An Instrument for Measuring Visual Power

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Visual Power, the overall efficiency of the visual apparatus, depends on four independent factors: 1) the distance D of the smallest details of the object; 2) the contrast C of these details and their surroundings; 3) the brightness B of the visual field; 4) the time of observation t . In general ophthalmic practice we measure only one of these variables, e.g., the minimum detail distance, keeping C and B constant, and making t so great that it does not play any role (except in cases of extremely busy and hard-pressed doctors).

Thus, according to Snellen, we measure the visual acuity, but it is a fallacy to think that visual acuity alone gives us complete information as to what the patient is able to do with his eyes.

Time and again we meet cases where we find a visual acuity of 6/6, but still the patient complains about bad eyesight and, in insurance cases, such persons are often considered as malingerers. We should not forget that we take our visual acuity in a dimly lit room without the immense brightness of the sky, and without any glaring lights in the visual field, as often occurs in industry. In cases of slight opacities of the cornea and the lens, these give rise to a greatly diminished contrast sensitivity, and it might well be that in many cases, especially in older people, the brightness sensitivity is diminished as well. We do not find any of these in our ordinary investigations in the office. There are many occupations, moreover, where the speed of perception is of utmost importance (typists, linotype printers, night fighter pilots and in many sports). We never measure this factor either.

The way these four factors interact and influence visual efficiency, has been investigated for a long time, but mostly in a more or less haphazard way. Fortuyn has been the first to examine them (with exclusion of the time factor) as a whole, and has tried to extract from the information thus received one single number in which to express the visual efficiency, or Visual Power as he calls it.

His method, however, calls for a room especially equipped for this purpose, with a big and complicated instrument, and he investigated only normal persons (Philips employees). For clinical

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purposes it would be interesting to examine patients, especially to answer certain difficult questions which were left open by Fortuyn; and to examine them with a small and portable instrument.

The apparatus which I show you here is a first attempt to achieve this purpose. With it we can measure the visual acuity under variable contrast and variable brightness conditions; the amount of brightness and contrast can be read from one scale. The test letters are printed on a diapositive which can easily be changed for other tests, Snellen hooks, Landolt rings and the like. Their rate of progression in size is logarithmic, with a multiplication factor of $\sqrt{2}$.

The instrument will be described in full elsewhere.

Discussion.

Waardenburg: In Denmark, Ehlers established a relationship between the velocity of vision and, among others, the question whether paleness of the papilla is based on optic atrophy or on some other factor (anaemia, glial proliferation, contrast, etc.). According to him, reduced velocity of vision (identification, perception) is only present in optical atrophy, and in this determination of the required exposition period, paleness in congenital achromatopsia is not brought about by atrophy. Does your experience extend to the differential diagnosis by means of the time factor? And might this not be of importance for clinical practice?

Mrs. Kok-Van Alphen: Would it be possible to define the brightness and contrast of the test used in the examinations? The examinations in their present form are actually valueless.

Dekking replied to Waardenburg: We have not yet considered the time factor, since these measurements take much more time, and the results are more difficult to compute than the other ones. In my instrument, however, there is place for a built-in shutter which we hope to use in the future;

to Mrs. Kok-Van Alphen: I certainly think that in the future it will be essential to consider the factors brightness and contrast sensitivity in screening tests especially for aircraft and navy personnel and railway employees and in particular in cases where unexpected failures occur combined with good visual acuity. Personally however

I am more interested for the moment in the effect on visual efficiency in cases with normal visual acuity and lowered contrast sensitivity (maculae of the cornea incipient cataract etc.). Up to now those people have been considered normal because they have normal visual acuity and consequently they are often victims of our insufficient methods of investigation.