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182. BARLOW J.S. (Cambridge, Mass., U.S.A.) and TRABKA J. (Cracow, Poland) The relationship between 'photic driving' in the EEG and responses to single flashes

In an attempt to clarify the distinction between specific evoked responses in the occipital EEG to photic stimulation and 'driving' in its strict sense (i.e., alteration of the intrinsic frequency of a self-oscillatory system to that of an externally imposed 'driving' signal), EEG records were taken from a small group of normal subjects using stroboscopic stimulation at frequencies ranging from 0.7 to 30 flashes per second. Events in the EEG that were time-locked with the flashes were studied by means of electronic averaging of a large number of responses.

The results showed that for all the flash frequencies, all the records were characterised by fairly constant appearance of an occiput-negative deflection occurring about 80 milliseconds after each flash, and followed by an occiput-positive event with a latency of about 120 milliseconds (in general, the lower the flash-rate, the more fully developed was this occiput-positive event). Earlier events (i.e. at 40-60 msec.) in the responses to slowly repeated flashes were not clearly discernible among the larger amplitudes of the above-mentioned deflections after 80-120 msec.

No definite increase in the amplitudes of the averaged responses was evident for flash rates in the alpha frequency range, but some suggestion of a slight shift to an earlier latency was evident for flash-rates in the range of 10/sec, as compared with lower and higher rates. The narrow range of frequencies for which this effect was maximal was not necessarily the same as the subject's resting alpha frequency (when present); the phenomenon was in fact apparent for subjects who had no appreciable alpha activity in the resting state. A somewhat similar phase-shift effect was observed for some subjects for flash rates of about 20/sec. No clear relationship emerged between the frequency of the rhythmic waves appearing after slowly repeated flashes (the sensory after-discharge); the possibility that this phenomenon may occur at these higher flash-rates cannot however be excluded on the basis of the present results.

The sequence in time of events in the EEG following each flash in a train is complex, and at times the generation of harmonic components of twice or three times the flash frequency is suggested. Upon close inspection of the averaged waveforms for different flash rates, however, it is evident that description of these phenomena as specific events in time, rather than as 'harmonics', is more appropriate.

An illustrative example of this effect is shown in figure 1. For a flash-rate of 8/sec., 3 separate major events (indicated by the arrows) appear following each flash; these are reflected by the triangular shape of the autocorrelation record above as the fundamental (8/sec) and third harmonic (24/sec). For a flash-rate of 11/sec., however, the successive flashes are so close together that the third event is now no longer present, and the remaining two, which follow at the same latency after each flash as before, are reflected by the notched shape of the corresponding autocorrelation record above as the fundamental (11/sec) and second harmonic (22/sec). (A frequency-analysis display would also suggest the presence of 'harmonics' in the EEG). It is the section between the two arrows of the averaged waveform on the right (i.e. for 11/sec flashing) that includes the constantly-appearing event for widely differing flash frequencies.

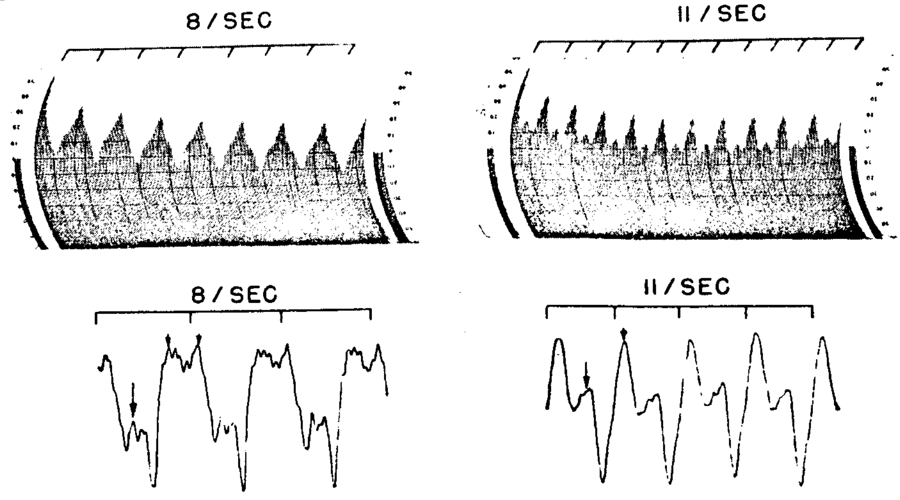

Figure I.
Autocorrelation records and averages for 8 and for 11 per second flashing. (Analysis of 30-second midline parieto-occipital recordings.) For explanation see text.