Using Chart's Time Shift Feature

ADINSTRUMENTS

Introduction

Time Shift is a useful but perhaps little known off-line analysis feature of Chart. It is bundled with Chart for Windows and available as a free download for Chart for Macintosh. Time Shift can be applied to one or more channels, and can move the recorded channel(s) ahead or back in time. This can facilitate analysis, for instance by taking into account conduction delays in neural pathways.

Using Time Shift

Step 1: Open a previously recorded data file in Chart.

Step 2: Select the channel(s) you wish to displace. In the pop-down menu for the channel select Time Shift.

NB. If this menu item is not present (in Chart for Macintosh) it means that the extension has not yet been installed. Visit our website and download the extension from Software Updates. Chart will need to be restarted before the feature is added.Step 3: Attach the muscle (using thread) to one of the holes along the arm.

Step 3: Choose the number of milliseconds or seconds you wish to move the channel in time. Negative numbers shift the channel back in time, positive numbers move the channel ahead.

Example:

Figure 1 shows muscle sympathetic nerve activity (MSNA) recorded via a tungsten microelectrode inserted into the peroneal nerve of an awake human subject. ECG, blood pressure, respiration, skin blood flow and sweat release were also recorded; heart rate has been calculated (using Cycle Variables) from ECG.

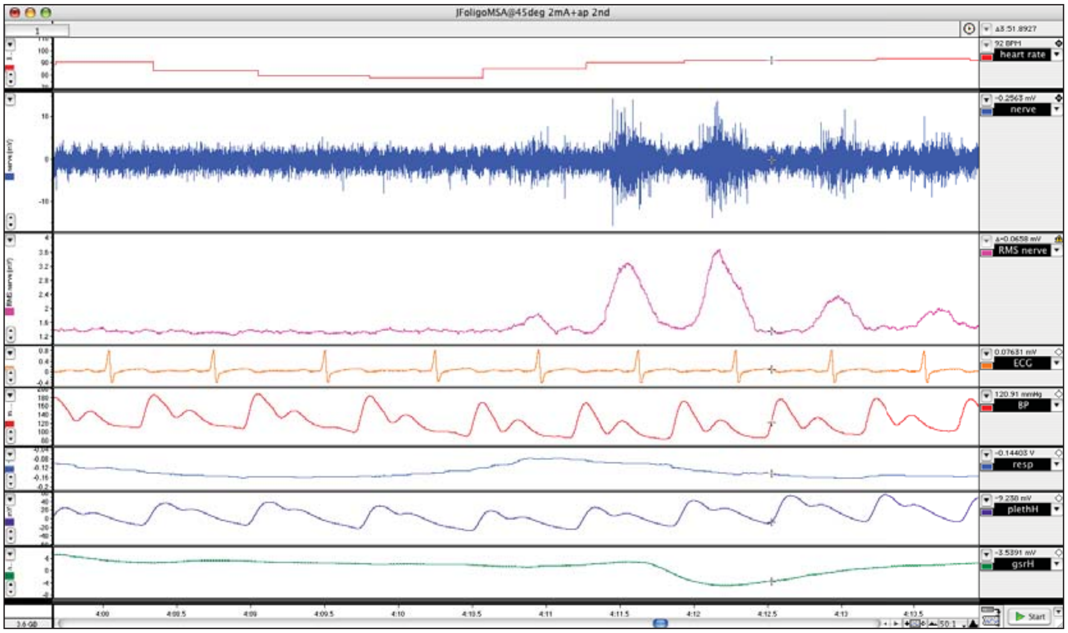

Fig. 1 Chart main view

MSNA occurs as bursts of vasoconstrictor impulses that are tightly coupled to the cardiac rhythm by the arterial baroreceptors: the bursts are initiated when the baroreceptors are unloaded during diastole and terminated during systole. Because postganglionic sympathetic nerve fibres are unmyelinated, conduction delays mean that a sympathetic burst arrives at the peroneal nerve at the knee approximately 1.3 s after the R-wave of the ECG. Time shift allows the nerve recording to be moved back in time by this amount, thereby bringing the peak of the burst close to the R-wave of the relevant ECG.

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Figure 2 shows the same data in Figure 1 following displacement of the "nerve" channel. Note that any calculated channel, in this case the RMS-processed signal, will also be displaced.

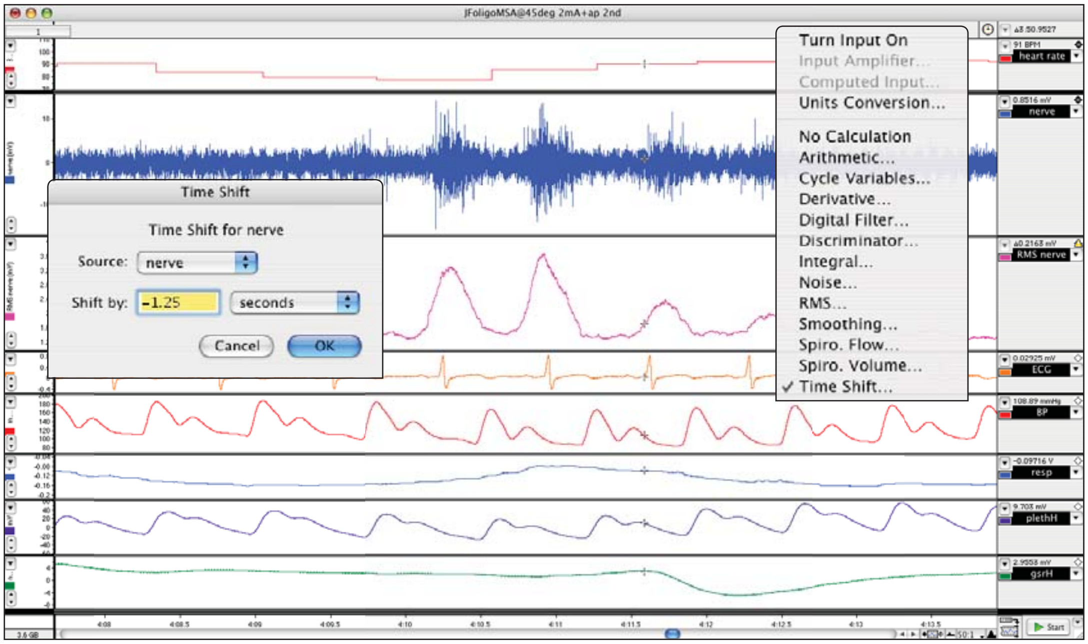


Fig. 2 Chart main view after time shift of "nerve"

This is useful, as it facilitates analysis of the RMS-processed burst (Macintosh only) or Integrated burst (Macintosh & Windows) using Peak Parameters. This is illustrated in Fig. 3.

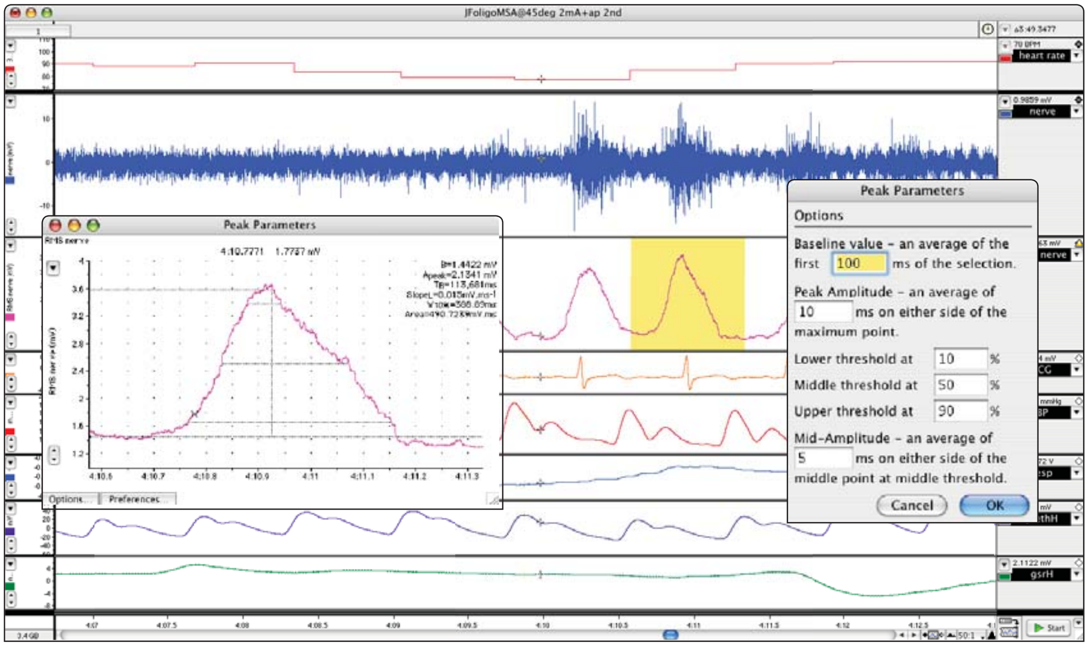


Fig. 3 Chart window and Peak Parameters extension

In Data Pad (selected in the Window menu) use the Data Pad Column Setup menu to select Peak Parameters. This allows you to extract various features of the sympathetic burst (measured from the RMS-processed or Integrated neurogram), such as Peak Amplitude and Width at 10%. This is shown in Figure 4.

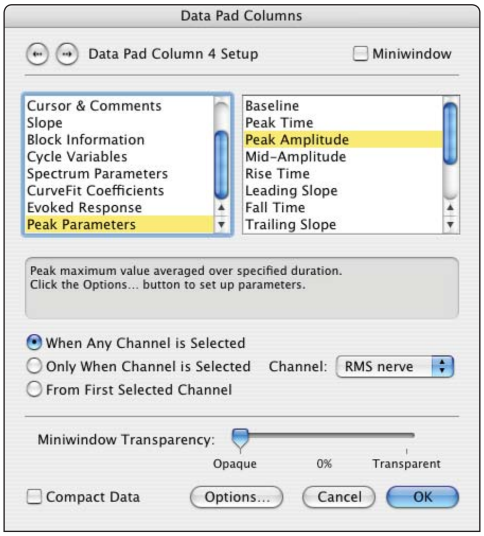


Figure 4: Data pad set-up dialog

Data Pad allows efficient automation of the analysis: the required processes are first set up in each column of the data pad and it is then simply a matter of navigating through the Chart file and adding data of interest. For instance, jumping from R-wave to R-wave is simple to implement using a peak-detecting macro: in the Commands menu choose Find…, Search in [ECG], Find Data, Local Maxima, Select [0.75 s] Around, Select All Channels. This is shown in Fig. 5.

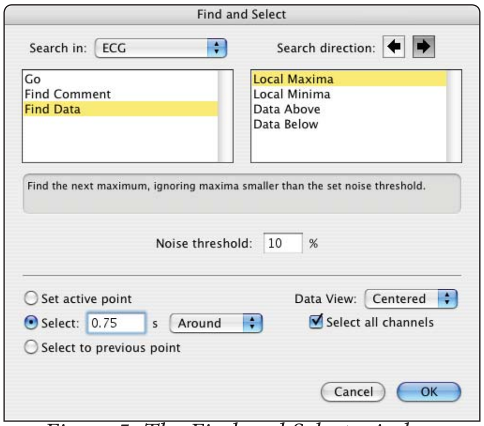
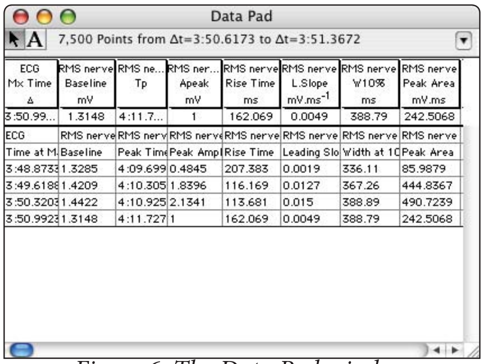


Figure 5: The Find and Select window

The requested calculations are then performed with the command Add to Data Pad (in the Commands menu). Sequential additions to the Data Pad appear in successive rows of the Data Pad (Fig. 6). Bringing the sympathetic burst in line with the relevant ECG allows burst amplitude to be correlated with the associated changes in blood pressure, for instance.



ECG Mx Time Δ	RMS nerve Baseline mV	RMS ne... Tp	RMS ner... Apeak mV	RMS nerve Rise Time ms	RMS nerve L.Slope mV.ms-1	RMS nerve W10% ms	RMS nerve Peak Area mV.ms
3:50.99...	1.3148	4:11.7...	1	162.069	0.0049	388.79	242.5068
ECG	RMS nerve	RMS nerv	RMS nerve	RMS nerve	RMS nerve	RMS nerve	RMS nerve
Time at M.	Baseline	Peak Time	Peak Ampl	Rise Time	Leading Slo	Width at 1C	Peak Area
3:48.8733	1.3285	4:09.699	0.4845	207.383	0.0019	336.11	85.9879
3:49.6188	1.4209	4:10.305	1.8396	116.169	0.0127	367.26	444.8367
3:50.3203	1.4422	4:10.925	2.1341	113.681	0.015	388.89	490.7239
3:50.9923	1.3148	4:11.727	1	162.069	0.0049	388.79	242.5068

Figure 6: The Data Pad window