



# On the duration of the perception of light in direct and indirect vision

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what constitutes a good creosote oil, and would exclude oils of the highest preservative character. We have lately examined timber "pickled" 30 years ago with creosote oils from the London tar, and which oils when cooled to 40° F. yielded a very large amount of naphthalene; and yet the wood remains perfectly sound to this day.

The directions for the preparation and estimation of pure phenol (carbolic acid) are very minute, and include the results of the most recent workers on the subject. The author also describes the methods of preparing carbolic soap and disinfecting powders.

The chapter on Ammoniacal Liquor is well written, and contains a full account of all the substances contained in it; directions are also given for estimating its value, and for working it up. This latter part of the work is fully illustrated with engravings.

In conclusion, we congratulate the author upon having produced a work which is absolutely indispensable to all manufacturers of coal-tar products.

*Worked Examination Questions in Plane Geometrical Drawing.*

By F. E. HULME. Longmans, Green, and Co.: London.

THIS work consists of three hundred questions taken from old examination papers, two thirds of which have figures corresponding to them, said to be *solutions* of the problems. There is no attempt at classification; on the contrary, it has been purposely avoided by the author, and for a reason with which we do not hold. There are no demonstrations, and in most cases only scant directions; and even these are given where least, and omitted where most, needed. Many of the constructions are empirical, and incapable of being demonstrated; hence, from a mathematical point of view, they are not solutions at all. Scale Questions, those bugbears of Candidates for Military Examinations, ought to have been collected, and complete solutions of typical cases given. What good results from answering precisely similar questions over and over again? Notwithstanding its many defects, there is much in the book to recommend it. The questions are such as are certain to be encountered in Woolwich and Sandhurst papers; and the constructions are well drawn and conveniently placed for easy reference.

XXVIII. *Intelligence and Miscellaneous Articles.*

ON THE DURATION OF THE PERCEPTION OF LIGHT IN DIRECT

AND INDIRECT VISION. BY AUG. CHARPENTIER.

AFTER various experimenters, I have sought to determine the time that elapses between the appearance of a light before the eye and the making of a signal by the subject of the experiment as soon as he perceives the light. There was interest in ascertaining if the duration of the perception was different for the centre and for the excentric portions of the retina, if exercise could modify that duration, and if the modification would or would not be limited to the part exercised.

For these experiments the eye, placed at the centre of a Landolt's perimeter, looked into a large box lined with black, in the bottom of which a perforation had been made, about 1 square centim. in

section, usually closed by a plate lined with black, which plate, heavy and metallic, was retained in its position by the attraction of an electromagnet, but without coming into immediate contact with the latter, so that as soon as a person placed behind the box interrupted the current animating the electromagnet the stopping-plate instantly fell and disclosed the window placed before the eye which was under experiment. A current supplied by a laboratory Gramme machine, after passing through the electromagnet, put in action a small Deprez signal, the pen of which left its trace on a registering cylinder with a Foucault regulator. The signal immediately announced the interruption of the current, and consequently the precise moment of appearance of the light. Then the subject under experiment, directly after perceiving the light, restored the current in the signal through a derived path, by pressing on a spring the index finger of his right hand; precisely at this moment a new sign is traced upon the registering cylinder.

The interval which had elapsed between the interruption and reestablishment of the current, measured by comparison with the vibrations of a Marey electric chronograph, indicated directly the time which had been required for the subject to perceive and signal the light. For shortness, I shall call that time simply the duration of the luminous perception.

Here are the principal results which I have obtained in this investigation:—

(1) For one and the same person, under the same conditions, the duration of the perception varies from single to double without any apparent regularity. But if in one and the same experiment the mean of a sufficiently large number of successive determinations be taken (ten for example), a duration constant during the whole time of the experiment is found. I have found for myself, in direct vision, a mean duration of 0.13 second with daylight.

(2) The duration of the direct perception varies according to the individuals. I have seen it vary, according to the persons, from 0.09 to 0.15 second.

(3) The duration of the perception is sensibly the same for the right and for the left eye when they are sound.

(4) The duration of the luminous perception is notably increased by another cerebral occupation imposed on the subject during the experiment. Thus, when he speaks, when he listens attentively to a reading or a discourse, while at the same time applying himself to the experiment, he must have, for the reaction, 0.04 or 0.06 second more than before.

(5) The duration of the luminous perception is always more considerable in indirect than in direct vision; it is more considerable in proportion as the point of the retina struck by the light is more distant from the centre. This cannot be due to a difference of sensitivity, since, as I together with M. Landolt have shown, the retina is everywhere nearly equally sensitive to light.

(6) The difference between the duration of indirect and that of direct vision showed itself especially considerable at the beginning of our experiments. There was then between the duration of per-

ception for the centre and for a point situated  $80^\circ$  on the outer side in the visual field a difference of nearly 7 hundredths of a second. That difference was notably lessened by repetition of the same experiments during a month and a half; at the end of that time it was not more, for my left eye, than 2 hundredths of a second.

(7) If exercise attenuates the difference of duration of direct and indirect perception, it never annihilates it; so that the first constantly takes place more rapidly than the second. The influence of exercise asserts itself rapidly from the first sittings; afterwards it takes effect rather slowly, and then affects direct as well as indirect vision.

(8) Having established at the commencement that the duration of perception is the same for the left as for the right eye, I made, almost every day during a month and a half, fifty determinations on two well-defined points of my left eye only, excluding all other points of my two retinas. I thus exercised exclusively, a very great number of times, the centre of the *left* eye and the point of the *left* retina corresponding to  $80^\circ$  in the external part of the visual field (the internal part of the retina). At the end of that time I could estimate the influence of exercise by comparing the duration of the luminous perception on the same points in the *right* retina, and even on other points in both retinas. That duration was, for the centre of the left eye 0.129 second, for the centre of the right eye (not exercised) 0.143; at  $80^\circ$  outside for the left eye the duration of perception was 0.160 second; at  $80^\circ$  outside, for the eye not exercised, 0.210 second. Therefore exercise had notably shortened the duration of the reaction of the points experimented on.

(9) I wished to see if the abbreviating influence had extended over the *left* eye to points which had not been exercised. Now the duration of the reaction *was found to have been shortened in the same proportion for all the points of the inner half of the left retina* (the outer side of the visual field), *but not for the points of the outer half*. Consequently the exercise of an excentric point affects the different points of the same retinal hemisphere, but not those of the other hemisphere.

(10) The shortening influence *had extended to the outer hemisphere of the retina of the right eye*, while the *inner hemisphere reacted much more slowly than the same part, exercised, of the left eye*.

These facts can hardly be explained, except by admitting Wollaston's theory respecting the incomplete crossing of the fibres of the optic nerve in the chiasma, and supposing that the exercise of one part of the retina does not act merely on that part itself, but rather on the whole of the nervous centre, which receives both the fibres from the half of the retina containing the exercised point and the fibres from the half *on the same side* of the opposite retina.

Most of these experiments were simultaneously made by my assistant M. Bernardy, who aided me throughout, but, unfortunately, being able only to utilize the right eye for these researches, did not control points 8 and 10.—*Comptes Rendus de l'Académie des Sciences*, July 10, 1882, t. xcv. pp. 96-99.