

July 29, 1963

Dr. Neil Burch
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Dear Neil:

It has been many weeks since we spoke, but these have not been idle. This letter is overdue, so let me take each item serially.

1. Many thanks for the digital cards from Tulane. The program was perfected on this material. In comparing our analyses, the two programs differed in response to whether changes to zero were or were not counted in the first derivative. After finding this discrepancy, the program was modified to fit the Tulane model. Our analyses were then identical to yours.

2. We obtained two digitized records from John Stern and these were analyzed. The resulting spectra were clearly related to the write-outs which he provided.

In both these analyses, we became concerned about the baseline problem. First, the Tulane record required an "artificial" baseline (the mean of first 1500 points). This was satisfactory because later samples showed no consistent deviation from this baseline. In the first Stern record, however, we found that the samples did sway above and below the initial baseline markedly. As we had no good solution, our error was compounded by modifying the program to provide concurrent analyses of as many as 5 baselines. Such data also yielded amplitude information.

Lately, in thinking this problem through, we decided that the least artificial solution was to analyze from a zero baseline after recording a sine wave through the EEG, centering the signals on the tape by bias adjustments and recording the EEG without other adjustment. We have done this twice successfully and found a zero baseline adequate.

3. Our equipment progress has been rapid. Last week, the 1710 system was installed and on Friday we were able to record our own record on tape; digitize at 320 and 640 pts. per second; analyze successive 2-1/2, 3, 5, 10 second epochs about a zero baseline. The resulting spectrum, and changes with pentothal, was very good.

In looking at the first derivative data, we found that we had too much noise. Our Offner has "choppers" at 7100 cps (looks more like 60 cps) which interfered. This week's project - to clean up the EEG signal on tape. Our new EEG will not be in until mid-August; and our plotter in September. By October we hope to be operational via tape.

4. We have read and re-read the report "Period Analysis of EEG on a G.P.D.C." with interest. Our comments and questions are few, as the report is straightforward.

a. There is no statement in the introduction of the theory or the goals of the analyses. For example, we are concerned as to rationale for 2nd derivative measurements? How are these to be interpreted in view of the "noise" of our amplifiers?

b. On page 10, the concern about the major index asymmetry presents a different side to the baseline problem. If a "true" baseline were determined, and if EEG waves were truly symmetric, then the positive and negative indices would be equal. But, is there any reason to expect EEG signals to be symmetric? For example, the 3 cps spike and wave is asymmetric. I would suggest that the symmetry of positive and negative counts be accepted as a measure of the wave characteristics; provided, a non-arbitrary way can be found to determine a reliable ("standard") baseline.

c. We are concerned with the loss of information inherent in filters before A-D conversion; and running averages. Your method of obtaining a 2nd derivative (and 1st derivative) is designed to reflect the fast activity on a slower carrier. By filtering and averaging, the record is indeed cleaner but a potential source of information is precluded. Why not keep all the jitter and study it?

d. Parenthetically, were Prast and Noell successful?

5. Enclosed is a page write-out of our analysis of your data, for 5 baselines. This sample shows the program permitting analyses of 5 baseline crosses, and 1st and 2nd derivative for up to 15 band widths. Epoch size and number of epochs can also be varied at will. Other measures are two measures of the average frequency response for the total sample. "Counts" = number of baseline crosses (or derivative counts). Also, the calculation of

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the mean square of amplitude deviations from baseline at points where 1st derivative is zero gives an index of amplitude (Mean sq. amp. = sum/counts).

We are now cleaning up our amplifier systems, and as soon as that is done, I plan to do a small study of varying pentothal patterns in different populations.

6. Thanks for concurring in the EEG abstract. That should encourage us to carry out this comparison. The abstract is general enough, however, to permit a report on the progress with the general purpose computer. Meanwhile, have your assistants had a chance at the tapes?

Just read a blurb that you will soon have some tapes of the astronauts. That project sounds like an exciting application of your data reduction methods. I would be pleased to read any other reports your group issues.

Good luck, and my best regards.

Sincerely yours,

Max Fink, M. D.
Director

MF:jr
Enclosures