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The Education (Administrative Provisions) Act passed last year enforces on education authorities throughout the country the duty of providing machinery for the medical inspection of elementary school children under their care. The potentialities for good which lie in this measure are great, almost overwhelming—that is, if the Act be administered in a broad and generous spirit. At the moment one cannot but be impressed by the fact that authorities generally, while rendering homage to the principle of the measure, seem to wish to get out of the practical responsibilities imposed upon them at the least possible cost. This is not the place to enter into local politics, but it is obvious that cheap inspection is likely to be perfunctory inspection, or if not perfunctory, at least not highly-skilled inspection. If the work is to fall into the hands of callow lads, or bread-and-butter young ladies, fresh from hospital, medical inspection is likely to become something very like a failure, both administratively and medically. Sympathetic knowledge of children and seasoned experience of parents are essential attributes for the work, for the inspector has first of all to entice youngsters to disclose their shortcomings, and then to persuade the parents that preventive or remedial measures are necessary.

In nothing will these qualities be more needed than in the discovery of defective eyesight and the teaching of its significance. The amount of ocular mischief in town-bred children is immense, and so little is it recognized that one is apt to be looked upon as a crank, a faddist, or an alarmist, for insisting on the elementary precautions that sense and science alike show to be necessary, if education is not permanently to damage thousands of the youngsters who are now hustled to school by crusty parents and conscientious attendance-officers. Nor is it only the children of the poor that are threatened, and not infrequently engulfed, by these dangers. It is paradoxical, but no less true, that the qualifications for teaching children and the capacity for understanding them are far more diligently inquired into in the case of most elementary school teachers than in that of those who instruct the young sprigs of the "nobility and gentry." A candidate for a mastership in an upper-class school is considered sufficiently accomplished if he has pursued a mute, inglorious career at one of the universities, and his claim is rendered undeniable if he has played cricket in his college eleven and been "tried for the 'Varsity." That these healthy young barbarians, as Matthew Arnold taught us to call them, have no knowledge of teaching may be a matter for regret; that they have no acquaintance with the physiology of the child is something approaching disaster. How can the pedagogue barbarian be expected to think that a wretched little astigmatic, who can only see half of his book at a time, is anything but a "stupid young ass"? Or what wonder is it if he add two or three dioptres to the myopia of all the short-sighted boys in his class by making them gaze at

the blackboard in impossible cross-lights, or write out five hundred lines because their nightwork is constantly unsatisfactory ? Just in proportion as the eye is of higher educative value than all the other senses, so is it worth the more careful preservation, and if parents and the custodians of the young are not instructed in the dangers of eye-strain and its prevention, their wards are likely to be cut off from the most valuable channel of knowledge.

The eye is endowed with capabilities for conveying information to the brain which makes all other sources pale into insignificance. The extent covered by the field of vision is bounded only by the horizon ; the rapidity with which knowledge is conveyed by the eye is as close an approximation to instantaneousness as we are acquainted with in nature ; and the variety of qualities such as form, size, colour, number, and texture, which it can appreciate in an object, has made the verb "to see" synonymous with the verb "to comprehend" in every civilized language. Milton deplored the loss of his sight at least as much from the educative as from the social standpoint, for in his address of 'Light,' after bewailing what his affliction deprived him of in æsthetic joy, he cries,—

"and for the book of knowledge fair
Presented with a universal blank
Of Nature's works, to me expunged and rased,
And wisdom at one entrance quite shut out."

That that one entrance should by all human effort be preserved is the birthright of every child.

It is only of recent years that it has been possible to obtain definite facts as to the eyesight of the rising generation. The credit of having instituted systematic inquiry belongs to the late London School Board, which in the year 1899 passed a resolution that teachers should be requested to test the eyesight of children by means of certain testing-cards with which they were supplied, and to record the results. The figures obtained were doubtless somewhat crude, as the work was new to the teachers, no checking or supervision by medical men was carried out, and the tests were somewhat hurriedly run through in the foggy month of December. Still, not only as a valuable departure in school hygiene, but as actual demonstrative evidence of the prevalence of eye-defects, the results were little short of epoch-making. To make the figures obtained intelligible to those unacquainted with the usual methods of expressing the results of vision-tests, it may be well to explain that the standard test-type is constructed to be read at a distance of 6 metres. If the examinee cannot read it at that distance he is shown types which a normal eye can read at 9 metres ; if he cannot read those, he is taken on successively to such as can ordinarily be read at 12, 18, 24, 36, and 60 metres. The smallest type the examinee can read is taken as the measure of his vision, and the result is expressed in a fraction, the numerator of which states the distance at which he was standing, namely, 6 metres in the usual way, and the denominator, the distance at which the type which he actually read can be read by a normal eye. Thus normal vision is expressed by the fraction $\frac{6}{6}$, which signifies that the type which should be read at 6 metres has actually been read at 6 metres. Less good is $\frac{6}{9}$, which indicates that the examinee could at 6 metres only read type which should have been read at 9 metres, and so on. In the first examinations under the School Board $\frac{6}{8}$ and $\frac{6}{9}$ were classified as "good vision"—though $\frac{6}{9}$ is already distinctly below par—and $\frac{6}{12}$ or less as "defective vision."

And now as to results. The number of children examined was 338,920. Of these, 259,523, or 76·6 per cent., were returned as having "good vision," and no less than 79,167, or 23·3 per cent. as having "defective vision." In other words, a quarter of this enormous number of children suffered—unsuspected—from marked eye-defects, and of them 2,675 at 6 metres could only see what they should have read at 60 metres, and 230 were unable to read any test type at all ! With regard to districts it is interesting to observe that the highest percentage of defects was found in the City, where only

56·6 per cent. of children—barely more than half—had good vision, the other districts below the average being Westminster, Hackney, Tower Hamlets, Finsbury, and Southwark. These are all thickly populated neighbourhoods, and as bearing out the relationship of congestion to visual deficiency, it is noticeable that in Greenwich, Lambeth, Chelsea, and Marylebone, where homes are less densely packed and open spaces more ample and numerous, the eyesight was above the average. These observations lend further illustration to the principle that where small demand is made on the eye for distant vision, the acuity of sight is proportionately less.

Dr. Kerr, who had been in practice as an ophthalmic surgeon, was appointed Medical Officer to the School Board shortly before that body was disintegrated, and was retained in the same capacity, to the great advantage of the London child, by the Education Committee of the London County Council. The work initiated before his advent met with his warm co-operation on taking office, and under his advice the machinery for examination was elaborated and strengthened. Ophthalmic surgeons were appointed to check the results of the teachers' testing, and various further points were brought under investigation. Vision was now classified as "good" when $\frac{6}{6}$, "fair" when $\frac{6}{9}$ or $\frac{6}{12}$, and "bad" when $\frac{6}{18}$ or less. The effect of defective vision on school progress was examined into, and the effect upon eyesight of crowded and open areas more thoroughly investigated. As the result of the first year's work under the new conditions, five important facts were brought out :—

1. That among children with defective sight the proportion below the average educational standard of their class, at every age from eight years to twelve, is considerably higher than that of those above the standard.

2. That visual acuity increases with each year of school life.

3. That a constant proportion of 10 per cent. of children have "bad" vision throughout school-life.

4. That the greater part of the defective vision is due to slight defects which give imperfect but fair vision, due probably to mental and ocular conditions, and of the greatest importance educationally in the first half of school-life.

5. Finally, that very bad vision ($\frac{6}{36}$ or worse) is met with in a proportion increasing regularly from 1·5 per cent. in the lowest standard to 3·5 per cent. in the highest.

One paragraph of the report is so important that it deserves quotation verbatim. "School effects," wrote Dr. Kerr, "from fine work and poor illumination are more likely to show themselves in general nerve strain and unhealthy neurotic or nutritional conditions than in very defective visual acuity during school-life. The real harm of defective vision and of school-work not adapted to the visual capacity of the young lies in the strain thrown on the developing nervous system."

Further experience has only served to strengthen these conclusions, and the work of weeding out the visually unfit and instilling scientific notions of what are proper conditions of illumination, and what class of work is adapted for children at various ages, has progressed steadily. The last year for which full returns are available is 1907, and the large number of children examined, over 400,000, the accuracy of the work—all the results being checked by ophthalmic surgeons—and the effect of extended experience as to what constitutes dangerous defect in vision in children, all combine to lend them permanent interest. Of the total examinees, 409,944 in number, the teachers returned 44,139 (10·7 per cent.) as defective for school purposes. This number was reduced on expert examination to 32,149 (7·8 per cent.), and, finally, 28,492 were given cards urging that surgical advice should be sought. A striking fact about these figures is that they include non-provided as well as provided schools, and though the former as a whole contain a rather better class of child, the visual defects were markedly higher in them than in the provided schools. One cannot resist the reflection that the bad

hygienic conditions, especially as to the lighting of class-rooms, prevailing in many non-provided schools may be largely responsible for this disparity. There is not room here to discuss more fully the question of the prevalence and significance of these eye-defects, but, lest it should be thought that the London child is gifted with exceptionally bad vision, it is instructive to note that in the investigations carried out among the school children of Aberdeen and Edinburgh under the auspices of the Royal Commission on Physical Training (Scotland), it was found that in Edinburgh the percentage of normal vision, as fully tested by refraction, was only 45·33, and that in Aberdeen was even less, namely, 43·8! It is not to be presumed that all the defective children these figures connote were in need of immediate treatment; but the Commissioners wrote with regard to those in Aberdeen: "The proportion of children requiring correction by spectacles for errors of refraction was slightly under one-fourth of the whole of the children examined"!

Before turning to the preventive measures necessary to obviate the aggravation of visual defects, attention should be drawn to the fact that in the child the eye normally is shallower from before backward than in the adult. The consequence of this is that the amount of accommodation which in an adult would focus the image of the object looked at on the retina, would in the child still throw it behind that structure, and that therefore a child needs to make a stronger effort at accommodation to achieve the same result as a grown-up person. Another difference is that the lens of a child's eye is normally more convex than in the adult, and therefore, whereas the latter relaxes his accommodation for distant vision, in the child a distinct effort is necessary to accomplish the same object. Now eye adjustments, especially those for near vision, are muscular actions. The reading of a book involves no less than three distinct efforts, namely, an effort by the muscles attached to the eyeballs to bring the eyes towards the middle line, so that the visual axes may converge on the print; an effort by the ciliary muscle to adjust the lens to an appropriate condition of convexity; and an effort by the circular muscles of the iris to make the pupil contract and shut out divergent rays of light. Now not only have these muscular efforts to be made, but they have to be kept up all the time that reading is going on, and as all muscles weary under strain, and as the strain in the case of the child is greater than in an adult, it is clear that this fatigue is a very real and trying factor. As the eye develops normally the visual acuity increases. It has already been pointed out in Dr. Kerr's figures that the vision in the various standards improves with age. But if by muscular strain the elastic eyeball of the child be unduly dragged upon, any existing defective condition may be greatly increased, and in any case the mental and nervous symptoms produced not only retard educational progress, but actually endanger the general health.

Though these questions may appear to many to be of more or less academic interest, to all associated with children in every class of society, they "palpitate with actuality," as the French have it. No parent, especially if he be a town-dweller, can afford to let his child run the risks involved to health, progress, and eyesight, which negligence of the hygiene of the eye involved. Some of the necessary elementary measures for avoiding eye-strain may be usefully mentioned. First and foremost is the question of illumination, natural and artificial. Lighting should not be too stinted, nor too abundant, nor wrongly directed. In the school-room or nursery the window-area should be at least one-sixth of the floor-space, and one-fourth is better. The windows should reach nearly to the ceiling, and should descend so near the floor that the minimum of shadow is obtained beneath them; moreover, they should be placed as close together as structural stability allows, so that there may be no shadow between them. It is far better that light should be admitted on one side only of the room; in the case of the school this should be the left. The end walls should be blank,

covered by a pale neutral tinted paper. Top-lights are rightly forbidden by the Education Code. If sufficient illumination cannot be obtained by the windows on the left, light must be admitted from the right, but it must be distinctly understood that such a supply is supplementary, and the amount of window-space strictly limited by actual needs. Nothing is more puzzling to the eyes than a cross-light. To prevent too great an access of light on sunny days, blinds should be provided to cover the whole window area, and they should be made of green holland or other dark material. For artificial illumination electric lighting is best, especially a high candle-power lamp in a frosted globe. One type of lamp is so excellent that out of gratitude I am almost tempted to mention it, but as my subject is scientific and not commercial, I refrain. No doubt there are plenty as good.

Next to illumination comes the question of position. The near point at which a child should work with its eyes is a distance of twelve inches; at any rate, not a fraction under ten. Any child who cannot read, write, and sew comfortably at this distance is either possessed of defective vision, or is forming habits fatal to ocular health. The body should be upright, supported in the middle of the back, with the thighs at right angles to the body, and the knees at right angles to the thighs; the feet should rest flat on the floor, and the desk or table should admit of this attitude being easily maintained. To prevent the head drooping the surface containing the work should be adjustable to an angle of from 15 degrees to 20 degrees for writing, and from 30 degrees to 40 degrees for reading. In the case of reading it is most important that no printed books should be given to young children under five, and picture-books should only contain bold objects unembellished with fine detail. School-books are much better than they were, but there is still much room for improvement. Children between nine and twelve years of age should be allowed no print smaller than *Pica*,

(This shows the size of Pica.)

Children below that age should have their books printed in *Double Pica*,

(This shows the size of Double Pica.)

or *Great Primer*,

(This shows the size of Great Primer).

The margins should be wide, the lines and letters well leaded out, and all type used should be fresh and sharply cut.

Writing is the most trying of all exercises, and it should never be long continued. Unlined paper and ink are the materials of choice, and the small ruled squares in which the letters have each to be formed separately should never be permitted. All paper for reading or writing should be unglazed, and the so-called vertical script is worthy of hygienic commendation on account of the lack of temptation it offers to the formation of faulty attitudes. For girls there remains the crucial question of sewing, and it must regretfully be admitted that this admirable domestic art is one beset with danger to the youngster's eye. For girls under five it should be absolutely forbidden. After that age a darning needle and coarse yarn may be used if the yarn is of a dark colour, and the material on which it is worked is of a pale shade, or vice versâ. But even this modest accomplishment must be carefully supervised, and if the child be found to bring the work close to the eyes, needle and yarn should be put away for a year or two. Fine needles, fine thread, and fine work are bad for anybody, and they certainly should not be used by girls till they are in their teens. Perhaps the most pernicious sewing-work is the very useful

one of "patching," when the object of the seamstress is to make her repairing work as neat and little obtrusive as possible. It is the veriest tempting of Providence to set children to it.

In view of the well-ascertained dwarfing of visual acuity which town life conduces to, it is hardly necessary to say that the open country is the ideal entourage for a child, more especially such as have known defects of vision. To give the eye free play as far as the horizon, with the minimum amount of near work and the least possible confinement to houses and streets, is the natural and rational method of preserving the eyesight. Apart from the direct benefit produced to the general health of children by bringing them up in the country, the value of rural life in sparing the eyes from undue fatigue, and thus sparing much mental and nervous irritability, is very real indeed, and constitutes not the least of the benefits which a back-to-the-land policy would bring about. I shall hardly be deemed guilty of exaggeration by those in a position to judge if I say that much of the change the national character has undergone during the last century is due to the changed ocular conditions under which children are brought up. It is the duty of everyone at least to see that these conditions operate as little harshly as may be.

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