

PORTABLE GOLD AND PHILOSOPHERS' STONES (Music From Brains In Fours)

David Rosenboom

for Ted Coons

Electrodes and appropriate monitoring devices are attached to monitor the brain waves of four musicians who have been well rehearsed in the voluntary control of their psychophysiological functions. Monitors are also attached to two of the performers for body temperature and to the remaining two for galvanic skin response. This information is all fed into an analyzing system that extracts such things as, percent time per minute spent emitting Alpha brain waves, average time spent emitting Alpha, the amount of variance in the amplitude of Alpha, the coherence time of any patterns discovered in the brain wave, correlations between brainwaves of two or more performers, relative entropy of the waveforms, relative intensity of various spectral bands in the brain waves, etc.

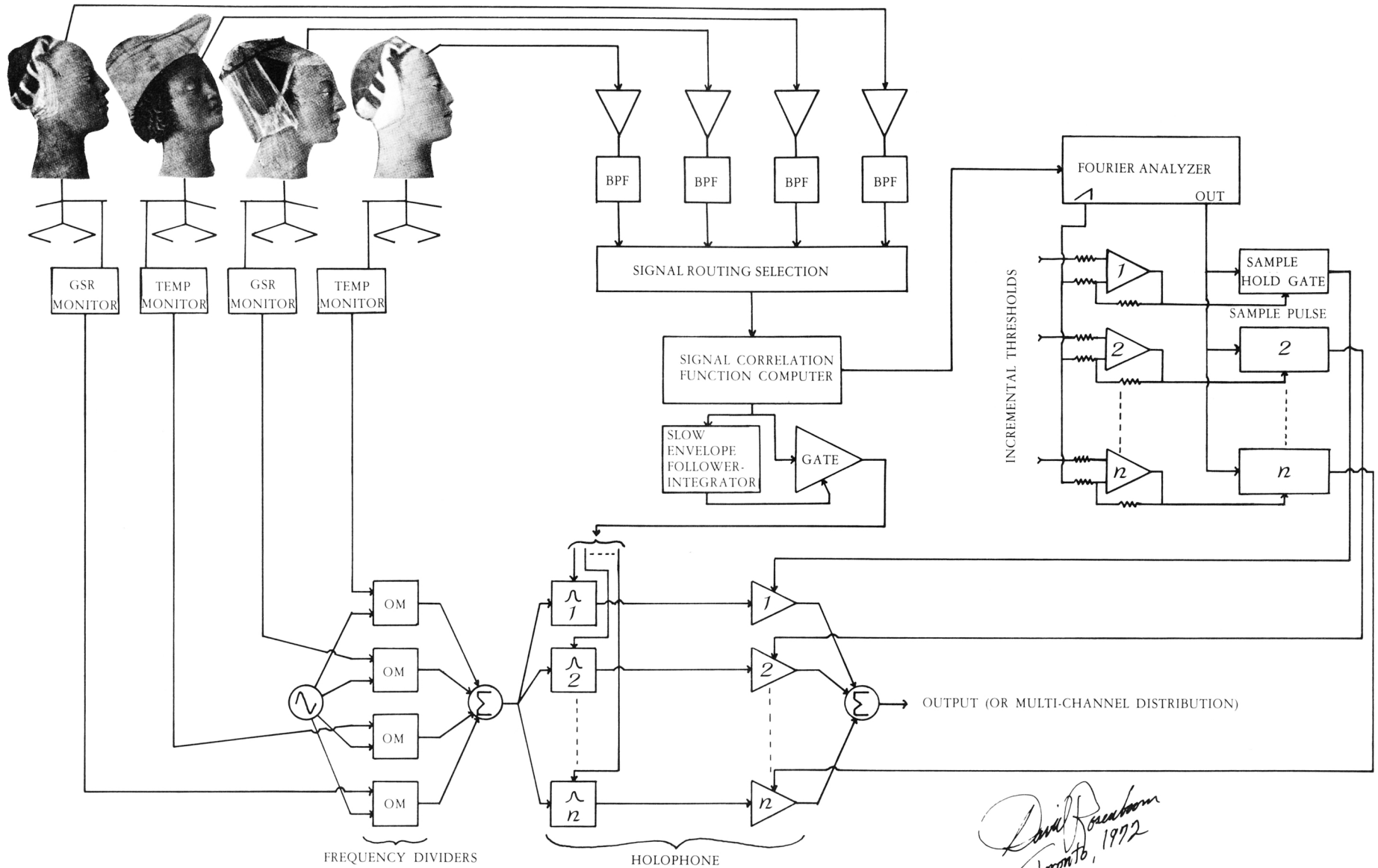
A sound producing system is set up as follows. Four frequency dividers, (NEURONA CO. Model 0M1100101, see operating instructions), capable of producing pulse waves that are some integral division of a sine wave frequency being fed to all four, are set up. These dividers are voltage controlled, in that the integral divisor of the input reference frequency can be varied by applying a varying reference voltage to a separate input on the unit. With one sine frequency being applied to all four dividers, then, exact pitch ratios can be produced. This divisor selecting reference voltage comes from the measures of body temperature and galvanic skin response of the performers. Further, the pulse waves of exact frequency ratios are fed into a bank of voltage

controlled resonant band pass filters, called a Holophone. Relative amplitudes of the filters' outputs can be programmed. The results of the analysis of the performers' brain waves is directly applied to the voltage control inputs of the filters. The relative output amplitudes of the filters are controlled by signals deriving from the Fourier analysis of the brain waveforms.

When two or more pulse waves of exact pitch intervals are applied to a resonant band pass filter, the filter can extract the harmonics present in the waveform composite. A particular exact interval will then produce a set of extractable harmonics that forms a mode. When the interval changes, so does the mode. The music proceeds as an improvisation within these modal possibilities. The pulse wave intervals are also played and function as a drone which is important to the piece.

The technician's part lies in the modes of analysis of the brain waves he uses and their application as control for the sound producing system. He must be schooled in brain biofeedback research and respond to the experiences of the performers during exploratory rehearsal sessions. For live performances the author uses a Princeton Applied Research Model 100A Signal Correlation Function Computer and a Model 102 Fourier Analyzer.

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