (like closing the lid on a laptop) and the power recovery logic of the computer doesn't refresh the USB devices correctly.

Fix:
First, try unplugging the dongle, waiting for 5 or 10 seconds, then plugging it in.
Note: EEGer ONLY looks for the dongle when starting so you must exit EEGer and then start it again to see if this fixed things.

Second, you need to UNinstall the driver so Windoze can reinstall it.
To do this, click on "Help->Run tech support menu "and click on the bottom right button labeled "Start Dongle Installer". UNPLUG the dongle. Check the "Uninstall" option on the lower left of the installation window, then click the button now labeled "Begin Uninstall". When it finishes, click on the "Start Dongle Installer" button again. This time check the boxes labeled "USB Dongle" and "Standalone", then click on "Begin Install". At the completion of the reinstall, you can close various windows (the installer and the Tech Support Menu) and verify that EEGer can detect the dongle (and display the dongle number on the lower left of the main screen).

License not installed on EEGer main screen

This message means that the EEGer dongle number does not match an installed license file (or that no license file at all is found). Clicking on "Help->Keyfile Information" will display a list of all the license files found on the machine.

Fix:
Install the license file matching the installed dongle using "Files->Read EEGer keyblock files". The license file is usually delivered on a CD but may also be emailed. If you cannot locate your license files, please contact Customer Support or Technical Support for another copy.

Games not tailored **on EEGer main screen**

This message means no valid game configuration files are found. EEGer does not "know" what games are physically installed on a computer until the Game Initialization Tool program has an opportunity to scan the computer for them.

Fix:
For single computer systems, run "Tools->Game Initialization Tool".
For two-computer systems:
    On the game computer, run the Game Initialization Tool.
    On the therapist computer, run "Tools->Retrieve installed games"

Game Communication Failure

This message means that the therapist computer cannot communicate with the game computer. Usually, this means an invalid serial port (if using serial interfaces) or invalid/mismatched ethernet addresses (if using ethernet mode). The "ENET" or "COMx" legend on the EGS game screen displays in RED if there is no connections seen and in white if connected and communicating.

Fix:
Serial connection:

The correct serial port must be found on both ends of the connection. On the EGS (game) end, pressing F3 will cycle through all the known serial connections (and ENET). If one of them displays in white, that is a valid connection. Please remember the original value since it may be the OTHER end that is the issue. Normally, when the EEGer program is started on the therapist end, a check is made for valid serial port numbers. If you got that message, please determine the installed ports. This is most easily done by using "Help->Run tech support menu" from the EEGer main screen. The installed ports should be displayed in the recessed message area at the top of the tech support menu. If none are reported, click the button labeled "Start Device Manager". When the Device manager starts, see if any devices are in yellow (error condition) and/or which ports are shown in the "Ports, COM and LPT" section. If may be that either a USB to serial adapter is not plugged in or that a driver needs reinstallation. Drivers for all devices sold with previous EEGer systems can be found at support.eeger.com but drivers for user-supplied devices have to be located. Once a port is located, the configuration must be set in "Options->EEGer configuration Options" on the "Devices" tab in the field labeled "Serial port for game computer connection".

Ethernet connection:

The most common issue here is having a wireless connection AND a wired connection. It seems that Windows has its own priority for ethernet addresses and "assumes" the device to use. Unfortunately, the default fixed address usually used by EEGer (192.168.1.*) is also the default address range used by most wireless routers. One thing to try is to make the EEGer game/therapist fixed addresses by in the 192.168.9.* range (192.168.9.1 for therapist/192.168.9.2 for game). Please contact Technical Support for problems since there are too many possibilities to cover each one in this appendix.

Game never shows up on menus even after installing keyfile

Installing a game keyfile does NOT install the game itself.

Fix:

Install the game. Games can be downloaded from the support site (support.eeger.com).

Game shows as pink in Game Selection

If the game shows a button in pink, it means that there is NOT a license for that game installed on the computer. It also means you cannot use the game from the Begin Session button.

Fix:

Please contact Customer Support for the game license.

Same data shows on both screens

This commonly happens on Dual-monitor laptops when the laptop is started/resumed and the external monitor is NOT plugged in.

Fix:

Close EEGer. RIGHT-click on an empty part of the Windows desktop and select "Screen resolution". Make sure you see two monitors listed. Change the line labeled "Multiple displays" to say "Extend these displays" and click "Apply".

To avoid having to do this all the time, make sure the monitor is plugged in before starting/resuming the laptop.

Errors when reading remote-use updates

These errors mean there is a process problem with using the updates. Common errors include:
7	This means the update file was ALREADY used.
100	This means the EEGer dongle number doesn't match the number in the update file
143,101	This means the client ID doesn't match
2,102	This means a date error (expired or invalid)

There are many other error codes.

Fix:

Usually, another update file from the supervising clinician will resolve the problem.
Otherwise, please contact Technical Support for assistance.

Realtime overruns

This message (or messages) that abort a session usually indicate some other program is using too much computer time and interfering with the timely processing of feedback data. Usually, this is some kind of antivirus (like Kaspersky).

Fix:

Make sure no other programs are running when EEGer is running.

You CAN disable this error process if you are sure the data is being properly processed by using the settings on the "Special" tab of the EEGer configuration options.

DVD game display is on therapist monitor

The DVD image is either black or on the therapist screen instead of the game screen.

Fix:

Exit EEGer. Start VLC by itself. Drag the menu bar to be completely on the game monitor.
Close VLC. This is because VLC "remembers" the screen it was last on when it starts up.

Or, install a version of DVDGame from version 1.19 or later. These versions force the video to the second screen if it is not already there.

Appendix 25: Supported Amplifier/Encoder Devices

Note that devices whose status is NOT "Currently supported" are not selectable for use unless the user explicitly enables them for use. In these modes, the device is not approved for anything but investigational use under the health care professional's license conditions. The right column shows P for tested and passed or U for untested but expected to work

Device Name	*Manufactur er*	*Hardware Interface*	*Interface method*	*Support status*	*EEG Channels Supported*	*P/ F*
BrainLynx	J&J Engineering	USB	Mfr DLL	Currently supported	2	P
C2mini	J&J Engineering	USB	Mfr DLL	Obsolete/ supported	2	U
C2	J&J Engineering	USB	Mfr DLL	Obsolete/ supported	2	U
C2+mini	J&J Engineering	USB	Mfr DLL	Currently supported	2	P
C2+	J&J Engineering	USB	Mfr DLL	Currently supported	2	P
Spectrum 2/ J202	J&J Engineering	USB	Mfr DLL	Currently supported	2	P
Spectrum 4/ J404	J&J Engineering	USB	Mfr DLL	Currently supported	2/4	P
esiPro 2.2	TeleDiagnos tic Systems	USB	Mfr DLL	Currently supported	2	P
esiPro 4.3	TeleDiagnos tic Systems	USB	Mfr DLL	Currently supported	2/4	P
A200/A202	Phoenix Neuro Systems	USB	Mfr DLL	Currently supported	2	P
A400/A404	Phoenix Neuro Systems	USB	Mfr DLL	Currently supported	2/4	P

Device Name	Manufacturer	Hardware Interface	Interface method	Support status	EEG Channels Supported	P/F
ProComp2	Thought Technology	Serial port	Internal code (serial interface)	Currently supported	2	P
ProComp+	Thought Technology	Serial port	Internal code (serial interface)	Currently supported	2	P
Infiniti	Thought Technology	Serial port	Internal code (serial interface)	Currently supported	2	P
ProComp2	Thought Technology	USB	Mfr DLL	Currently supported	2	P
ProComp+	Thought Technology	USB	Mfr DLL	Currently supported	2/4	P
Infiniti	Thought Technology	USB	Mfr DLL	Currently supported	2/4	P
ProComp5	Thought Technology	USB	Mfr DLL	Currently supported	2/4	U
Brainmaster 2E	Brainmaster	Serial port	Mfr DLL	Currently supported	2	P
Atlantis 2	Brainmaster	USB with serial port	Mfr DLL	Currently supported	2	P
Atlantis 4	Brainmaster	USB with serial port	Mfr DLL	Currently supported	2/4 Note: 4 channel only works in 24-bit mode for now	P
Discovery	Brainmaster	USB with serial port	Mfr DLL	Under test/no device	2/(4- ?)	U
Pet2.0	Brainquiry	Bluetooth serial	Internal code (serial interface)	Obsolete/no device but previously supported	2	U

Device Name	Manufacturer	Hardware Interface	Interface method	Support status	EEG Channels Supported	P/F
QPET	Brainquiry	Bluetooth serial	Mfr DLL	Obsolete/no device but previously supported	2	U
Pendant-EEG	Pocket-Neurobics	Bluetooth serial	Internal code (serial interface)	Under test/no device but previously supported	2	U
Q-Wiz	Pocket-Neurobics	USB or Bluetooth serial	Internal code (serial interface)	Currently supported	2/4	P
U-Wiz	Pocket-Neurobics	USB or Bluetooth serial	Internal code (serial interface)	Currently supported	2	P
(external amplifier)	--------------------	USB	A/D device supported by Measurement Computing Corporation InstaCal software	Currently supported (used for system testing)	2/4	P