these circumstances the ghost was very distinct, of complementary color to the primary image, and at a distance from it which translated into time was equal to one-fifth of a second, so long as the eye of the observer had not been adapted for darkness; the constant darkness adaptation of the eye was maintained, since the walls of the room were black, by frequently looking out of the window. The first image is sharply defined, not quite circular, but rather cylindrical, with a concave edge behind; the second gradually fades off in a faint trail, and its head is surrounded by a circle of more than ordinary blackness. But if the light is very intense, so much so, for instance, that the trail stretches out through the entire circle, then the first image is also much longer (this is, no doubt, the ordinary positive after image), and becomes joined on to the secondary image; this is the form in which Exner saw the phenomenon—without any interval.

If the eye has first suffered complete darkness adaptation (that is, has been kept in the dark for two hours, at least), the appearance presented is very different; the secondary image is of a brilliant white, and it appears almost immediately after the first image, which is consequently in shape more like a slender crescent. The secondary image, in one or the other of its two forms, Professor v. Kries very properly takes to be at least the principal cause of the phenomenon of the fluttering heart. Both forms alike vanish when the real image goes through the central part of the retina. One observer said that it seemed as if they slipped into a tunnel. The area of this ineffective space was about 35 by 38 mm. at a distance of 1 m. from the eye, which corresponds very exactly with the size of the space which is practically free from rods.

From various attendant circumstances, Professor v. Kries is forced to assume that there are two distinct reactions of the rods, not simply one reaction which takes place after adaptation both with greater force and with greater promptness. He suggests that one may be due to visual purple in the rods, and the other to that outside of the rods, assuming in both cases that the visual purple is a true visual substance, whose product of decomposition excites the nerve end.

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Theorie des Talbotschen Gesetzes. Von KARL MARBE. Wundt's Studien, XII., Heft 2, pp. 279–296.

The general statement of Talbot's Law is as follows: If two light stimuli successively and periodically excite the same point on the retina there will result either a series of separate sensations or one single sensation of a constant intensity and quality. This latter is identical with that sensation which would be excited if the light acting through one stimulation were distributed uniformly over that entire stimulation period.

Under these conditions there are four factors which promote the production of this constant sensation:

1. The decrease of the stimulation period.
2. The increase of the difference of duration of the two stimuli.
3. The decrease of the difference of the intensity of the stimuli.
4. The strengthening of the mean intensity of both stimuli.

If the succession of stimuli be given by means of a rotating disc, then a fifth factor enters, viz., the rate of movement. The slower the movement the less do the stimuli fuse. That the influence of these five factors applies to the fusion of colored light is proved in an experimental appendix to this paper.

The theory of Talbot's Law must explain both the general fact of fusion and also the influence of these five factors. This is found in a general photo-chemical principle. The photo-chemical action in the retina is not a summation effect, for if we fixate a white surface for two seconds the sensation is no more intense after the second second than after the first. Nor can it be limited to the 'elementary effect' of the corresponding time element, for then the series of stimuli would never fuse into a constant sensation. There remains the view that it is a function of the elementary effects immediately preceding and simultaneous with the sensation, these forming a 'characteristic effect group.' The excitation in the retina grows with the duration of the stimulus until the duration reaches a determined critical value.

We see, then, that as the equality of light dispersion progresses the 'characteristic effect groups' become more similar not only to each other but also to the 'effect group' produced when the light is uniformly distributed.

With this theory the explanation of the first four factors is not difficult.

1. The shorter the stimulation period becomes the more evenly the light is distributed over the whole period and the more nearly the 'effect groups' approach the 'elementary effects.'
2. By the increase of the differences of duration of the two stimuli the mean variation of the 'elementary effect' is lessened.
3. This also takes place when the difference in intensity is lessened.
4. By increasing the intensity of the whole series, the single 'ele-

mentary effects' will of course be increased. But with this there must be an increase of the difference which 'characteristic effect groups' shall have in order to produce a notable difference in sensation.

The fifth factor, the movement of contour, requires some further explanation. Suppose we fixate a black square on a white ground. One part of the retina will be affected by the light coming from the square and another by the neighboring white ground, and we see the boundary of the square sharply outlined. Now let us suppose that the square moves very slowly while the eye remains in absolute rest. Under these circumstances every 'characteristic effect group' will be determined by its own time element. There will no longer be a sharp boundary between the white surface and the square, for each point of the retina here will have a different time element, thus giving rise to sensations of proportional intensity. This will cause a gradual shading of the two fields, as the time elements gradually shade into each other in the direction of the movement. With light of a given intensity the width of this shaded portion will be proportional to the swiftness of the movement. If, instead of one dark surface, a series of them be moved before the point of fixation, their shaded portions will gradually widen with the rapidity of the movement until finally they overlap and fuse into a constant sensation. This is the state of affairs when the sections of the color wheel finally fuse. As this fusing process is a function of the movement of the edge of the surface it follows finally that a surface *a* with movement *b* is less favorable for fusion than surface *2a* with movement *2b*.

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A Preliminary Study of some of the Motor Phenomena of Mental Effort. ERNEST H. LINDLEY. Am. Jour. Psy., VII., 4., July, 1896.

This is an experimental study of those peculiar automatic movements which one is apt to execute more or less unconsciously when one's attention is concentrated; as, for example, in reading, writing, conversation, study, 'trying to remember,' etc. The material was obtained partly from responses to President Hall's syllabus on 'Some Common Automatisms,' and partly from observations made in the kindergarten and primary grades of the Boston Normal Training School. Something over 600 cases were observed, and the results are tabulated so far as may be. The first table classifies automatisms