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The Birch-Hirschfeld
Visual Photometer

The instrument is adapted for examination in cases of noctalopia. It provides a means of rapid adjustment to the liminal value of the stimulus, and of quickly comparing the liminal value of a night-blind eye with the controlling eye of the physican during the interval of dark-accommodation. It affords an excellent control of the patient's statements and does not make any particular demands upon his intelligence. It may likewise, be employed to ascertain the faculty of vision and to detect simulated amblyopia.

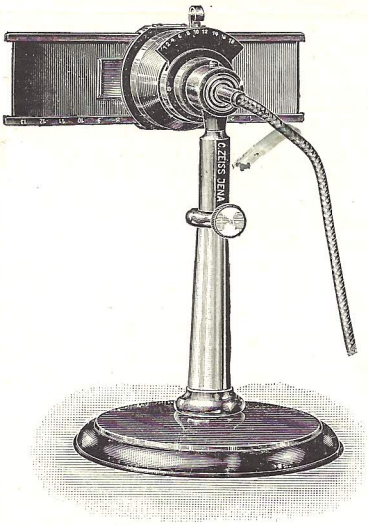

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Fig. 1. Visual Photometer mounted on a round foot, with small lamp and flexible conductor, with five-point diaphragm and Goldberg wedge.

The Birch-Hirschfeld *Luminous Point Visual Photometer* is another device for the like purpose. In this particularly handy instrument a radio-active substance takes the place of the electric current.

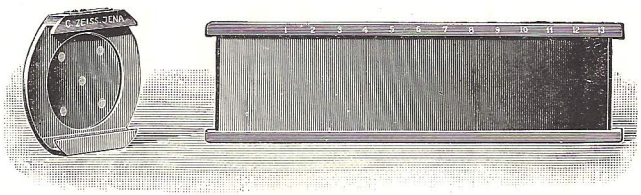

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Fig. 2. The Birch-Hirschfeld Luminous Point Photometer.

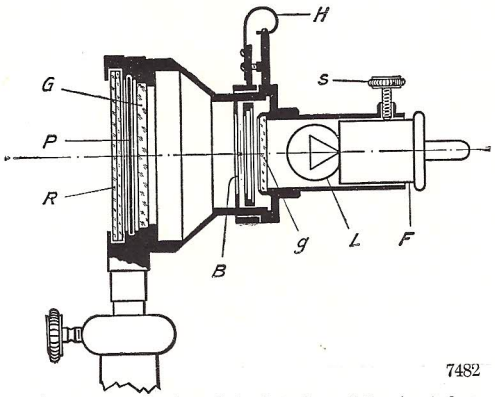

Fig. 3. Cross section of the light box of the visual photometer. *F* Lamp fitting; *L* frosted filament lamp bulb; *s* Clamping screw; *g* Opal glass plate; *B* Iris diaphragm; *H* Regulating lever; *G* Opal glass plate; *P* Five-point diaphragm; *R* Goldberg wedge.

The light supplied by a frosted filament lamp bulb is diffused by an opal glass plate to a sufficient extent to produce a fairly uniform illumination over a surface 18 mm. in diameter, which serves as the source of light. In front of this plate is mounted an iris-diaphragm which may be set to a scale in the dark by means of a lever *H* projecting above the top of the casing. When the lever is set to the right as far as it will go the diameter of the stop is 1 mm., whilst in its extreme position to the left it is 18 mm. Between these extremes eight intermediate positions are obtainable by widening or contracting the diaphragm, the whole range of the ten openings being thus: 1, 2, 4, 6, 8, 10, 12, 14, 16, 18. As the intensity is approximately proportional to the square of the diameter of the stop it follows that the diameter affords a means of varying the intensity within a range of 1 and 324. Another opal glass plate is mounted 3 cm. in front of the iris-diaphragm, and in front of this is mounted the five-point test object. It consists of a blackened metal disk having punched out of it the well known quincunx of the throw-dice. The diameter of each punch hole is 4 mm. and the distance between the dots forming the outer square is 20 mm. The entire five-point test object conforms accordingly at a test distance of 30 cm. to a retinal region of $(1.3 \text{ mm.})^2$, and at a distance of 30 cm. the individual dots have corresponding to them a retinal image 0.22 mm. in diameter (that is to say, under the conditions of accurate fixation it falls upon the rodless area). A slide frame is mounted in front of the five-point diaphragm along which travels an intensity moderating disk (Goldberg wedge) fitted with an arrestment. This wedge disk is produced by photographic means and its light-absorbing power increases uniformly. By this means, besides varying the intensity of the five dots as a whole, their relative intensities are made to differ, e. g the two points vertically above one another on the right are the brightest, the middle point appears darker, and the two on the left appear darkest. The middle point serves for determining the liminal value of the stimulus. The moderating slide greatly assists in rapidly finding the liminal value and conversely it shortens the duration of the experiment. The latter has an important bearing upon the determination of the initial liminal value and the comparative tests on the night-blind eye and the standard eye.

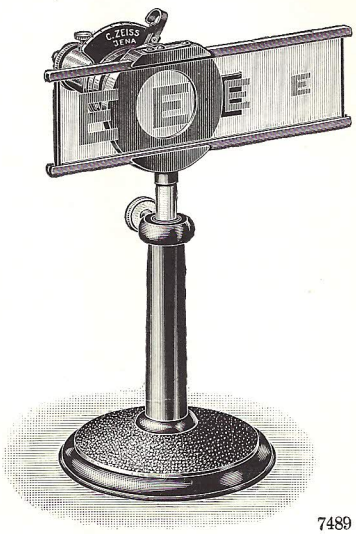

Fig. 4. The visual photometer with test type frame in position, and diaphragm for determining the visual capacity and for detecting simulated amblyopia.

The apparatus is thus provided with two devices for varying the intensity, viz. the iris-diaphragm and the moderating disk. The latter serves for finding the liminal value of the standard eye, the former for measuring the increase of the sensibility in the dark and of the liminal value of the night-blind eye, or conversely.

Bibliography: Birch-Hirschfeld: Das Fünfpunkt-Adaptometer und seine Anwendung. Zeitschrift für ophthalmologische Optik, 1917, Jahrg. V, Heft 2, pp. 44—49.
— — Eine einfache Methode zur Bestimmung der Sehschärfe bei Simulation und Uebertreibung. Zeitschr. f. Augenheilkunde, 1917, Vol. XXXVII, pp. 289—293.

Directions.

I. Putting in a fresh lamp.

Releasing the clamping screw in the lamp casing, withdraw the lamp fitting and screw in the 3.5-volt, 0.4-amp. lamp with frosted bulb. A regulating resistance for 0.5 amp., 700 ohms should be put in when the apparatus is to be connected to the public supply system. The required current may also be derived from a 4-volt battery.

II. Intensity Changes.

a. By the iris-diaphragm.

(1) The opening of the iris-diaphragm should be expanded or contracted by the displacement of the lever. The diameter of the opening corresponding to any position of the lever is shown (in millimetres) on the slot fitting of the lever. The squares of these diameters indicate fairly accurately the relative intensities.

(2) When set to any of the stop numbers the position of the lever is arrested by a spring catch. By counting the clicks the diameter of the iris opening may thus be ascertained in the dark without reference of the scale.

b. By means of the Goldberg wedge.

The Goldberg wedge, which is contained in the mount with spring catch attachment, should be inserted in front of the five-point-diaphragm, the latter having been placed in front of the opal glass plate. It serves not only to vary the total intensity but also the intensity of the five points with respect to each other.

c. By means of the slide with smoked and coloured glasses.

(1) The place of the Goldberg wedge may be taken by a frame with three different, more or less transmissive, smoked glasses, together with a red and blue glass. With the aid of these glasses the intensity of the five points may be uniformly reduced. The final critical adjustment should be made with the iris-diaphragm.

(2) This slide should be used when the entire five-point diaphragm is to be employed for the examination of more or less extensive peripheral regions of the retina.

(3) The smoked glasses diminish the intensity by 50, 80 and 96 %.

III. Test for Noctalopia.

a. Determination of the initial liminal value of the stimulus.

(1) The first step should be to secure an excellent and prolonged bright-adaptation, whilst the patient's statements, his refraction, and acuity of vision are being tested. Thus persons with ametropic eyes should be tested with their sight-correcting spectacles on.

(2) Next, the physician, entering the dark room together with the patient, should determine his initial liminal value by setting the iris-diaphragm to a mean diameter (say 8 mm.) and moving the smoked glass wedge forward into such a position that he can just see the middle point.

(3) The patient, whose index finger should be led to the five-point diaphragm to indicate the direction in which he is to look, should now be required to say how many points he can see and in what position.

(4) If he sees three points, two bright ones and the third a little darker, and if he is able to describe accurately their relative position, it follows that his liminal

value is the same as that of the examinig physician. If he recognises five points, it follows that his liminal value is lower than that of the physician. If he sees two points, one above the other, or no point at all, this would indicate that his liminal value has experienced a rise.

(5) The iris-diaphragm should then be opened until the middle point is just recognisable.

(6) If, for example, the setting be made for a liminal value with the opening of the diaphragm at 8 mm., whilst the patient fails to see the three points until the diaphragm is opened to 16 mm., the liminal value of the oculist will be to that of the patient in the ratio of $8^2 : 16^2$, i. e. as 64 : 256, or 1 : 4; that is to say, the initial liminal value of the patient is four times higher than that of the physician.

b. Various comparative measurements.

(1) In progressive dark-adaptation, the duration of which should be noted from a luminous watch dial, various comparative readings may be taken.

(2) If the adaptation of the patient is normal, which is the case if his sensibility is the same as with a normal eye, the ratios of the liminal values do not differ in the two eyes. Thus, if after a dark-adaptation continued for ten minutes, the oculist recognises the middle point at 8 mm., the resulting ratio is $4^2 : 8^2 = 16 : 64 = 1 : 4$.

(3) On the other hand, if the fraction becomes smaller than it was at the beginning of the adaptation, say 1 : 6, the inference is, not only that the liminal value of the patient has risen, but also that his dark adaptation has diminished at the same time.

(4) The method affords accordingly a simple means of ascertaining by comparison with the examining eye the liminal value of the stimulus and the accommodation changes in night-blind eyes.

IV. Determination of the faculty of vision.

(1) The five-point diaphragm (and the Goldberg wedge) should be removed so as to produce a larger bright surface.

(2) A test type frame should be slid in front of the illuminated opal glass plate. To vary the position of the test types the entire apparatus should be turned.

(3) The test types, when used at a distance of three metres corresponds to visual capacities o. $^1/_2$ ($^3/_6$), $^1/_6$ ($^3/_9$), $^1/_4$ ($^3/_{12}$) and $^1/_5$ ($^3/_{15}$).

V. The determination of simulated amblyopia.

(1) After determining the visual faculty in a completely darkened room, the test distance, the size of the test types, and that of the bright field ol view (with the aid of the stops) may be varied to any required extent, without affording the examinee any other clue as to the actual size of the test type than the size of the retinal image.

(2) If, for example, the same test type be presented to him, first in a large and next in a small illuminated field, he is liable to take the latter to be the larger type. If, in addition, the test distance be varied, the most practised simulator will scarcely be able to state the appropriate values.

The test is best made in a previously darkened room, in which a series of gauge marks are arranged, along a stretched cord, say, to enable the examiner to ascertain his distance by touch.