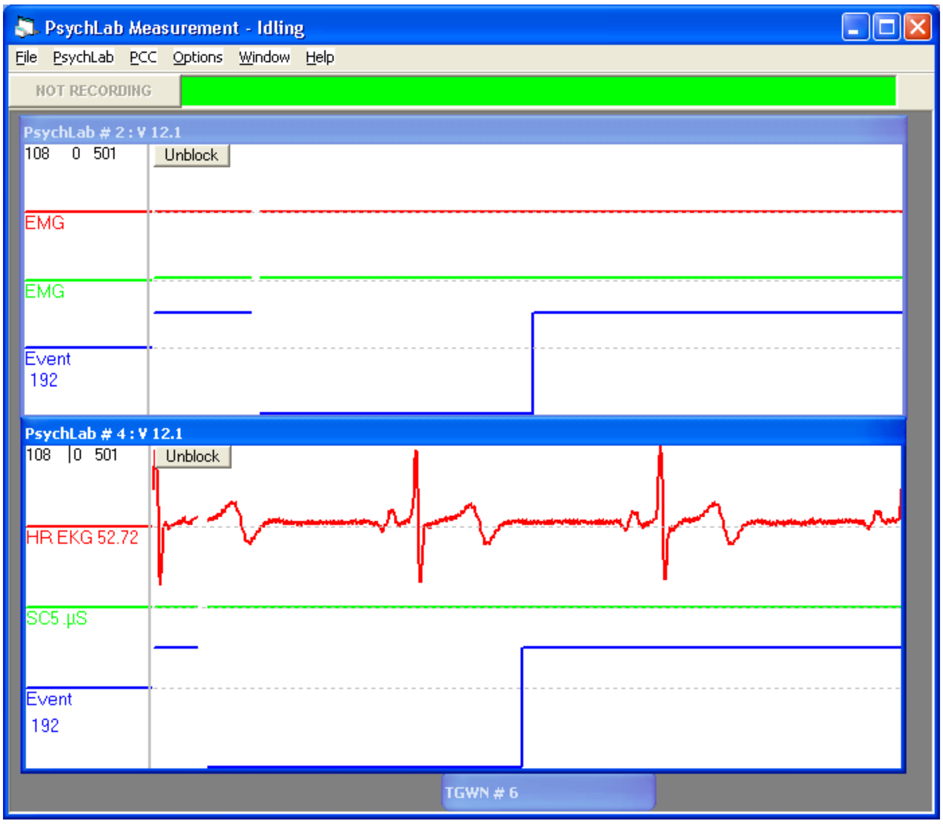
PsychLabAcquire

May 2009.

Data acquisition and stimulus control.

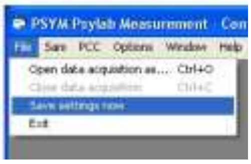
Table of Contents.

PsychlabAcquire Measurement window.



The main program window contains one PsychLab View window for each PsychLab unit which is connected to the computer and turned on. In a multiple PsychLab system, each PsychLab will have a different number. PsychLab View windows may be arranged in any way inside the parent window. After PsychLab Views are arranged, use File, Save settings now.to retain the chosen positions. Note that View *position* is registered only when its *size* is changed.

The window containing such Views is the main program window; closing it shuts the program down. It contains the main menu: File, PsychLab, PCC, Options, Window, Help. Stimulator devices show minimized in the bottom of the main window.

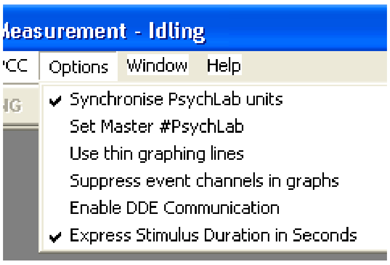

PSYM Psylab Measurement Con
File
Sam
PCC
Options
Window
Help
Open data acquisition as.... Ctrl+O
Close data acquisition Ctrl+C
Save settings now
Exit

Within each PsychLab View, moving traces are seen for each PsychLab device connected. The number of traces within each PsychLab View depends on the number of channels in that PsychLab device. The title bar of the PsychLab View shows the PsychLab number, whether it is master or not, denoted by the letter M, and the version of its firmware (that is the program running inside the PsychLab unit).

In the top left corner of each PsychLab View, small numbers show Time in seconds. When data acquisition commences, this time value is re-set to 0, such that it will show how long a recording is active. The other numbers shown here are an error count, which keeps track of any miscommunications with PsychLab devices, and sample rate as calculated by measuring the number of samples collected from the device in a 10 second period timed with the computer internal clock. Sampling in PsychLab devices is controlled by a crystal clock inside each device, so this provides a check on that. The number of samples counted by the computer gets more accurate as time goes on, as there will be minor discrepancies between the time when the PsychLab device starts and the time when the computer starts counting.

Because of the nature of the computer being a multi tasking device, it cannot be centrally involved in data acquisition timing in the PsychLab units – there will always be short delays between data being generated and it being registered at the computer. For this reason multiple devices in the PsychLab system are synchronized, see next section.

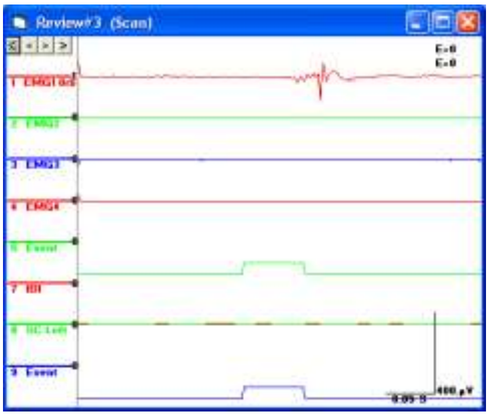
Synchronizing multiple PsychLab units.



In a multiple PsychLab system, when Options menu, Synchronize PsychLab units., is checked, one PsychLab device provides the time clock for all the others, so that they all gather data synchronously in a Master – Slave configuration. PsychLabAcquire software automatically selects a Master, or a preferred master may be chosen in the Options menu. The synchronization clock is linked from one PsychLab to the others via the flat gray cable supplied to link up the ‘Event Synchronization’ sockets. All devices, including stimulators and BIN8 unit, must be linked. When devices are synchronized, if a record is scrutinized in the replay program, where all devices appear in one window, it will be seen that the event traces for all devices exactly correspond.

Event channels.

Each PsychLab unit has an event channel, that is a channel which runs alongside physiology channels and is recorded synchronously with them. The purpose of the event channel is to enable the analysis program to identify sections of physiology data, so it is essential that in any procedure where discrete events occur, the event channel is used to indicate the precise moment of any stimulation. The event channel is one byte, that means it can have 256 different settings. It can be affected by several things:



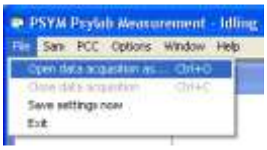
Synchronized events seen in a zoom-in to replayed data in Psylab8 replay program.

-A command in the PCC program, for example ‘event = x’
-Operation of any PsychLab stimulation device whereby an event level is setup in the SetNoise, SetTone, etc. command and that level is asserted to the event channel at the instant when the stimulator is activated
-TTL input directly to the BIN8 unit or to the event port via a parallel printer port adaptor.

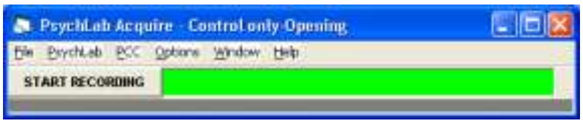
The inverse physical value of the event channel is found on pins 1 – 8 of the event synchronization port. The state of these pins should not be forced by user connection to external equipment, the latter method above must be used for external stimulus equipment connection. External events connected via BIN8 or the parallel printer port adaptor affect the event port in bitwise OR method, such that if for example the TTL input of BIN8 asserts the top bit but not any other bits, the event port would register 128. If another method then asserts value 1, value seen on the event port is 129.

Checking data synchronization and integrity in a multiple PsychLab system.

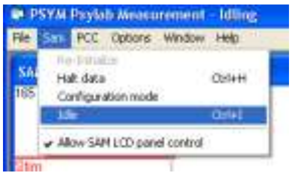
All PsychLab Views in a multiple PsychLab system show an event channel, because the gray cable physically links event ports. This provides a means, when data are reviewed off-line, to check that the PsychLab units were correctly synchronized, by comparing start time of events throughout the recording. Data integrity is indicated by the numbers which appear in the top right area of each Review when data are analyzed using the PSYLAB8 program. These numbers will show greater than 0 if any discrepancy occurred in recording from a PsychLab unit.


PSYM Psylab Measurement - Idling
File
Sam
PCC
Options
Window
Help
Open data acquisition as… Ctrl+O
Close data acquisition Ctrl+C
Save settings now
Exit

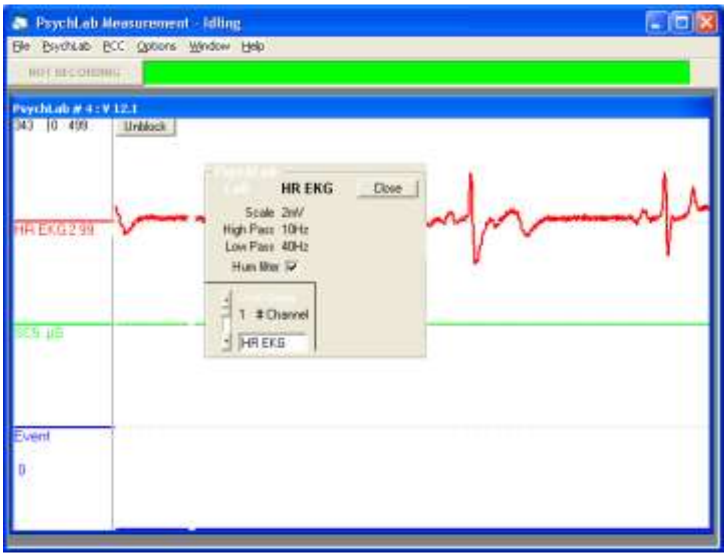
Making a recording. When the PsychLab1 program starts up, data are read from the PsychLab unit and graphed, but not saved to disk. This is Idle mode. To switch to Acquisition mode, use File menu, Open data acquisition…. A file selection panel will appear, requesting a file name to be used for storing data. The recording will not start until the Start Recording button is clicked, at which time the green bar will turn to red, indicating recording in progress. Click 'Stop recording' to end a recording session.



Changing idle sample rate.



The PsychLab menu can be used in combination with the Idle sample rate slider in the properties window to change idle sample rate. After moving the slider to a new position, click Idle in the Psychlab menu to assert the new setting.



Scale 2mV
High Pass 10Hz
Low Pass 40Hz
Hum filter ☑

1 # Channel
HR EKG

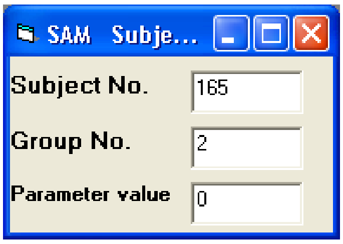
Controlling filter, gain, etc.

A panel is obtained within each PsychLab View by double clicking within the body of the View. This panel shows the status of the analogue signal conditioning inside the PsychLab unit. Filter and gain setting may be changed by clicking on the value shown. The Psychlab unit retains these settings in non-volatile internal memory when disconnected from the computer, settings stay with the device, not the computer program.

Changing graph channel names.

In the bottom left of the above panel, controls are provided to allow the label shown next to each channel in the graph view to be changed. The system assigns default labels such as Bio, EEG8 etc. but more informative channel names may be specified here. Channel names should be 8 characters or less. To retain new channel names, use File, Save settings now.

Subject Details window.



Subject No. 165

Group No. 2

Parameter value 0

This window may be used to enter details about the subject or group, which will accompany raw experiment data when stored during data acquisition. These numbers are available to the analysis program, such that data reduction results for export to statistical programs carry fields resenting this information, for automatic identification purposes.

The parameter field may be used as a third details field, it is also carried with raw data, but mainly it is provided for purposes where a PCC program needs to respond to some kind of operator input. A prime example of this is the shock workup procedure, whereby a comfortable shock level for each particular subject is established prior to starting the experiment. This level is then entered into the parameter field of the Subject Details window, and the PCC program is designed to control shock level using the parameter value. This is simply achieved by putting the 'parameter' keyword into the SetShock command.

e.g. SetShock parameter, 1000

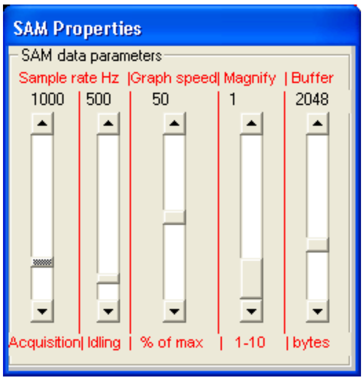
An example of this is given in the 'Classic Conditioning Experiment' in the software section of our web site.

Properties window.

This window is provided for control of data sample rate, buffering and graphing. The PsychLab1 program provides two modes for data, Idle and Acquisition. In Idle mode, data are simply graphed in the PsychLab View windows, to allow the operator to see how well the devices are operating; adjust electrodes, etc. No data are stored to disk, no recording is made in Idle mode.

Acquisition and Idle Sample rate.

In acquisition mode, data continue to be graphed as in Idle mode, but simultaneously data are stored to disk. The sample rate for Idle and Acquisition mode may be separately set, using the left two sliders of the Properties window. Changing the setting of sample rate sliders does not take effect until sampling mode is re-asserted. This happens when switching from Idle to Acquisition or back again, and when certain other menu functions are performed. To re-assert sample rate, use PsychLab menu, Idle (or press ctrl + I while the main program window is in focus).



SAM data parameters

Sample rate Hz |Graph speed| Magnify | Buffer

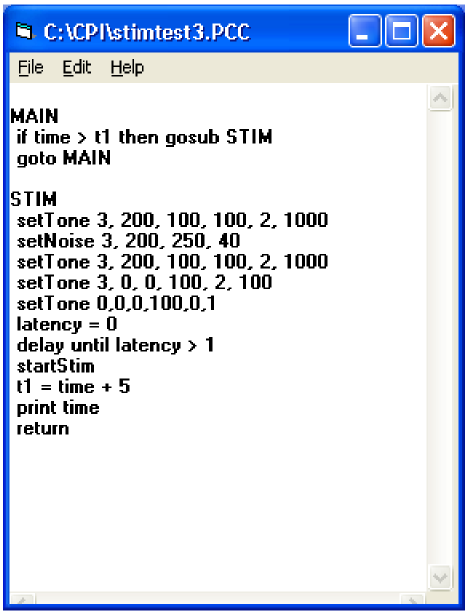
1000 | 500 | 50 | 1 | 2048

Acquisition| Idling | % of max | 1-10 | bytes

Acquisition sample rate may also be set *in a PCC program* using the $rate command (e.g. $rate 1000 sets acquisition sample rate to 1000 per second on all channels). This allows sample rate to be automatically adjusted to suit each experiment.

Data buffering.

Sample rate is determined by the PsychLab precise internal clock; data are sent to the host computer via a buffered interface. In addition to a small buffer in each PsychLab unit, the host computer USB driver also buffers data as it arrives, such that the PsychLabAcquire program only receives data when a buffer is filled. This reduces CPU overhead. The host computer data buffer size may be set depending on how fast is the selected sample rate, and how much data the devices connected to the PsychLab unit produce. A PsychLab unit with two channels may produce about 10 bytes per data sample, so at 100 per second it will be 1kB per second. The larger the buffer size, the more jerky graphing will appear, and the more lag there will be between the graphs and real-time. The above example will cause a one second delay with a 1kB buffer setting. If an experiment is designed such that the PCC program waits for an external event to affect the event channel, it may be desirable to reduce buffer size and thus reduce this delay, as the event channel at the host computer, running the PCC program, will only see the event after this delay. The downside of using a small buffer is that it takes more CPU power. If multiple PsychLab units fill up the computer buffers (one buffer is allocated for each PsychLab unit) too frequently, the computer may crash because it unable to keep up with the data.



```
MAIN
 if time > t1 then gosub STIM
 goto MAIN

STIM
 setTone 3, 200, 100, 100, 2, 1000
 setNoise 3, 200, 250, 40
 setTone 3, 200, 100, 100, 2, 1000
 setTone 3, 0, 0, 100, 2, 100
 setTone 0,0,0,100,0,1
 latency = 0
 delay until latency > 1
 startStim
 t1 = time + 5
 print time
 return
```

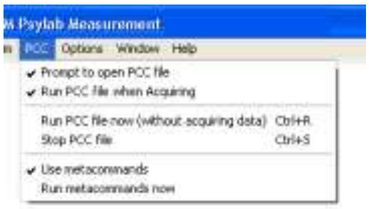
After changing Buffer size, Use File, Save settings now to retain the setting. The buffer size is not dynamically affected by the slider position; buffers are set up when PsychLab1 program starts, so a change in buffer size only takes effect after it has been saved, and PsychLab1 program is stopped and re-started.

Graph speed.

Graphing data is also CPU intensive. To reduce computer workload, reduce graph speed; this helps to prevent any system crash in high data volume applications.

PCC Editor window.

PsychLab Command Code (PCC) is used mainly for controlling stimulus devices. In some applications, for example emotion experiments (interpersonal interaction) where no computer generated stimulation is used, no PCC file is required and the PCC editor window can be left closed. The default status of all windows in PsychLabAcquire program (whether the program starts with the windows showing or not) is determined by the settings in the Window menu. To retain these settings, use File menu, Save settings now.


Psylab Measurement
PCC
Options
Window
Help
✓ Prompt to open PCC file
✓ Run PCC file when Acquiring
Run PCC file now (without acquiring data) Ctrl+R
Stop PCC file Ctrl+S
✓ Use metacommands
Run metacommands now

The PCC file may be loaded and saved using the File menu in the PCC Editor window. However, if a PCC file is nearly *always* used, PsychLabAcquire program can be configured to prompt the operator to load a PCC file at the time when PsychLabAcquire program is first started. This is done by selecting PCC menu, Prompt to open PCC file.

In order for the PCC file to take effect during data acquisition, PCC menu, Run PCC file when Acquiring., must be checked. However, PCC menu, Run PCC file now., is provided so that when a PCC program is under development, it can easily be tested without needing to switch to Data Acquisition mode.

A PCC file consists of a list of command lines which are compiled and acted upon sequentially from the top line down by the PsychLabAcquire program when the PCC file is selected to ‘run’. The top line of the program is not enacted; it is reserved to be used for a ‘remark’, to identify the file, if required. Flow is from one line down to the next unless it is diverted with commands such as ‘goto’, ‘gosub’ and ‘return’. Goto and gosub are always used in conjunction with a label; in the above example ‘if time > t1 then gosub STIM’ causes flow diversion to the STIM label when the condition ‘if time > t1’ is true. Labels are recognized because they are positioned without a space before them. All other lines must begin with at least one space. ‘Gosub’ is always used in conjunction with a ‘return’ at the bottom of the subroutine.

‘If time > t1 then…’ is a conditional statement which compares the value returned by keyword ‘time’, which is time in whole seconds since the file began to run, with variable ‘t1’. A variable is any combination of letters and numbers (it must start with a letter) which do not form one of the reserved words used in the PCC language. Such variables, invented by the user when the file is created, are assigned a numerical value, which may be fractional, positive, negative or zero. When a variable is first created, it has value 0. Henceforth that variable may be modified (e.g. t1 = 5). When the above file starts to run, time will be 0 and t1 will also be 0, so the condition ‘if time > t1’ will not be true and the gosub command will not take effect. The next command ‘goto MAIN’ will cause a loop back to the MAIN label, and so to again check ‘if time > t1’. PsychLabAcquire program is designed to limit the speed with which it repeats such loops to 1000 times per second, to conserve CPU power. As soon as time increases past the first second, the condition ‘if time > t1’ will be found to be true and the gosub command will take effect, causing a jump to the STIM label.

At the bottom of the subroutine which starts with the STIM label, the command ‘t1 = time + 5’ assigns a new value to variable t1, such that when the ‘return’ command sends flow back to the line after where the ‘gosub’ evoked the original jump, 5 seconds must elapse before it next jumps into the STIM subroutine. Thus the stimulus sequence is timed to repeat on a 5 second cycle. PCC provides methods for randomization and pseudo-randomization, so that a typical experiment which requires repeat of a stimulus sequence with randomized inter trial intervals is easy to create. A PCC file may contain any number of different subroutines, and randomization can also be used to choose subroutines, so that complex procedures can be achieved. This method of stimulation control, using intelligent script file, allows huge flexibility in designing experiment paradigms, much more than is possible with a simple list of commands, or menu choice of stimulus options.

With the PsychLab system, there is finite time taken when the PCC program sends a command to operate one of the stimulators. Unfortunately, this time period is also variable; it could take tens of milliseconds in certain circumstances. In order to allow perfect accuracy in producing a *sequence* of stimuli, the SetNoise, SetTone, SetShock, SetBIN8, and SetRelay commands are provided. Each of these commands includes a list of parameters determining volume or other values required by the particular device, always including a duration parameter, in milliseconds. In version 5 and above PsychLab firmware, when a list of Set… commands is encountered, it sets the PsychLab unit up with a list of stimulation devices which will be operated in turn, such that when the startStim command executes, the first device operates for the duration specified, then the next takes over, and so on, using exact time control inside the PsychLab unit, eliminating time errors caused in communication with the PsychLab unit. In the example, a tone is presented for a second, then there is a burst of noise for 40mS, then the tone continues for another second. Two more tone commands are used to tailor the decay shape of the tone.

The ‘latency’ function is similar to the ‘time’ function, but whereas ‘time’ produces a value in whole seconds, which cannot be changed by commands in the PCC file, ‘latency’ produces time values accurate to millisecond fractions of a second. ‘Latency’ can be used to time intervals of less than a second, and the absolute value of ‘latency’ can be changed with statements like ‘latency = 0’. A complete description of all PCC commands is given in the PCC language reference.

PCC View window.

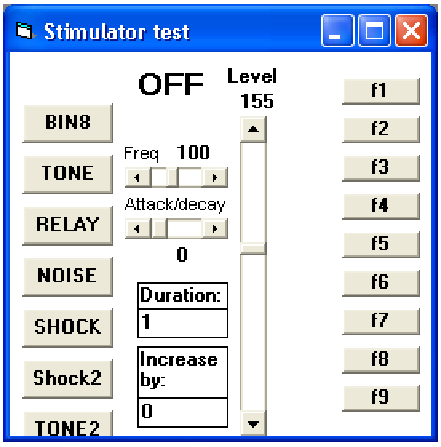
2 9 16 23

At the bottom of the STIM subroutine, the line ‘print time’ demonstrates use of the PCC View window. The print command may be used in the PCC file to show the value of any variable or function, at the instant when that line of the file is enacted. The PCC view window might be used in the design of an experiment, for example to show the operator trial current trial number, and it is also useful when developing PCC files, to help track down how the file is operating when test running.

A separate manual is provided with a complete list and definitions of all PCC commands. Help will also be available on-line in future versions of PsychLab1, obtained by placing the cursor on the PCC keyword in the PCC Editor window and pressing f1.

PCC additionally includes commands to show pictures on the computer screen, play sounds, and even run multi-media movies. Advanced methods are provided to help with accurate time synchronization for all stimulation methods. In some fundamental respects, the PCC file is similar to a BASIC program, any BASIC programming experience would undoubtedly be helpful when learning to use PCC. When developing a PCC file, changes to the file take effect when running is stopped and re-started. It is advisable, but not essential, to save the PCC file before running it.

Stimulator Test window.



This window may be used to check operation of stumulus PsychLab devices, such as Tone/Noise generator, Shocker, Somatosensory stimulator, TTL and Relay unit. The buttons on the left side directly operate one of those devices, sending the level set on the slider to the device for the selected duration.

Manual event marking.

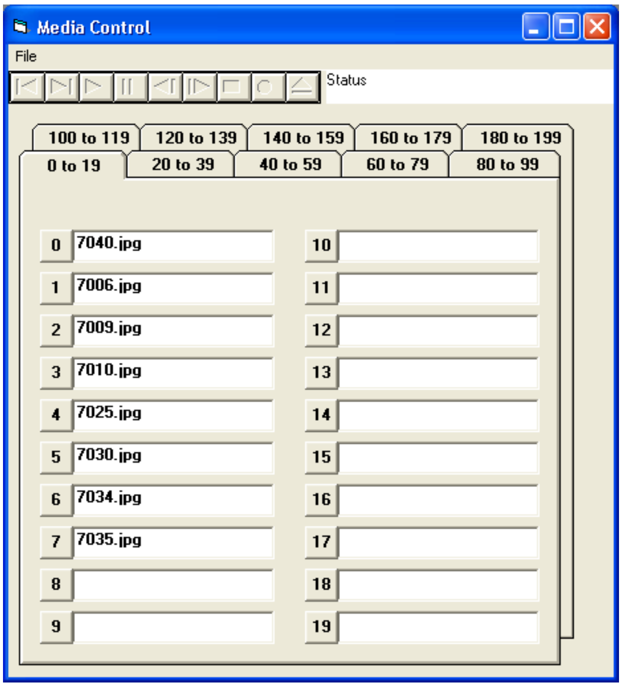
The buttons on the right side directly affect the Event trace seen in each PsychLab View. These may be used to manually mark events in an experiment. These buttons may also be operated by pressing function keys f1 thru f9. These keys only take effect if the Stimulator Test window is *in focus*. A window is in focus if the title bar is lit, to get a window into focus just click on a blank place in the window.

Using the stimulator test window for shock workup.
A shock workup is a procedure whereby the subject is tested with increasing shock levels to determine the threshold level at which they can tolerate the shock. The 'Increase by:' box is set to determine incremental shock level increase, and the Shock button is repeatedly clicked so that the subject receives shocks of increasing severity. The 'Level' slider goes up with each shock, and the Level indicator on top of the slider shows shock level. When tolerance level is established, this shock level is entered into the 'parameter' field of the Subject Details panel. The PCC program is designed to control shock level using the parameter value. This is simply achieved by putting the 'parameter' keyword into the SetShock command. e.g. for a 1 second shock:

```
SetShock parameter, 1000
```

Using the stimulator test window for calibrating sound level.
Accurate sound level can only be achieved by measuring sound at the headphone sound cup, because each pair of headphones has a different sensitivity. An artificial ear is placed over the headphone, and the level in the Stimulator test window adjusted until the desired dB level is achieved. For this purpose, duration may be increased such that the sound stays on for long enough to get a stable reading.

Media Control window.



0 7040.jpg
1 7006.jpg
2 7009.jpg
3 7010.jpg
4 7025.jpg
5 7030.jpg
6 7034.jpg
7 7035.jpg
8
9
10
11
12
13
14
15
16
17
18
19

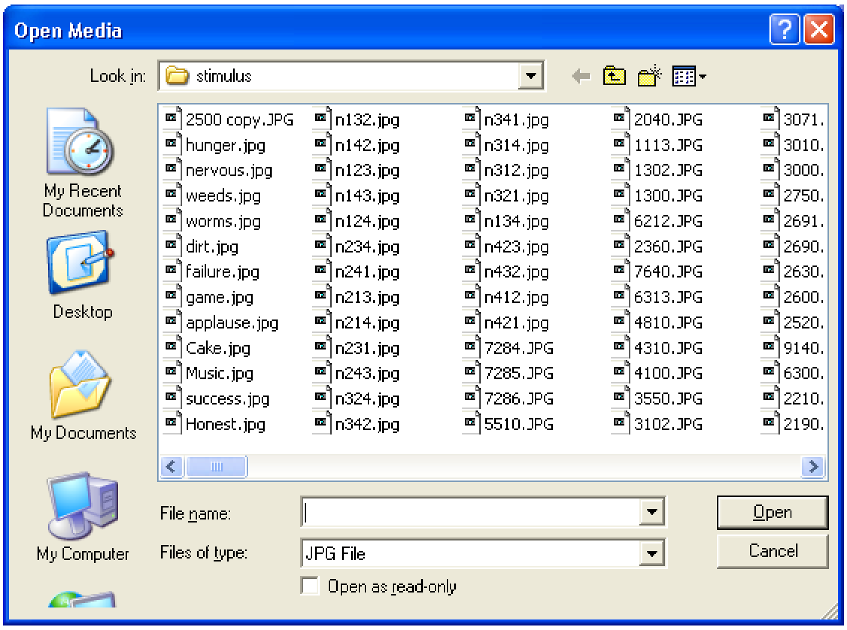
This window is used to relate the names of media files to a number system used in PCC files. For example, a PCC program might be designed to load a picture, play a sound file or WMV/AVI video using the command

```
Load x
```

The value of x will determine which media is presented, referring to file name corresponding to that number in the Media Control window.

Picture and all other media files must be placed in the C:\CPI\STIMULUS folder. Once files are in this folder, their names can easily be added to one of the numbered fields by double clicking inside the field.

A file name is selected from the list, and will be transferred to the numbered field when Open is selected.

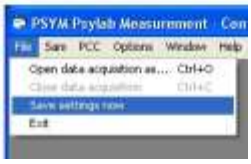


Look in: stimulus

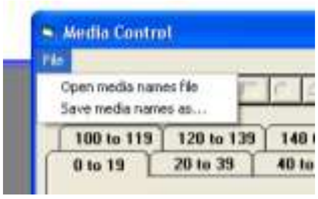
2500 copy.JPG
hunger.jpg
nervous.jpg
weeds.jpg
worms.jpg
dirt.jpg
failure.jpg
game.jpg
applause.jpg
Cake.jpg
Music.jpg
success.jpg
Honest.jpg
n132.jpg
n142.jpg
n123.jpg
n143.jpg
n124.jpg
n234.jpg
n241.jpg
n213.jpg
n214.jpg
n231.jpg
n243.jpg
n324.jpg
n342.jpg
n341.jpg
n314.jpg
n312.jpg
n321.jpg
n134.jpg
n423.jpg
n432.jpg
n412.jpg
n421.jpg
7284.JPG
7285.JPG
7286.JPG
5510.JPG
2040.JPG
1113.JPG
1302.JPG
1300.JPG
6212.JPG
2360.JPG
7640.JPG
6313.JPG
4810.JPG
4310.JPG
4100.JPG
3550.JPG
3102.JPG
3071.
3010.
3000.
2750.
2691.
2690.
2630.
2600.
2520.
9140.
6300.
2210.
2190.

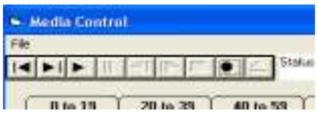
File name:
Files of type: JPG File
□ Open as read-only

Up to 200 different file names may currently be referenced with the Media Control window. When the required file names have been placed in the window, use Psylab Measurement Window menu, File, Save settings now., to retain these file names.

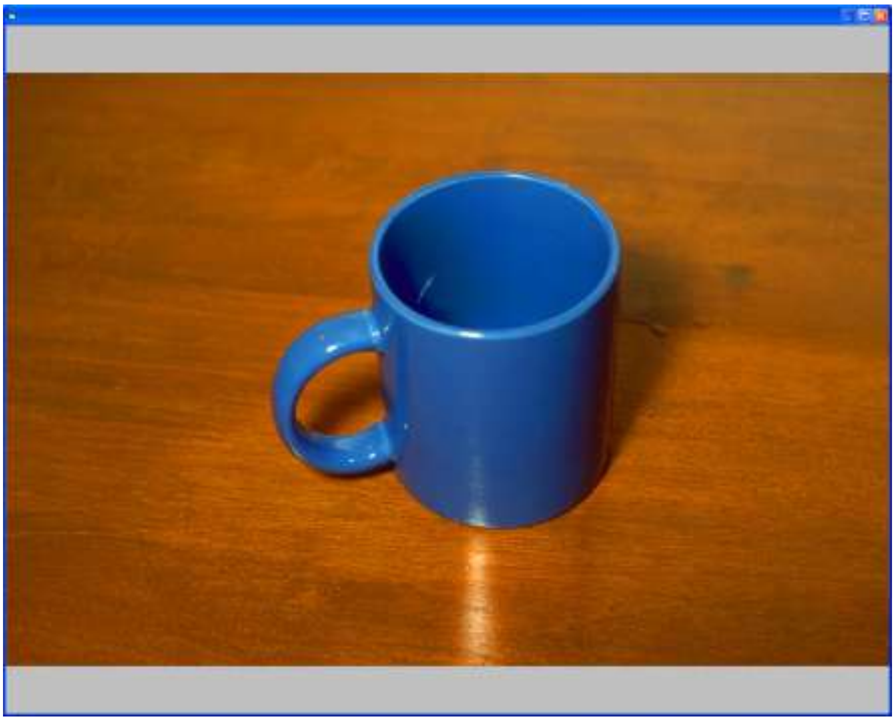

PSYM Psylab Measurement Con
File
Sam
PCC
Options
Window
Help
Open data acquisition as... Ctrl+O
Close data acquisition Ctrl+C
Save settings now
Exit

The pattern of file names may also be stored in a file, using the File menu in the Media Control window. It is recommended to save Media Control file names using both these methods, so that the pattern file provides a backup if the default settings are inadvertently changed. If more than one pattern of media control file names is required, different patterns can be saved using Media Control, File, Save media names as.., which allows you to give a name to each pattern. Whichever pattern is present when Psylab Measurement Window menu, File, Save settings now., is used will be the pattern that is loaded when PsychLab1 program starts up. In future versions of PsychLab1, it is planned to allow a Media Control window patterns to be loaded by a metacommand in a PCC file, such that different patterns may be used without requiring the user to manually load them. However, at present, 200 different fields should allow enough flexibility to let different PCC programs refer to different *areas* of the filename index pattern if required. To test a picture or other media loaded in the Media Control window, click on the number next to the name field. Sound and movie media, when loaded, may be tested using the control bar.



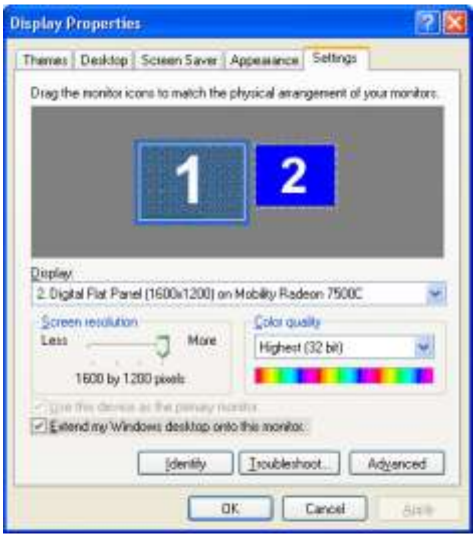


Media View window.



The media View window is used to show pictures to the subject for stimulation purposes. By clicking the number next to the file name field in the Media Control window, if that field contains a picture file name (and the picture file is present in the C:\CPI\STIMULUS folder), that picture will appear in the Media View window. Pictures are automatically sized to fill the Media View window.

In order for the subject to see only this window, the Media View window may be presented on a separate VDU monitor.



Display: 2. Digital Flat Panel (1600x1200) on Mobility Radeon 7500C

Screen resolution: 1600 by 1200 pixels

Color quality: Highest (32 bit)

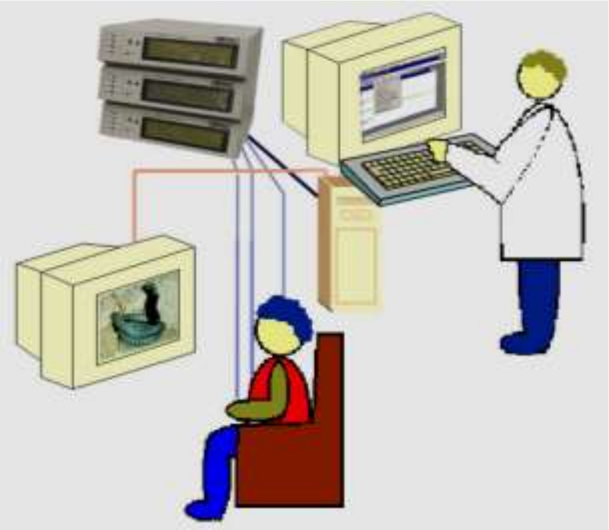
☐ Use this device as the primary monitor

☑ Extend my Windows desktop onto this monitor

Using a separate monitor to present pictures to the subject.

‘Professional’ versions of Windows operating systems allow ‘Extended desktop’ to be used when two monitors are attached to one computer. With desktop computers, this requires that a second graphics card be fitted, but with laptop computers the external monitor socket is normally driven by a separate graphics unit inside the laptop. When a second monitor is enabled, use windows Control Panel, Display, check box ‘Extend my windows desktop onto this monitor’.

This has the effect that the mouse pointer, when moved to the edge of one of the monitors, will appear in the other one, and windows can also be dragged from one monitor to the other. Use the main monitor for the windows in the PsychLab1 program, except drag the Media View window onto the other monitor. Then size the Media View window so that it fills the monitor (don't use the maximize button). Now use Psylab Measurement Window menu, File, Save settings now., to retain this window position setup.



An example PCC file to present pictures in a startle paradigm.

The following program demonstrates the basics of using PCC to present pictures with startle probes at given latency after picture onset.

Counterbalanced order of picture presentation is set up using the table to provide pseudo-randomization. Two types of picture are shown, neutral and critical. The Media Control window is loaded with the names of neutral pictures in positions 1 to 10, and critical pictures in positions 51 to 60 (leaving a space between neutral and critical allows easy expansion to more pictures without major re-design). The first part of the table contains a number which will be used to determine which category of picture will be shown in each trial, where 1 is neutral and 2 is critical.

```
 ‘ Startle program with picture stimulus example
 $table 1,2,2,1,1,1,2,2,2,1
 $table 2,1,1,2,2,2,1,2,1,1
```

The second part of the table contains inter-stimulus-interval for each trial, as time in seconds, in range 15 to 25 seconds, averaging at 20 seconds.

```
 $table 15,25,20,17,23,20,15,25,19,21
 $table 21,19,25,15,20,23,17,20,25,15
```

A variable `isiPointer` is created, to point to the second part of the table, which starts at position 21, and another variable `nextTrialTime` is created which will be used to determine the time of the first trial, and by updating this variable in each trial, the time of each subsequent trial. Separate pointers `NeutralPointer` and `CriticalPointer` are created to reference each neutral picture and each critical picture. Note that the PCC file is not case sensitive, capitals may be used to help readability. Variable names may not however contain spaces or characters other than letters and numbers.

```
 isiPointer = 21
 nextTrialTime = 20
 neutralPonter = 1
 criticalPointer = 51
```

A main loop is designed such that command execution will loop waiting for the function ‘time’ to exceed the value of variable `nextTrialTime`.

```
MAIN
 if time > nextTrialTime then gosub STIM
 goto MAIN
```

The STIM subroutine is created. A variable to count `trialNumber` is created and incremented. A procedure is designed to load one of the pictures, chosen on the basis of the value found in the top part of the table, by using `trialNumber` as the table index to point into the part of the table beginning at position 1.

```
STIM
 trialNumber = trialNumber + 1
 If table(trialNumber) = 1 then load neutralPointer
 If table(trialNumber) = 2 then load criticalPointer
```

The pointer for that category of picture must now be incremented, so that the PsychLabe picture is not shown twice.

```
 If table(trialNumber) = 1 then neutralPointer = neutralPointer + 1
 If table(trialNumber) = 2 then criticalPointer = criticalPointer + 1
```

A delay is now organized to allow the picture to load. This is done using the `latency` function, which is first set to zero, and then used conditionally in the `delay` function. File execution will stop at the `delay` line until the condition becomes true. After this the loaded picture is shown using the `show` command. At this instant, a value is set in the event channel to indicate that the picture is shown. This value needs to indicate which type of picture is being shown, so value found in the first part of the table is used to set the event channel, so that it will record either 1 or 2, `event = table(trialNumber)`. Coding of the event channel is essential, so that when data are analyzed trials can easily be sorted into categories.

```
 Latency = 0
 Delay until latency > 1
 show
 event = table(trialNumber)
```

The noise generator must now be set ready to produce the startle probe. When the noise occurs, it will generate a new value in the event channel. This value must be different to the value indicating start of picture presentation, yet it must also reflect the type of picture, because when data are analyzed, probe stimuli may be used to synchronize data extraction, so the event accompanying the probe stimulus must also contain information about which picture type is associated with the probe. A temporary variable `eventCode` is therefore created to contain a number which is a compound of a value which will indicate a probe (128 is used here) and the type of the picture. This value is then used in the SetNoise command to determine the event code that will show when the startle noise is on. Parameters for the SetNoise command are ears (3 is both ears), volume (255 is maximum), event value, duration (mS).

```
 eventCode = 128 + table(trialNumber)
 setNoise 3,240,eventCode,40
```

Another delay is now produced, which will be the stimulus – probe interval, in this case 4 seconds is chosen. A more complex PCC file could choose different intervals for different trials.
At the time when the picture was shown, latency had the value 1, therefore we must now wait until latency is 5. Note that with the latency function, the comparison must always be > (greater than) rather than =, because precise time values produced by the latency function may not ever be exactly some value, they are lightly to be some infinitesimal fraction larger or smaller, so comparing for an equal value is likely never to produce a true result. After this delay, the startle noise is presented.

```
 delay until latency > 5
 noise
```

After another 1 second delay, the picture is turned off using the `clear` command.
Stimulation is now completed, but the `isiPointer` and `nextTrialTime` variable must be adjusted ready for the next trial.

```
 delay until latency > 6
 clear
 isiPonter = isiPointer + 1
 nextTrialTime = time + table(isiPointer)
 return
```

One further line is added at the top of the STIM subroutine so that measurement will automatically stop when 20 trials have completed.

```
If trialNumber = 20 then store
```

The entire file listing is shown below. Spaces between file lines are ignored, and may be used to assist readability. This file can be copied and pasted directly into the PCC editor window, in order to try it, or modify it for a revised experiment model.

Entire listing for example Startle program using Picture Pre-Stimulation.

```
‘ Startle program with picture stimulus example

 $table 1,2,2,1,1,1,2,2,2,1
 $table 2,1,1,2,2,2,1,2,1,1

 $table 15,25,20,17,23,20,15,25,19,21
 $table 21,19,25,15,20,23,17,20,25,15

 isiPointer = 21
 nextTrialTime = 20
 neutralPonter = 1
 criticalPointer = 51

MAIN
 if time > nextTrialTime then gosub STIM
 goto MAIN

STIM
 if trialNumber = 20 then store
 trialNumber = trialNumber + 1
 if table(trialNumber) = 1 then load neutralPointer
 if table(trialNumber) = 2 then load criticalPointer
 if table(trialNumber) = 1 then neutralPointer = neutralPointer + 1
 if table(trialNumber) = 2 then criticalPointer = criticalPointer + 1
 latency = 0
 delay until latency > 1
 show
 event = table(trialNumber)
 eventCode = 128 + table(trialNumber)
 setNoise 3,240,eventCode,40
 delay until latency > 5
 noise
 delay until latency > 6
 clear
 isiPonter = isiPointer + 1
 nextTrialTime = time + table(isiPointer)
 return
```