

How to Debug an Experiment with the Verbose Log

09/23/2008 (Today) 12:03:49

RSS

I recently had a customer contact us describing an issue where an experiment was taking longer to run than expected, so the MRI results were unusable, as by the end of the experiment, there was potentially a several second difference between what the MRI scans expected and what SuperLab was actually doing. I've attached the user's experiment (so don't give this to customers), and the following is my explanation from the verbose log of precisely where the delays came from. Note that this is a subset of the log, beginning with the start of one of the blocks and continuing to the start of the second trial in that block. My comments are in brown.

[go no go.sl4](#) 

Columns 1&2: If you have to ask, you're in the wrong field.

Column 3: Time in milliseconds since experiment start according to SuperLab's clock. On the Mac, this has nanosecond precision, but here it has been rounded to the nearest .01 millisecond for your sanity. Seriously. I felt that .1 milliseconds wasn't enough and .001 milliseconds was overkill. If you *really* want to see the insane numbers, they can be provided. Personally, I'd rather not.

Column 4: The piece of information we deemed important enough to put in the log. Note that actual response values are not in this log. Since the purpose of the log is to help with timing and managing macros, I've considered the actual response value to be unimportant. If you do actually need the value, it's in the data file, and you'll probably want to enable the column that notes that time since that start of the experiment.

```
04/04/2008 - 13:47:23.252 - 38762.48 - Presenting block 'Block 1':
04/04/2008 - 13:47:23.252 - 38762.48 - Sync Trial:: Resetting.
```

If the trials were configured to be a certain length, the sync trial timer would be reset to zero here.

```
04/04/2008 - 13:47:23.252 - 38762.49 - Starting up composite trial 'Go/No-Go Trial (6sec isi) 2':
04/04/2008 - 13:47:23.252 - 38762.49 - Entering trial 'Go/No-Go Trial (6sec isi) 2':
04/04/2008 - 13:47:23.252 - 38762.49 - Preparing trial 'Go/No-Go Trial (6sec isi) 2':
04/04/2008 - 13:47:23.252 - 38762.61 - Flushing keyboard input.
04/04/2008 - 13:47:23.252 - 38762.70 - Flushing keyboard input.
04/04/2008 - 13:47:23.252 - 38762.79 - Flushing keyboard input.
04/04/2008 - 13:47:23.252 - 38762.88 - Flushing keyboard input.
04/04/2008 - 13:47:23.253 - 38762.97 - Flushing keyboard input.
04/04/2008 - 13:47:23.253 - 38763.06 - Flushing keyboard input.
04/04/2008 - 13:47:23.253 - 38763.15 - Flushing keyboard input.
04/04/2008 - 13:47:23.253 - 38763.23 - Flushing keyboard input.
```

Unfortunately, the input device is prepped for each event in the trial. This is a known bug that in your case adds .53ms to the start of the trial.

```
04/04/2008 - 13:47:23.257 - 38767.13 - Presenting trial 'Go/No-Go Trial (6sec isi) 2':
```

Note that we lost about 5ms between 38762.49 and 38767.13 -- preparing the trial to run.

```
04/04/2008 - 13:47:23.257 - 38767.14 - Starting event 'No Go (6sec isi) ' with ID: 147321:
04/04/2008 - 13:47:23.260 - 38769.94 - Flushing secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:23.260 - 38769.95 - Flushed secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:23.260 - 38769.96 - Erased The Screen
```

My primary display does not provide synchronization information. With a display that does, one refresh goes toward erasing the screen.

```
04/04/2008 - 13:47:23.260 - 38769.96 - Presenting stimulus: No Go (6sec isi)
04/04/2008 - 13:47:23.260 - 38769.96 - Presenting bitmap and flushing offscreen buffer to screen...
04/04/2008 - 13:47:23.284 - 38794.16 - Flushing secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:23.284 - 38794.17 - Flushed secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:23.284 - 38794.17 - Amount of time taken to draw text to the screen: 24.17
```

Note that when you preview an event, it's this number that is displayed in the top-left corner.

```
04/04/2008 - 13:47:23.284 - 38794.18 - Finished Stimulus Presentation and reset RT Timer. Last Stim Onset
Time: 38794.17
```

Somehow OS X is aware of the synchronization information, so on 10.4 and later, we can only flush the buffer once per refresh. Therefore, between drawing the text (which takes an insane amount of time--pictures are easier) and flushing the buffer (less than .01ms in this case), we lost 24ms here.

```
04/04/2008 - 13:47:23.284 - 38794.18 - Looking for input with time limit: 1000 msec...
04/04/2008 - 13:47:24.284 - 39794.68 - Time limit has elapsed since last stim onset: 1000 ms
```

Notice that this is precisely 1000ms + the .5ms of time given back to the system. .5ms isn't much, but these errors will add up. The only way to fix this is to synchronize the trial starts. Then, the error will be reset to zero at the start of every trial.

```
04/04/2008 - 13:47:24.284 - 39794.68 - Registered this as a correct response.
```

04/04/2008 - 13:47:24.284 - 39794.69 - Cleaning up after event...
 04/04/2008 - 13:47:24.284 - 39794.69 - Done cleaning up after event.
 04/04/2008 - 13:47:24.284 - 39794.69 - Running feedback (if applicable)...
 04/04/2008 - 13:47:24.284 - 39794.69 - Feedback completed.
 04/04/2008 - 13:47:24.284 - 39794.69 - Starting event 'Fix Cross (6sec isi) 1' with ID: 147322:
 04/04/2008 - 13:47:24.287 - 39797.50 - Flushing secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:24.287 - 39797.51 - Flushed secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:24.287 - 39797.51 - Erased The Screen

Note that erasing the screen before presenting a stimulus does involve a literal blank screen, as shown by the above three lines.

04/04/2008 - 13:47:24.287 - 39797.51 - Presenting stimulus: Fix Cross (6sec isi) 1
 04/04/2008 - 13:47:24.287 - 39797.51 - Presenting bitmap and flushing offscreen buffer to screen...
 04/04/2008 - 13:47:24.307 - 39817.22 - Flushing secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:24.307 - 39817.23 - Flushed secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:24.307 - 39817.23 - Amount of time taken to draw text to the screen: 19.68
 04/04/2008 - 13:47:24.307 - 39817.23 - Finished Stimulus Presentation. Last Stim Onset Time: 39817.23

The onset of this stimulus is 1023.06ms after the previous stimulus. This is the 1000ms ISI from the previous event plus about 3ms in the start of the event plus about 20ms drawing to the screen.

04/04/2008 - 13:47:24.307 - 39817.23 - Looking for input with time limit: 1000 msec...
 04/04/2008 - 13:47:25.307 - 40817.50 - Time limit has elapsed since last stim onset: 1000 ms

Off by less than the .5ms regular delay.

04/04/2008 - 13:47:25.307 - 40817.50 - Not marking this response as a self correct. Event IDs: curr:
 147322 prev: 147321
 04/04/2008 - 13:47:25.307 - 40817.50 - Registered this as a correct response.

The IDs are SuperLab's internal method of differentiating objects. The actual value is virtual irrelevant to users, but it affects whether a response gets marked as "Correct" or "Self Correct." The Trial ID and Block ID are also taken into account, but I don't recall if they ever get spit out in the verbose log. Note that an event's ID is shown in here when the event starts so that you can search and see if necessary. You probably won't ever need this information, but it's here.

04/04/2008 - 13:47:25.307 - 40817.50 - Cleaning up after event...
 04/04/2008 - 13:47:25.307 - 40817.50 - Done cleaning up after event.
 04/04/2008 - 13:47:25.307 - 40817.50 - Running feedback (if applicable)...
 04/04/2008 - 13:47:25.307 - 40817.51 - Feedback completed.
 04/04/2008 - 13:47:25.307 - 40817.51 - Starting event 'Go (6sec isi) 1' with ID: 147323:
 04/04/2008 - 13:47:25.310 - 40820.33 - Flushing secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:25.310 - 40820.34 - Flushed secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:25.310 - 40820.34 - Erased The Screen
 04/04/2008 - 13:47:25.310 - 40820.35 - Presenting stimulus: Go (6sec isi) 1
 04/04/2008 - 13:47:25.310 - 40820.35 - Presenting bitmap and flushing offscreen buffer to screen...
 04/04/2008 - 13:47:25.327 - 40837.22 - Flushing secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:25.327 - 40837.23 - Flushed secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:25.327 - 40837.23 - Amount of time taken to draw text to the screen: 16.84
 04/04/2008 - 13:47:25.327 - 40837.24 - Finished Stimulus Presentation. Last Stim Onset Time: 40837.24

1020.01ms after previous stimulus.

04/04/2008 - 13:47:25.327 - 40837.24 - Looking for input with time limit: 1000 msec...
 04/04/2008 - 13:47:25.655 - 41165.06 - Registered a response. This is the potential reaction time: 2370.88 ms
 04/04/2008 - 13:47:25.655 - 41165.06 - Registered a response. This is the actual reaction time: 2370.05 ms

Keyboard and mouse events have a time stamp. SuperLab compares this stamp with the current time of the clock used by events and subtracts the difference from its own clock. In this case, it took .83ms from the point that the event occurred to the time that SuperLab received the event. Through my own experimentation, I found that the Apple keyboard that came with our original Intel iMac was precise to about 8.01ms. I haven't tested the Kensington I'm using now.

04/04/2008 - 13:47:25.655 - 41165.06 - Not marking this response as a self correct. Event IDs: curr: 147323
 prev: 147322
 04/04/2008 - 13:47:25.655 - 41165.06 - Registered this as a correct response.
 04/04/2008 - 13:47:26.327 - 41837.58 - Time limit has elapsed since last stim onset: 1000 ms
 04/04/2008 - 13:47:26.327 - 41837.58 - Cleaning up after event...
 04/04/2008 - 13:47:26.327 - 41837.58 - Done cleaning up after event.
 04/04/2008 - 13:47:26.327 - 41837.58 - Running feedback (if applicable)...
 04/04/2008 - 13:47:26.327 - 41837.58 - Feedback completed.
 04/04/2008 - 13:47:26.327 - 41837.59 - Starting event 'Fix Cross (6sec isi) 2' with ID: 147324:
 04/04/2008 - 13:47:26.330 - 41840.38 - Flushing secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:26.330 - 41840.39 - Flushed secondary buffer to OS's primary buffer (no beam
 information available on this machine).
 04/04/2008 - 13:47:26.330 - 41840.39 - Erased The Screen

04/04/2008 - 13:47:26.330 - 41840.39 -
04/04/2008 - 13:47:26.330 - 41840.41 -
04/04/2008 - 13:47:26.346 - 41856.04 -
information available on this machine).
04/04/2008 - 13:47:26.346 - 41856.05 -
information available on this machine).
04/04/2008 - 13:47:26.346 - 41856.05 -
04/04/2008 - 13:47:26.346 - 41856.05 -

Presenting stimulus: Fix Cross (6sec isi) 2
Presenting bitmap and flushing offscreen buffer to screen...
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Amount of time taken to draw text to the screen: 15.60
Finished Stimulus Presentation. Last Stim Onset Time: 41856.05

1018.81 ms after previous stimulus.

04/04/2008 - 13:47:26.346 - 41856.06 -
04/04/2008 - 13:47:27.346 - 42856.10 -
04/04/2008 - 13:47:27.346 - 42856.10 -
04/04/2008 - 13:47:27.346 - 42856.11 -
04/04/2008 - 13:47:27.346 - 42856.11 -
04/04/2008 - 13:47:27.346 - 42856.11 -
04/04/2008 - 13:47:27.346 - 42856.11 -
04/04/2008 - 13:47:27.346 - 42856.12 -
04/04/2008 - 13:47:27.349 - 42858.93 -
information available on this machine).
04/04/2008 - 13:47:27.349 - 42858.94 -
information available on this machine).
04/04/2008 - 13:47:27.349 - 42858.94 -
04/04/2008 - 13:47:27.349 - 42858.95 -
04/04/2008 - 13:47:27.349 - 42858.95 -
04/04/2008 - 13:47:27.360 - 42870.65 -
information available on this machine).
04/04/2008 - 13:47:27.360 - 42870.66 -
information available on this machine).
04/04/2008 - 13:47:27.360 - 42870.66 -
04/04/2008 - 13:47:27.360 - 42870.66 -

Looking for input with time limit: 1000 msec...
Time limit has elapsed since last stim onset: 1000 ms
Registered this as no response.
Cleaning up after event...
Done cleaning up after event.
Running feedback (if applicable)...
Feedback completed.
Starting event 'Go (6sec isi) 2' with ID: 147325:
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Erased The Screen
Presenting stimulus: Go (6sec isi) 2
Presenting bitmap and flushing offscreen buffer to screen...
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Amount of time taken to draw text to the screen: 11.67
Finished Stimulus Presentation. Last Stim Onset Time: 42870.66

1014.61 after previous.

04/04/2008 - 13:47:27.360 - 42870.67 -
04/04/2008 - 13:47:27.623 - 43132.77 -
04/04/2008 - 13:47:27.623 - 43132.77 -
04/04/2008 - 13:47:27.623 - 43132.77 -
prev: 147324
04/04/2008 - 13:47:27.623 - 43132.77 -
04/04/2008 - 13:47:28.361 - 43870.89 -
04/04/2008 - 13:47:28.361 - 43870.90 -
04/04/2008 - 13:47:28.361 - 43870.90 -
04/04/2008 - 13:47:28.361 - 43870.90 -
04/04/2008 - 13:47:28.361 - 43870.90 -
04/04/2008 - 13:47:28.361 - 43870.90 -
04/04/2008 - 13:47:28.364 - 43873.70 -
information available on this machine).
04/04/2008 - 13:47:28.364 - 43873.74 -
information available on this machine).
04/04/2008 - 13:47:28.364 - 43873.74 -
04/04/2008 - 13:47:28.364 - 43873.75 -
04/04/2008 - 13:47:28.364 - 43873.75 -
04/04/2008 - 13:47:28.377 - 43887.47 -
information available on this machine).
04/04/2008 - 13:47:28.377 - 43887.48 -
information available on this machine).
04/04/2008 - 13:47:28.377 - 43887.49 -
04/04/2008 - 13:47:28.377 - 43887.49 -

Looking for input with time limit: 1000 msec...
Registered a response. This is the potential reaction time: 4338.59 ms
Registered a response. This is the actual reaction time: 4338.05 ms
Not marking this response as a self correct. Event IDs: curr: 147325
Registered this as a correct response.
Time limit has elapsed since last stim onset: 1000 ms
Cleaning up after event...
Done cleaning up after event.
Running feedback (if applicable)...
Feedback completed.
Starting event 'Fix Cross (6sec isi) 3' with ID: 147326:
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Erased The Screen
Presenting stimulus: Fix Cross (6sec isi) 3
Presenting bitmap and flushing offscreen buffer to screen...
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Amount of time taken to draw text to the screen: 13.70
Finished Stimulus Presentation. Last Stim Onset Time: 43887.49

1016.83 ms after previous.

04/04/2008 - 13:47:28.377 - 43887.49 -
04/04/2008 - 13:47:29.378 - 44887.75 -
04/04/2008 - 13:47:29.378 - 44887.75 -
04/04/2008 - 13:47:29.378 - 44887.76 -
04/04/2008 - 13:47:29.378 - 44887.76 -
04/04/2008 - 13:47:29.378 - 44887.77 -
04/04/2008 - 13:47:29.378 - 44887.77 -
04/04/2008 - 13:47:29.378 - 44887.77 -
04/04/2008 - 13:47:29.380 - 44890.56 -
information available on this machine).
04/04/2008 - 13:47:29.381 - 44890.57 -
information available on this machine).
04/04/2008 - 13:47:29.381 - 44890.57 -
04/04/2008 - 13:47:29.381 - 44890.58 -
04/04/2008 - 13:47:29.381 - 44890.58 -
04/04/2008 - 13:47:29.392 - 44902.26 -
information available on this machine).
04/04/2008 - 13:47:29.392 - 44902.27 -
information available on this machine).
04/04/2008 - 13:47:29.392 - 44902.28 -
04/04/2008 - 13:47:29.392 - 44902.28 -

Looking for input with time limit: 1000 msec...
Time limit has elapsed since last stim onset: 1000 ms
Registered this as no response.
Cleaning up after event...
Done cleaning up after event.
Running feedback (if applicable)...
Feedback completed.
Starting event 'Go (6sec isi) 3' with ID: 147327:
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Erased The Screen
Presenting stimulus: Go (6sec isi) 3
Presenting bitmap and flushing offscreen buffer to screen...
Flushing secondary buffer to OS's primary buffer (no beam
Flushed secondary buffer to OS's primary buffer (no beam
Amount of time taken to draw text to the screen: 11.65
Finished Stimulus Presentation. Last Stim Onset Time: 44902.28

1014.79 after previous.

```
04/04/2008 - 13:47:29.392 - 44902.28 - Looking for input with time limit: 1000 msec...
04/04/2008 - 13:47:29.767 - 45276.92 - Registered a response. This is the potential reaction time: 6482.75 ms
04/04/2008 - 13:47:29.767 - 45276.93 - Registered a response. This is the actual reaction time: 6482.04 ms
04/04/2008 - 13:47:29.767 - 45276.93 - Not marking this response as a self correct. Event IDs: curr:
147327 prev: 147326
04/04/2008 - 13:47:29.767 - 45276.93 - Registered this as a correct response.
04/04/2008 - 13:47:30.392 - 45902.50 - Time limit has elapsed since last stim onset: 1000 ms
04/04/2008 - 13:47:30.393 - 45902.51 - Cleaning up after event...
04/04/2008 - 13:47:30.393 - 45902.51 - Done cleaning up after event.
04/04/2008 - 13:47:30.393 - 45902.51 - Running feedback (if applicable)...
04/04/2008 - 13:47:30.393 - 45902.51 - Feedback completed.
04/04/2008 - 13:47:30.393 - 45902.51 - Starting event 'Fix Cross (6sec isi) 4' with ID: 147328:
04/04/2008 - 13:47:30.395 - 45905.37 - Flushing secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:30.395 - 45905.38 - Flushed secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:30.395 - 45905.38 - Erased The Screen
04/04/2008 - 13:47:30.395 - 45905.39 - Presenting stimulus: Fix Cross (6sec isi) 4
04/04/2008 - 13:47:30.395 - 45905.39 - Presenting bitmap and flushing offscreen buffer to screen...
04/04/2008 - 13:47:30.410 - 45919.52 - Flushing secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:30.410 - 45919.53 - Flushed secondary buffer to OS's primary buffer (no beam
information available on this machine).
04/04/2008 - 13:47:30.410 - 45919.53 - Amount of time taken to draw text to the screen: 14.10
04/04/2008 - 13:47:30.410 - 45919.53 - Finished Stimulus Presentation. Last Stim Onset Time: 45919.53
```

1017.25 ms after previous. There *is* a pattern here. It's about one screen refresh on top of your 1000ms delay. My LCD runs at 60Hz, so that's 16.67ms.

```
04/04/2008 - 13:47:30.410 - 45919.53 - Looking for input with time limit: 1000 msec...
04/04/2008 - 13:47:31.410 - 46919.93 - Time limit has elapsed since last stim onset: 1000 ms
04/04/2008 - 13:47:31.410 - 46919.94 - Registered this as no response.
04/04/2008 - 13:47:31.410 - 46919.95 - Cleaning up after event...
04/04/2008 - 13:47:31.410 - 46919.95 - Done cleaning up after event.
04/04/2008 - 13:47:31.410 - 46919.95 - Running feedback (if applicable)...
04/04/2008 - 13:47:31.410 - 46919.95 - Feedback completed.
04/04/2008 - 13:47:31.410 - 46919.96 - Cleaning up after trial 'Go/No-Go Trial (6sec isi) 2'
04/04/2008 - 13:47:31.411 - 46920.47 - Exiting trial 'Go/No-Go Trial (6sec isi) 2':
04/04/2008 - 13:47:31.411 - 46920.47 - Starting up composite trial 'Go/No-Go Trial (4sec isi) 4':
```

That trial took 8157.98ms, or about 158 ms longer than desired. There are two necessary parts to the solution:

- 1) Figure out what the refresh is on your monitor. Subtract one refresh from your ISI.
- 2) Under the "End" tab of the Trial Editor, configure the length of each trial. Along with this, you'll want the last event in the trial to not have an ISI (or one that's guaranteed short enough to not interfere with the trial synchronization feature). Since the last event in all your trials is the fixation cross, this should be fine, since you are expecting no response during this period.

... more trial runs left out ...

```
04/04/2008 - 13:49:15.296 - 150800.18 - Dumping optimal input accuracy histogram
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.0 count: 0
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.1 count: 43
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.2 count: 5
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.3 count: 0
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.4 count: 0
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.5 count: 284927
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.6 count: 135
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.7 count: 5
04/04/2008 - 13:49:15.296 - 150800.19 - Time 0.8 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 0.9 count: 2
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.0 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.1 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.2 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.3 count: 1
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.4 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.5 count: 0
04/04/2008 - 13:49:15.296 - 150800.20 - Time 1.6 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 1.7 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 1.8 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 1.9 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 2.0 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 2.1 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 2.2 count: 0
04/04/2008 - 13:49:15.296 - 150800.22 - Time 2.3 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.4 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.5 count: 0
```

```

04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.6 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.7 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.8 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 2.9 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.0 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.1 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.2 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.3 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.4 count: 0
04/04/2008 - 13:49:15.296 - 150800.23 - Time 3.5 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 3.6 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 3.7 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 3.8 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 3.9 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.0 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.1 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.2 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.3 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.4 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.5 count: 0
04/04/2008 - 13:49:15.296 - 150800.24 - Time 4.6 count: 0
04/04/2008 - 13:49:15.296 - 150800.25 - Time 4.7 count: 0
04/04/2008 - 13:49:15.296 - 150800.25 - Time 4.8 count: 0
04/04/2008 - 13:49:15.296 - 150800.25 - Above 4.8 count: 0

```

The above just shows a histogram of the amount of time taken for each loop through the list of input devices. On Windows, the largest number will be at 0.0ms, as we virtually never allow the process to sleep. On the Mac, the largest number will be at 0.5, since we sleep for .5ms every time through the loop. The Mac isn't as precise as I'd like with respect to amount of time taken to sleep, so there is always some amount of error here. If the error is more than .5ms, it will show up in the verbose log (as a notice), specifying when the error occurred and how much of an error it was. This time through, I got none of these notices, but I'm running very little else on an 8-core machine. As you'd expect, your mileage varies from machine to machine depending on how many things it can literally do at once (number of cores) and how high the current demands are. Our old G4 mini does surprisingly well, though. Running on that machine, I experimentally determined that 5ms of error in the mach kernel's sleep function equates to a catastrophic failure in the system's real-time priority (and that will show up in the verbose log as a warning noting this detail... but you should NEVER see that).

I know the preceding paragraph implies a one-to-one correlation between the histogram and the sleep function, but there's more. If you're using the keyboard or mouse input, we *have* to give time to the Carbon event loop, and sometimes, Apple likes to do their own stuff there (we also *have* to give time eventually in order for the escape button to be able to exit an experiment that doesn't use the keyboard). That stuff still shows up in the histogram, and if it's too big to fit on the histogram (that is 4.9ms or more), an entry is written to the verbose log. If you ever play QuickTime movies in SuperLab, you will *definitely* see this error. Otherwise, you'll hopefully not see this error.

```
04/04/2008 - 13:49:15.296 - 150800.25 - Overhead of debug logging mechanism: 1.27 µs per entry.
```

Since the printing of the histogram is a tight loop with nothing but calls to the logging mechanism, I added this piece of information to show that the act of logging the information does take time, but it's negligible. This number is *much* larger for our own internal debug builds of SuperLab--since we want to watch the data live--so this was really here to convince the boss that adding the feature doesn't affect timing.

Interpreting Sync Trials

Josh contacted me with an issue where it appeared that the Sync Trial feature was not actually synchronizing the trials. As it turns out, he was comparing the times at the end of each trial, when the feature only synchronizes the start of the trials, and this detail was not visible in his data file. Furthermore, this experiment presents movies which introduce relatively large timing errors into the equation. This error is visible in the verbose log. The writeup includes references to a spreadsheet included in this attached zip file, but this is not necessary for understanding how this feature works.

[Josh SyncTrials.zip](#) 

... left out some stuff, but here's the important information from the first trial:

```

06/13/2008 - 16:26:43.153 - 0.00 - -----
06/13/2008 - 16:26:43.153 - 0.00 - Starting the Experiment!
06/13/2008 - 16:26:43.153 - 0.16 - Presenting block 'Run 1':
06/13/2008 - 16:26:43.153 - 0.17 - Sync Trial:: Resetting.
06/13/2008 - 16:26:43.153 - 0.17 - Starting up composite trial 'Safe Trial 1':

```

```

06/13/2008 - 16:26:43.153 - 0.18 - Entering trial 'Safe Trial 1':
06/13/2008 - 16:26:43.153 - 0.18 - Preparing trial 'Safe Trial 1':
06/13/2008 - 16:26:43.155 - 1.78 - Flushing keyboard input.
06/13/2008 - 16:26:43.172 - 18.79 - Flushing keyboard input.
06/13/2008 - 16:26:43.173 - 20.04 - Presenting trial 'Safe Trial 1':
06/13/2008 - 16:26:43.173 - 20.04 - Executing sync of trial 'Safe Trial 1'...
06/13/2008 - 16:26:43.173 - 20.04 - Sync Trial:: The previous trial did not have a specified length. Nothing to
do.
06/13/2008 - 16:26:43.173 - 20.04 - Sync Trial:: on exit, Trial started at: 20.04 minimum duration: 45000
msec

```

Note here that the trial is starting at 20.04ms into the experiment. All trials in this block are set to be 45000ms long.

... skipping a lot of trials...

```

06/13/2008 - 16:31:45.223 - 302052.85 - Cleaning up after trial 'Shock Trial 2'
06/13/2008 - 16:31:45.223 - 302052.93 - Exiting trial 'Shock Trial 2':
06/13/2008 - 16:31:45.223 - 302052.94 - FLUSHING DATA TO DISK

```

I turned on the option to flush data to disk at the end of every trial. With this turned on, I can watch the data file in the Terminal using "tail -f <filename>".

```

06/13/2008 - 16:31:45.224 - 302053.80 - Starting up composite trial 'Safe Trial 4':
06/13/2008 - 16:31:45.224 - 302053.81 - Entering trial 'Safe Trial 4':
06/13/2008 - 16:31:45.224 - 302053.81 - Preparing trial 'Safe Trial 4':
06/13/2008 - 16:31:45.225 - 302054.55 - Flushing keyboard input.
06/13/2008 - 16:31:45.239 - 302069.45 - Flushing keyboard input.
06/13/2008 - 16:31:45.240 - 302069.94 - Presenting trial 'Safe Trial 4':
06/13/2008 - 16:31:45.240 - 302069.94 - Executing sync of trial 'Safe Trial 4'...
06/13/2008 - 16:31:45.240 - 302069.94 - Sync Trial:: on entry, Last Time = 270020.04, When to Exit = 315020.04

```

Even though we're 300 seconds into the experiment, that 20.04ms stuck around. We don't store the time that the subsequent trials *actually* start; we store what time they *should* have started. There is no accumulating error this way.

```

06/13/2008 - 16:31:58.191 - 315020.34 - Sync Trial:: on exit, Trial started at: 315020.04 minimum duration:
45000 msec

```

The trial was supposed to start at 315020.04ms, but it's starting at 315020.34ms. This difference comes from the fact that SuperLab regularly gives up processor time in .5ms chunks on Mac OS X. Therefore, subsequent trials will never start at precisely the right moment, but they will never be off by more than a half millisecond.

```

06/13/2008 - 16:31:58.191 - 315020.35 - Starting event 'mark trial start' with ID: 44880:
06/13/2008 - 16:31:58.191 - 315020.36 - Presenting stimulus: mark trial start
06/13/2008 - 16:31:58.191 - 315020.36 - Presenting bitmap and flushing offscreen buffer to screen...
06/13/2008 - 16:31:58.197 - 315026.52 - Flushing secondary buffer to OS's primary buffer (no beam
information available on this machine).
06/13/2008 - 16:31:58.197 - 315026.53 - Flushed secondary buffer to OS's primary buffer (no beam
information available on this machine).
06/13/2008 - 16:31:58.197 - 315026.54 - Amount of time taken to draw text to the screen: 6.11
06/13/2008 - 16:31:58.197 - 315026.54 - Finished Stimulus Presentation and reset RT Timer. Last Stim Onset
Time: 315026.54

```

This onset time is at L22 in the spreadsheet file: 315027. Note that this number is 6.20ms larger than the actual start of this trial, which is represented at L22 in the excel spreadsheet. That number in the spreadsheet is calculated as a modulus relative to the very first trial. We can do that in the spreadsheet because all trials are the same length.

```

06/13/2008 - 16:31:58.197 - 315026.55 - More than 500 ms has passed since this input device has been used.
06/13/2008 - 16:31:58.197 - 315026.55 - Flushing keyboard input.
06/13/2008 - 16:31:58.197 - 315026.67 - Looking for input with time limit: 1 msec...
06/13/2008 - 16:31:58.197 - 315026.67 - Including Device: Keyboard-Single Keys
06/13/2008 - 16:31:58.199 - 315027.79 - Time limit has elapsed since last stim onset: 1 ms
06/13/2008 - 16:31:58.199 - 315027.79 - Registered this as no response.

```

We set the time limit to 1ms to ensure that this event appears in the data file.

```

06/13/2008 - 16:31:58.199 - 315027.79 - Cleaning up after event...
06/13/2008 - 16:31:58.199 - 315027.80 - Done cleaning up after event.
06/13/2008 - 16:31:58.199 - 315027.80 - Running feedback (if applicable)...
06/13/2008 - 16:31:58.199 - 315027.80 - Feedback completed.
06/13/2008 - 16:31:58.199 - 315027.80 - Starting event 'Safe_Movie_Full_1' with ID: 44883:
06/13/2008 - 16:31:58.199 - 315027.81 - Presenting stimulus: Safe_Movie_Full_1
06/13/2008 - 16:31:58.199 - 315027.88 - Playing movie synchronously
06/13/2008 - 16:31:58.211 - 315040.51 - Waiting for movie to finish playing...
06/13/2008 - 16:32:27.304 - 344131.98 - Synchronous movie finished playing.

```

The movie took 29091.47ms to play. It was *supposed* to be 29000ms, right? Here's your error. Thanks QuickTime. It's very difficult to mix movies with accurate timing. Don't rely on results that rely on QuickTime. Anything after this point in this trial is susceptible to this.

06/13/2008 - 16:32:27.304 - 344131.99 - Finished playing movie. Moving on...
06/13/2008 - 16:32:27.305 - 344132.61 - Finished Stimulus Presentation. Last Stim Onset Time: 344132.60
06/13/2008 - 16:32:27.305 - 344132.61 - Cleaning up after event...
06/13/2008 - 16:32:27.305 - 344132.61 - Done cleaning up after event.
06/13/2008 - 16:32:27.305 - 344132.61 - Running feedback (if applicable)...
06/13/2008 - 16:32:27.305 - 344132.61 - Feedback completed.
06/13/2008 - 16:32:27.305 - 344132.62 - Starting event 'Crosshair_no_delay' with ID: 44888:
06/13/2008 - 16:32:27.308 - 344135.58 - Flushing secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:27.308 - 344135.58 - Flushed secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:27.308 - 344135.58 - Erased The Screen
06/13/2008 - 16:32:27.308 - 344135.59 - Presenting stimulus: Crosshair_no_delay
06/13/2008 - 16:32:27.308 - 344135.59 - Presenting bitmap and flushing offscreen buffer to screen...
06/13/2008 - 16:32:27.334 - 344161.44 - Flushing secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:27.334 - 344161.45 - Flushed secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:27.334 - 344161.46 - Amount of time taken to draw text to the screen: 25.82

For some completely bizarre reason, really tiny text events take an insane amount of time to draw. You can shrink this dramatically by simply drawing an image file. A full screen jpeg takes less than half that time on this computer.

06/13/2008 - 16:32:27.334 - 344161.46 - Finished Stimulus Presentation. Last Stim Onset Time: 344161.46

This onset time is not in the spreadsheet.

06/13/2008 - 16:32:27.334 - 344161.46 - More than 500 ms has passed since this input device has been used.
06/13/2008 - 16:32:27.334 - 344161.47 - Flushing keyboard input.

If the user had been typing away like crazy while the movie was playing, it would have shown up as input in a moment. This is the fix.

06/13/2008 - 16:32:27.334 - 344161.57 - Looking for input with time limit: 1 msec...
06/13/2008 - 16:32:27.334 - 344161.57 - Including Device: Keyboard-Single Keys
06/13/2008 - 16:32:27.336 - 344163.51 - Time limit has elapsed since last stim onset: 1 ms
06/13/2008 - 16:32:27.336 - 344163.52 - Registered this as no response.

This is at cell I23 in spreadsheet. Note that I set this event to end after 1ms, which means our trial is actually done WAY early.

06/13/2008 - 16:32:27.336 - 344163.52 - Cleaning up after event...
06/13/2008 - 16:32:27.336 - 344163.52 - Done cleaning up after event.
06/13/2008 - 16:32:27.336 - 344163.52 - Running feedback (if applicable)...
06/13/2008 - 16:32:27.336 - 344163.53 - Feedback completed.
06/13/2008 - 16:32:27.336 - 344163.53 - Cleaning up after trial 'Safe Trial 4'
06/13/2008 - 16:32:27.336 - 344163.60 - Exiting trial 'Safe Trial 4':
06/13/2008 - 16:32:27.336 - 344163.61 - FLUSHING DATA TO DISK
06/13/2008 - 16:32:27.337 - 344164.22 - Starting up composite trial 'Anticipation Trial 4':
06/13/2008 - 16:32:27.337 - 344164.22 - Entering trial 'Anticipation Trial 4':
06/13/2008 - 16:32:27.337 - 344164.22 - Preparing trial 'Anticipation Trial 4':
06/13/2008 - 16:32:27.337 - 344164.32 - Flushing keyboard input.
06/13/2008 - 16:32:27.345 - 344172.26 - Flushing keyboard input.
06/13/2008 - 16:32:27.345 - 344172.79 - Presenting trial 'Anticipation Trial 4':
06/13/2008 - 16:32:27.345 - 344172.80 - Executing sync of trial 'Anticipation Trial 4'...
06/13/2008 - 16:32:27.345 - 344172.80 - Sync Trial:: on entry, Last Time = 315020.04, When to Exit = 360020.04

Okay, so we really only have about 9ms of stuff to do this time around... We still have 15 seconds left, though, so in this set up, it wouldn't be a big deal to load stimuli between trials. After all, we have fifteen seconds that SuperLab is sitting around between trials doing nothing. Just a thought.

06/13/2008 - 16:32:43.193 - 360020.16 - 45000 msec Sync Trial:: on exit, Trial started at: 360020.04 minimum duration:

Notice the 20.04ms in there again, though this trial is starting .12ms later than it claims.

06/13/2008 - 16:32:43.193 - 360020.17 - Starting event 'mark trial start' with ID: 44880:
06/13/2008 - 16:32:43.193 - 360020.18 - Presenting stimulus: mark trial start
06/13/2008 - 16:32:43.193 - 360020.19 - Presenting bitmap and flushing offscreen buffer to screen...
06/13/2008 - 16:32:43.194 - 360020.24 - Flushing secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:43.194 - 360020.25 - Flushed secondary buffer to OS's primary buffer (no beam information available on this machine).
06/13/2008 - 16:32:43.194 - 360020.26 - Amount of time taken to draw text to the screen: 0.02
06/13/2008 - 16:32:43.194 - 360020.26 - Finished Stimulus Presentation and reset RT Timer. Last Stim Onset Time: 360020.26

This is only .22ms after the trial was supposed to have started, which rounds down to the oms at L24.

Skipping to the end...

06/13/2008 - 16:36:12.340 - 569155.29 - Exiting block 'Run 1'
06/13/2008 - 16:36:12.340 - 569155.29 - Terminating the Experiment!
06/13/2008 - 16:36:12.340 - 569155.31 - Dumping optimal input accuracy histogram

SuperLab polls input devices. After polling all input devices, SuperLab gives up .5ms on Mac OS X. Each time through the loop, the amount of time that has passed since the previous iteration is marked in an internal array. Unfortunately, it's possible for the operating system to squeeze things in while we're checking for keyboard input. We have to do this--otherwise you wouldn't be able to press the escape key to cancel out of the experiment. The following shows how well we did this time around.

```
06/13/2008 - 16:36:12.340 - 569155.31 - Time 0.0 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.1 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.2 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.3 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.4 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.5 count: 341069
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.6 count: 154
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.7 count: 3
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.8 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 0.9 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 1.0 count: 0
06/13/2008 - 16:36:12.340 - 569155.32 - Time 1.1 count: 1
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.2 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.3 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.4 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.5 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.6 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.7 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.8 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 1.9 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 2.0 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 2.1 count: 0
06/13/2008 - 16:36:12.340 - 569155.33 - Time 2.2 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.3 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.4 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.5 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.6 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.7 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.8 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 2.9 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 3.0 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 3.1 count: 0
06/13/2008 - 16:36:12.340 - 569155.34 - Time 3.2 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.3 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.4 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.5 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.6 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.7 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.8 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 3.9 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 4.0 count: 0
06/13/2008 - 16:36:12.340 - 569155.38 - Time 4.1 count: 1
06/13/2008 - 16:36:12.340 - 569155.38 - Time 4.2 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.3 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.4 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.5 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.6 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.7 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Time 4.8 count: 0
06/13/2008 - 16:36:12.340 - 569155.39 - Above 4.8 count: 0
```

If you are playing a movies and looking for input at the same time, the above histogram would look VERY different. Fortunately, you aren't.

```
06/13/2008 - 16:36:12.340 - 569155.39 - Overhead of debug logging mechanism: 1.57 µs per entry.
```

SuperLab also times how long it took to create the above histogram. It involved 50 entries to the debug logging mechanism. Since it's a very tight loop spitting out this data, we can estimate how long it takes on this machine to produce a debug entry. Note that the actual text that you see isn't created until after the experiment is done--this is a simple copy of a static string, potentially two floating point values, and several representations of the current time. This number varies from run to run. I have a similar writeup to this one from April, and the number there is 1.27 microseconds.

```
06/13/2008 - 16:36:12.939 - (n/a) - FLUSHING DATA TO DISK
```

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