

regretted, as one such sketch figures the chalk idol found many years ago by Mr. Leslie Armstrong at Grimes Graves and which I fancy has never up to now been illustrated. One gets the unfortunate impression that the illustrations have been included rather to catch the eye of a would-be purchaser than to illustrate the text. The book is very readable, and one can be full of admiration for Prof. Fleure, who certainly set himself a difficult task.

M. C. BURKITT

THEORIES OF THE VISUAL THRESHOLD

Les théories photochimiques classiques et quantiques de la vision et l'inhibition nerveuse en vision liminaire

Par Ernest Baumgardt. Pp. 61. (Paris: Éditions de la *Revue d'Optique théorique et instrumentale*, 1950.) 300 francs.

SINCE the pioneer work of Hecht, Shlaer and Pirenne on the significant part played by the quantum nature of light in the perception of threshold light stimuli, a number of workers, including the author of this little book, have applied themselves enthusiastically to the full exploitation of the idea. M. Ernest Baumgardt belongs to those who believe that two or more light quanta must be absorbed within a certain small time-interval and within a certain retinal area if perception of the stimulus is to ensue. The experimental results which it is sought to explain on this hypothesis consist of measurements of the absolute threshold as a function of the exposure time and the area of the test stimulus. The second half of the book is, in fact, devoted to new measurements of this kind by the author, dealing in the main with the effect of stimulus area for both foveal and extrafoveal vision and employing blue and deep-red stimuli to separate the rod and cone responses.

So far as the variation of threshold with exposure time is concerned, the central hypothesis is not entirely adequate, the deviations being in the direction one might expect if the minimum number of quantum absorptions for perception exceeded two. The author is able to show, however, that a possible explanation is obtained on the following lines. The neurone receiving the pulses from the receptors which have absorbed light quanta is assumed to be thrown into a state of facilitation following the absorption of the first light quantum. This lasts for a critical time τ , and if within this time a second quantum is absorbed the neurone discharges and perception ensues. But if the second absorption is delayed beyond the time τ , the neurone passes into a refractory state and, even though a third quantum may be absorbed within a time τ after the second, there is no discharge and no perception. For extrafoveal vision the effect of area on the threshold is found to accord well with the central hypothesis, the critical area corresponding to about 45' diameter for rod vision and 8' diameter for cone vision. For foveal vision the situation is complicated by the inhomogeneity of the receptor network. It is remarkable—and this criticism applies not only to the present work—that investigators of areal summation rarely make any attempt to explore the uniformity of the threshold over the retinal region under study by point-to-point observations with a small test stimulus.

Some interesting comments are made by M. Baumgardt on the notion that as the level of adaptation of the retina is raised the progressive modification of visual functions such as differential sensitivity is associated with a steady reduction in the concentration of photosensitive substance (visual purple for rod vision) in the end-organs. He vehemently rejects this view, at least for levels up to about one lumen per square metre. While we may not be prepared to go all the way with him, his arguments seem worthy of careful consideration. Unfortunately the style in which the book is written is a little repelling: it tends to oscillate between the dogmatic and the obscure. This is a pity, as M. Baumgardt's views should prove stimulating to all workers in the subject.

W. S. STILES

FUNCTION THEORY

Leçons sur la théorie des fonctions

Par Émile Borel. (Collection de monographies sur la théorie des fonctions.) Quatrième édition. Pp. xiii+296. (Paris: Libr. Gauthier-Villars, 1950.) 1200 francs.

Leçon sur les nombres transfinis

Par Prof. Waclaw Sierpiński. (Collection de monographies sur la théorie des fonctions.) Nouveau tirage. Pp. 240. (Paris: Libr. Gauthier-Villars, 1950.) n.p.

THE great collection of monographs on the theory of functions, directed by Émile Borel, was inaugurated in 1898 by his own "Théorie des fonctions", of which the present work is a fourth edition. Although the substance of the book has not changed much, and is therefore more than fifty years old, it is still perhaps the most inspiring introduction for the young student to the concepts of aggregates, measure and modern theories of integration, concepts the development of which can be traced back to the stimulus of Cantor's work on "Mengenlehre". The new edition contains some additional matter in notes and in a new appendix, all tending to emphasize Borel's own philosophical position with respect to current controversies on the foundations of mathematics.

Borel has always held the view that definitions which are not constructive, numbers which cannot be calculated, descriptions which do not define, are insecure pillars in a mathematical edifice, though his scepticism is not carried to the extreme position occupied by Brouwer and his school. If, as he says, the result is that the pupils of his pupils regard him as a reactionary, it is because his own work and teaching have been extraordinarily stimulating.

The reprint of Prof. W. Sierpiński's tract on transfinite numbers in the Borel collection is welcome. The author was the acknowledged master of the virile Polish school of real-variable theory, and his account of the transfinite cardinals and ordinals is clear, precise and succinct. While Sierpiński's main logical position is almost flatly opposed to Borel's, the series of Borel monographs would have been sadly incomplete without some account of Cantor's fundamental work on transfinite numbers, and no one was better fitted than Sierpiński to write such an account. Since the techniques employed are in themselves not of great complication, the book can be read and enjoyed, without much previous acquaintance with the topic, by anyone with a taste for fantastic logical adventures of a severely abstract type.