

would be ineffective; but that cyclic changes in irritability might manifest themselves as a modulation of the responses to repeated stimulation. Considering that photic stimulation of the retina results in repetitive responses of optic nerve fibers, a steady illumination should correspond to steadily repetitive stimulation of the optic nerve, and flickering illumination to repeated bursts of repetitive stimulation. Such bursts should be maximally effective if the individual nerve responses approached the optimum rate (100 per second for the cat), and if the bursts occurred at the frequency of the alpha rhythm.

The accompanying paper (Bartley) contains certain evidence on the sensory effects of flicker frequency that suggests such a relationship in human subjects.

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A Central Mechanism in Brightness Discrimination.*

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Rapidly repeated flashes are seen as steady light, equivalent in sensory brightness to the same amount of light uniformly distributed in time. This is Talbot's law, and the outcome is what would be expected from a simple train of events copying the output of the photoreceptors.

But as soon as flash rate is reduced below the fusion point for steady sensation, the flashes begin to produce an average impression which is greater than that expected from photochemical considerations. As the rate is reduced more and more, the flashes produce an effect more and more nearly equivalent to steady light of the same physical intensity, and finally surpass it, reaching a maximum when the rate is reduced to the neighborhood of 8 or 10 per second. With still slower rates, the flashes approximate equivalence to steady light, with the recognized exception that single isolated flashes always appear brighter than steady stimulation of the same intensity.

The phenomenon of enhancement was first observed in 1864 by Brücke with rotating black and white sectored discs, but was not plotted for various rates of intermittency. The phenomenon shall

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be called the Brücke effect, though we used flashes instead of the revolving discs.

The significance of the Brücke effect is that a series of momentary stimuli is more effective for sensation than steady stimulation of the same strength. In order to account for this, the responding system must act very different from what would be expected of photoreception in the sense cells. Since the nervous system is capable of rhythmicity and periodic facilitation, we might look immediately to it. And since the maximum Brücke effect occurs at flash rates of 8 to 10 per second, such a periodicity should be sought to account for it.

The alpha rhythm in the human is of this order, and the alpha rhythm has been shown (in the cat by Bishop and O'Leary,¹ and in the rabbit by Bishop² and Bartley³ to be directly connected with the periodicity of elicitation of maximum cortical response from peripheral stimulation. Stimuli given at rates not corresponding with it are able to evoke either no responses or very small ones.

There is every reason to suppose that the enhancement in the sensory effect of properly timed flashes is due to the same mechanism as underlies enhanced cortical responses from direct optic nerve stimulation after the removal of the eye, where there is no possible retinal involvement. Thus, we have here a definite case in which *brightness discrimination* is determined by a central mechanism in just as true a sense as that ascribed to photoreception.

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Spirochetes in Gastric Glands of *Macacus rhesus* and Humans without Definite History of Related Disease.

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The observation of spirochetes in the gastric glands of *Macacus rhesus* by Cowdry and Scott¹ prompted the study of the incidence of these organisms and reaction associated with or caused by their presence in the sections of the gastro-intestinal tract of the animals used in their study. Sections of human stomach taken at necropsy in the

¹ Bishop, G. H., and O'Leary, J., *Am. J. Physiol.*, 1936, **117**, 292.

² Bishop, G. H., *Arch. Ophthalm.*, 1935, **14**, 992.

³ Bartley, S. H., *J. Cell. and Comp. Physiol.*, 1936, **8**, 41.

¹ Cowdry, E. V., and Scott, G. H., *Arch. Path.*, 1936, **22**, 1.