

To all who value their sight : a few practical suggestions and illustrations, intended briefly to awaken the attention of every individual to the condition of his sight; and enable him to promote the improvement and preservation of that invaluable faculty / By R.B. Bate.

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OF THAT
Invaluable Faculty.

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OPTICIAN TO THE KING.

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TO ALL WHO VALUE THEIR SIGHT.

AS the Eye is universally admitted to be the most *precious*, the most *delicate*, and the most *indispensable* of all our organs of sensation, the judicious employment and the preservation of its powers might be supposed to be objects of such general interest and importance, that an attempt to awaken attention to them would be quite uncalled for and superfluous,—more especially through a medium, to the employment of which the cultivation, or at least the exercise of those powers is matter of absolute necessity. Value of the eye, especially to readers,

So far, however, is this from being the true state of the case, that a long experience has convinced the writer of this essay that there exists an inattention to these important objects much too prevalent in all, but so nearly universal amongst the young, that the publication of a few popular remarks upon the subject, *WITHIN THE REACH OF ALL*, and capable of being easily remembered or referred to, would be more extensively useful, and more generally effective, than the best personal suggestions, which, however well meant, are commonly received with prejudice, and therefore are too often thrown away. not sufficiently attended to.

The general neglect of this organ is, perhaps, the most remarkable inconsistency of the present day. When so great a part of the business of education consists in impressing the young mind with maxims of precaution; when the effects of bad habit and neglect are so studiously guarded against in every other particular, the *SIGHT* seems altogether an exception, as if this invaluable faculty were considered to be either above or beneath our care: to show that it is not either, to point out the mischievous consequences of many errors which prevail respecting it, and the great benefit to be derived from a reformation of these errors, are the objects of the following pages. Inconsistency of this neglect.

The distance
at which we
read the best ;

It may be observed, that persons having ordinary sight read the small print of a newspaper at a distance of *ten* or *twelve* inches from the eye: if such persons attempt to read this print at the distance of *twenty-four* inches, they will, in many cases, find it impossible; and when they succeed in reading it, they find that it requires a considerable effort.

experiment
upon this dis-
tance :

The necessity for this effort principally arises from the image of the print being *actually reduced to ONE QUARTER OF ITS FORMER SIZE!*—To be satisfied of this fact we may take a sheet of paper, and having divided it into two equal parts, place one upright before us at two or three feet distance, and having folded the other into half its *height*, first convince ourselves that it is so by holding its left edge in contact with the tall one, then move it slowly forward until the short and tall appear of equal height*: it will be found that the shorter is only half its former distance from the eye. In the next place, further doubling the folded leaf into half the *width* of the other, it will become one quarter of its size or surface; and moving it forward in like manner until it just hides the first, it will be again found to be half its distance from the eye.—It is therefore obvious that when the print is held at double its former distance, our eyes are compelled to make the same exertion as if the whole page with its lines of type had been crowded into that diminished space.

should be
maintained.

A little consideration will now satisfy us of the advantage of maintaining this *DESIRABLE DISTANCE*, at which we *see the best*, instead of suffering the print to be gradually *diminished in size by its removal* from us: if the reader feel at once the force of this suggestion, it is not necessary for him to read one line further; but if he do not perceive it, and especially if he consider that he has, without aid, a full controul over the choice of the distance at which he reads, his attention is earnestly invited to the following short considerations, which will convince him of his error, and when well understood, will sufficiently illustrate the practical parts of the subject.

1. The focal
length of the
eye increas-
ing with years

1. There is a point or distance at which each person severally sees a small object more distinctly than at any other: this distance is the focal length, or (as it is commonly called) the focus of that person's eye. There is also

* This will be best observed with *one* eye.

a *gradual increase* in this focal length, as we advance in life, which produces the necessity for a corresponding increase in the distance of the paper from the eye when reading; but so perfect is the sympathetic action of the nerves and muscles, and so admirably are they adapted to perform the functions required, that this increase of distance is effected without any apparent effort; and therefore it goes on for several years, not being even suspected by ourselves, though very obvious to others.

2. The distance of the paper from the eye being increased, the size of the print is diminished in the high degree before expressed*; and the reader is compelled to make the same effort as if he had actually so much smaller print to read. The mischief of this increased effort is evinced by the painful sensations which it produces, and which are frequently such as to compel him to *desist from the EMPLOYMENT of a faculty*, the most abundant source of amusement and instruction.

3. This increased effort being *never* called for until the sight begins to suffer *some DIMINUTION* of its powers, the demand is made at the very time when the eye is becoming *less capable* of answering it; and the diminution of capacity requiring a greater amount of exertion, the re-action of these effects upon each other accelerates the progress of decay;—in consequence, the energies, which should be treasured up as the most valuable of our possessions, and the most necessary to the comfort of old age, are spent and dissipated in painful and ineffectual efforts.

Happy did we duly estimate the value of a gift, which, having the power of *preserving* and *perpetuating* to us this *DESIRABLE DISTANCE* at which we see the best, prevents the demand for these painful and ineffectual efforts, and all the mischievous consequences resulting from them: this is the proper business of spectacles †.—But whoever ascribes to spectacles more beneficial results or greater capabilities, such as the “*restoration*” of lost powers, or the *strengthening* of impaired ones, may be justly accused of stooping to the common cant of quackery.

This cant is not only contemptible, it is seriously mischievous, and should be reprobated; for by begetting a

* viz: as the *square* of the distance.

† It should be observed, that by “Spectacles” is here meant such only as are adapted to near objects: those for distant objects will be treated of hereafter.

Notion of
their *restoring*
the sight in-
duces neg-
lect ;

notion in the heads of millions that a restorative is always at hand, to replace them in possession of their former energies, it induces an habitual disregard of consequences, and they carelessly proceed, until arrested by some formidable impediment or calamity.—So it is with spectacles: few persons think of having recourse to them, until aroused to a sense of the necessity of affording some assistance to their sight, by its inadequacy to the performance of its ordinary functions; a discovery commonly the result of some interruption of its use, or a rapid acceleration of that *gradual* progress of decay, which otherwise eludes their observation.

not capable
of restoring,

But though we cannot ascribe to spectacles the extraordinary powers alluded to, let them not suffer in our estimation because they fall short of the extravagant expectations which have been excited in us; rather let us accept with thankfulness the good, such as we find it, for it may prove even better adapted to our real wants, than the imaginary perfection with which we have been flattered. The fact is, that although spectacles cannot restore a good sight, they are adequate to its almost entire preservation; and when judiciously applied, will maintain the powers of this inestimable faculty to the last, in a state of energetic action with which no other powers can compare.

but will almost
entirely pre-
serve it,

It has been often said, that we are blind to the value of things within our reach, and estimate others by their difficulty of acquirement, rather than by their capability of answering our real wants:—with what truth may not this be said of spectacles! They are admirably calculated to supply our wants, are within the reach of every one*, and are as easy a remedy as the imagination can conceive; yet how many despise this aid because it is cheap, and how many more defer recourse to it because it is always at command! Let the former be reminded that the best gifts we have cost us less, and are even more *common* † than this; and the latter, that they but increase the necessity for aid by delaying its adoption.

with the ut-
most ease.

Not to be de-
spised because
cheap or com-
mon.

Injury of ab-
staining from
their use ;

If it be supposed that the before stated consequences cannot be so mischievous as there expressed, because, if really experienced, such consequences must have been ob-

* Spectacles are sold at 2s. 6d. per pair, by the most respectable opticians, who never employ any other than the best worked glasses even in these.

† The eye, the ear, the understanding, life itself.

vious to those who experienced them, and these persons would have warned their friends and children, so that, in the course of time, the like provision would have been made against this, as against other evils, by the common operation of experience; this objection may be set at rest by the assurance that the extent of these mischievous consequences is *NOT KNOWN* to those who sustain them; for the more the sight has suffered before recourse is had to spectacles, the greater is the relief afforded by their use; and as the *PRESENT COMPARISON* of their *impaired* with their *assisted* sight is *all they have to judge by*, they may well be satisfied!

not known to those who sustain it.

If it be further objected that the use of spectacles cannot prevent these mischiefs, or else opticians would have impressed that conviction on the public mind; it may be truly said, that to attempt this, is, and has always been, their practice; that such attempts have not been more successful may be accounted for by their suggestions being received with indifference by those who are not in want of aid, and with mistrust by most of those who are; and that they have every where to encounter the strongest and the most deeply rooted prejudices. A sincere desire to remove these injurious prejudices has therefore induced this new effort; in the belief, as before observed, that it will be found more generally effective to such a purpose than *personal* explanations ever can be.

Prejudices against spectacles

The most mischievous of these prejudices has its origin in the notion that the first use of spectacles is a *step towards old age*. As no one, endued with reason, can possibly conceive such a step to *hasten on* old age, we can only mean that the use of spectacles *betrays* our advancement to it. It has already been shown that this step, whatever it be, cannot be *deferred* with impunity: let us now consider, not whether it really brings us nearer to old age, but whether it is *indicative* of our approach to it.

as "a step towards old age."

In the first place, it should be observed that spectacles are worn by many *young* persons (the number of whom daily and hourly increases); their *use* therefore cannot *singly* be indicative of age. Secondly, it should be recollected that the increasing length of sight, already described, is very palpable to others before we even suspect it ourselves; and as the *increasing length of sight* is an *INDISPUTABLE PROOF* of the advance of age, it evidently appears that the adoption of spectacles can only be a partial and *uncertain* indication of it, whilst the *delay* of their adoption, on the part of those who require them, is an *infallible* one.

This objection examined;

found to be directly opposed to truth,

and really to
expose *itself*.

The use of
spectacles

the best con-
cealment of
the effects of
age.

The notion
that they
"cannot be
left off"

not true of the
well suited,

such being
more capable
of doing with-
out.

If it be further considered that the increasing length of sight is not only an infallible proof of its decay, but, on account of the well-known inconveniencies to which it compels us to submit, is also a *proof of our WISH TO CONCEAL this decay*; this consideration ought surely to induce the conviction, that our attempts at concealment are not only vain and fruitless, but degrading also, inasmuch as they expose our real motives to general observation*.

The difficulty of performing the common operations which all require †, and the having recourse to others to perform them for us, palpably betray the effects of age; on the contrary, the timely application of spectacles enables us to perform these operations without impediment. If, therefore, we desire to *conceal* the *CONDITION* of our *sight*, it is obvious that we ought to employ an aid which is in itself no proof of age, but which will enable us to do as we always have done, and to escape those exposures which call the attention of others to this condition.

Another formidable prejudice against the use of spectacles is the very prevalent notion, that when persons once begin, they cannot do without them; and, although this is not fair matter of complaint against any thing really useful, yet as it operates to deter many from beginning who have great occasion for them, it may be proper also to examine into the grounds of this complaint. As this complaint is never made by those who begin betimes ‡, neither can it be made by any other persons who are *properly suited* with spectacles, (unless, indeed, such persons mean that they want the *will* and not the *power* to do without them,) because the progress of decay being retarded from the moment such persons begin to use spectacles, they are really more *capable* of doing without them than they would have found themselves, *after the same interval*, if they had not been so aided. The difference, however, between seeing well and imperfectly is so impressive, and the comparison

* The writer has often noticed and lamented the imbecile attempts of persons to *hide* their want of spectacles, by persevering to read or work at half a yard, or at even a greater distance from the eye.—He presumes that it is only necessary to *inform* such persons that the very means they take to *conceal*, *betrays* the condition of their sight.

† Strongly instanced in the nibbing of a pen, and the threading of a needle.

‡ On the contrary, there are numerous instances of persons, who, having used spectacles betimes, can see to read *without* them even in old age.

so striking, that persons may be well excused for imagining that they see worse without them than before.

The strong impression made by the comparative indistinctness of the print, immediately on the removal of their spectacles, alone induces many to believe that they cannot read without them, particularly if they have long delayed beginning with them; but if such persons, on taking off their spectacles, would give time for the sympathetic action of the nerves and muscles, before alluded to, to move the print to such a distance as to suit the focal length of the eye when unassisted, they might feel satisfied that they see the print as well as they did before, because they would then perceive no other impediment than what arises from the diminution of its size by removal, as before described.

The impression felt on removal induces this opinion:

It must however be admitted, that *some* ground for this prejudice is afforded by the mischief which actually arises from the use of spectacles improperly chosen *; as in the instance of those who, not having access to persons capable of or disposed to pay proper attention to their selection, have chosen such as they liked the best, frequently those which magnified the most. This effect is perhaps more strongly instanced in others, who have adopted the spectacles of their deceased friends, the glasses † of which, being commonly too old for the survivors, also magnify too much; and by their use, the eye, becoming adapted to such glasses, is in some degree incapable of seeing without them.—As it is highly desirable that the occasion of this effect, as well as of the condition which begets the necessity for aid, should be somewhat explained, the reader's attention is requested to the following illustrations, which shall be stripped of technicalities, and made as plain and intelligible as possible.

which only holds against glasses improperly chosen,

and too old.

I. The ball of the eye is nearly round, and internally consists of three transparent humours, distinguished by their supposed resemblance to water, glass, and crystal: upon the action ‡ of these depends the focal length of the eye,

Attempt to explain the cause of this.

* These however, being instances of the abuse rather than of the use of spectacles, are no objections to their judicious employment.

† It cannot be too generally known, that glasses may be obtained at the best opticians, properly suited to the sight, and fitted to the frame, for 1s. 6d. and 2s. per pair.

‡ To illustrate this, take a magnifying glass into the darkest part of the room, and hold it in such a manner as to let the light fall *directly* through it on a piece of paper; by moving the glass to and fro, a distance will be found at which the image of the window will be distinctly seen upon the paper: this distance is the *focal length* of that glass. If a glass of

The image must be distinct upon the retina ;

falls short of it when magnifying glasses are employed.

Cause of the increasing length of sight,

why imperceptible.

or the distance at which a small object is most distinctly seen. The image of the object is received upon the *retina*, which is an expansion of the optic nerve, spread out, like a fine net, over the whole posterior surface of the eye, and which, being sensible to the impression of this image, gives perfect vision when the image itself is perfect, and imperfect vision if otherwise*. Now a magnifying glass, being interposed between the eye and the object, increases the power, and shortens the focal length of the whole †; the distinct image is consequently formed rather too soon, and becomes *imperfect* upon the retina, which, being sensible of the imperfection, stimulates the optic nerve, and through it the muscles of the eye, to the exertion necessary to remove it; and this exertion, *long continued*, produces such an alteration in the figure of the eye, as renders it incapable of distinct vision without such a glass.

II. On the other hand, the humours above mentioned being furnished by the body, their strength or *densities* gradually *decline* with years; and as their refractive powers depend upon their densities ‡, they decline with them, and the focal length of the eye becomes consequently *increased*. This change is however so slowly progressive, and the muscular action which removes the object to its due distance is so delicate and imperceptible, that it may be said to be quite involuntary; the distinctness of the image on the retina being consequently never interrupted, all that ensues is, as before described, that its *SIZE* becomes diminished.— It cannot be too often repeated, that all which is required of spectacles is to *prevent this diminution* by *PRESERVING THE DISTANCE* at which we see distinctly when the eye is in its *best condition*.

If, therefore, it were possible for us to procure an aid,

greater curvature or convexity be employed, it will be found to be of a shorter focal length; and this length or distance, diminishing as the figure of the magnifier becomes more convex, is least of all when the magnifier becomes a sphere, the distinct image being *then* formed close to the magnifier itself.

* In like manner as the paper receives a perfect image of the window only at one point or distance from the glass, and an imperfect image at every other.

† As may be illustrated by interposing a spectacle-glass of low magnifying power between the magnifier and the window, in the preceding experiment.

‡ This is demonstrated by comparing the focal lengths of glass and pebble of the *same* figure, when it will be found that the latter, having the greatest density, has also the shortest focal length.

the powers of which would *increase in the same progression* with this gradual *elongation* of the sight, the summit of perfection would be thereby obtained. This perfection is, however, nearly attained by the production of a series of glasses, the powers of which begin so low, and increase by such imperceptible degrees, that the sight may, in the first place, be accommodated to the utmost nicety; and, by pursuing the series, may preserve this DESIRABLE DISTANCE with sufficient uniformity to enable us to escape all sensible inconvenience.

The glasses employed should increase in power, as imperceptibly;

It is hoped, that the *impropriety of the use of spectacles which MAGNIFY will now be sufficiently obvious*, and that persons will avoid selecting such as do so, by observing that the *distance* at which they used to read when their eyes were in the best condition is not *diminished* by them*. This is an adequate guide for the protection of their sight, because the object cannot be distinctly seen through magnifying glasses, unless it be brought *within* this distance, as exemplified by the experiment in a foregoing note. And although persons who have long abstained from spectacles must begin with such as *apparently* magnify, this is only because the image of the print upon the retina has suffered a very considerable diminution; and its restoration to the original size consequently produces a great apparent increase; but as those who begin betimes do not suffer any perceptible diminution in the size of this image, its restoration to the former magnitude is to them equally imperceptible.

not to magnify or increase the original size of the image,

It is on this account that glasses, of the earliest sights, are called "Preservers;" and they well deserve that appellation, because, besides *preserving* this DESIRABLE DISTANCE, they also sustain the visual powers to the utmost, by continuing their easy wholesome exercise, instead of leaving them exposed to the necessity of exertions, in the beginning slight and occasional, it is true, but which daily become more violent and frequent, and the increasing frequency and violence of which produce such an acceleration of the progress of decay, that the non-observance, or the neglect of it, may with equal propriety be denominated "blindness."

but to preserve it,

avoiding all unnecessary exertion.

However prevalent and obstinate these prejudices against

* As few persons may be sensible of what this distance was, it may be observed, that the sight need not generally be considered to require aid until the focal length of the eye begins to exceed twelve inches, unless some painful sensation or other difficulty be previously felt.

Reading-
glasses

very injurious,

and *single eye-*
glasses.

“Near-sight-
edness :”

its advantages;

where most
prevails ;

the use of spectacles, some consolation may be derived from the evidence of their decline, afforded by the almost total disappearance of reading-glasses, so very prevalent twenty years ago, and to the disuse of which the writer flatters himself his humble efforts have largely contributed, having never omitted an occasion of exposing their mischievous effects; such as their magnifying the object; their being held at a distance from, and not partaking of the motion of, the head; their employing but one eye, and thereby occasioning a difference in the sight of the two! This last objection applies, however, more especially to a practice, which has lately somewhat increased, of using a single eye-glass, the resting which against the face is undoubtedly a *step* towards improvement, though a very small one, and the consideration of which shall be combined with that of its more prevalent use amongst near-sighted persons.

The character of near-sightedness is opposite to that which has hitherto been treated of, the images of distant objects being in this case formed before they reach the retina, and consequently indistinct upon it (as described in page 10); so that every object, the distance of which exceeds the focal length * of such an eye, produces an imperfect image in it, whilst those only which can be brought to the required distance are distinctly seen.—This inconvenience is, however, abundantly compensated by the superior magnitude and brilliancy of the images of objects at this required distance, which together enable the near-sighted to read such print as others can scarcely see, and to read in such a light as would by them be considered darkness; whilst a similar aid is provided for their defective sight of distant objects, as for the more prevalent defective sight of near ones.

Near-sightedness prevails the most in cities, where children have no opportunity of accustoming their eyes to distant objects; and more particularly amongst the wealthy, whose constant solicitude † to amuse their children, too fre-

* This focal length varies very greatly in “near sighted” persons, but may be always considered to be within twelve inches, persons who distinctly see objects at this distance, or beyond it, not being usually so called;—it is in some few instances less than two inches from the eye: glasses are, however, made to reach even these extreme cases.

† The intelligent reader will not consider this observation as condemnatory of that interesting excitement of the opening faculties, which so powerfully contributes to their enlargement, and lays the foundation for that subsequent extension, by education, which alone distinguishes the scholar from the peasant.

quently confines their notice to near objects altogether; and, although this description of sight is not to be regretted, because, besides being peculiarly adapted to the habits of those who reside in such situations, it is the most durable and effective of all sights if properly cultivated, yet its cultivation is necessary to its durability, as well as its efficiency, for otherwise it becomes incapable of being assisted in old age.

This sight is adapted to objects at a distance by the application of glasses, the figure of which is concave, or the reverse of those heretofore referred to, and which increase * the focal length of the eye as required: as the increase of this length, however, does not assist in reading, (but the contrary, since the image of the print is diminished in size, as before described, by its increased distance from the eye,) they are not to be recommended for such a purpose †; but as they are admirably calculated to assist the vision of objects at other distances, they cannot be prized too highly.—Such glasses, properly chosen, call the optical powers into full and easy exercise; they give the effect of the sudden removal of a mist from before the eyes, and open, as it were, A NEW SENSE to the observer, the enjoyment of which gives such *animation* ‡ to the countenance, as fully to reconcile their appearance to those who would otherwise consider it disfigured by them.

how assisted.

Benefits of this assistance.

On the contrary, by the neglect of this aid, the powers of vision, in such persons, are continually subject to the extremes of lassitude and excitation, particularly when objects of interest are passing around them: for as many cannot recognise their most intimate friends at five yards distance, occasions are frequently arising which induce them to make the greatest possible exertion to distinguish such objects; and the sight becomes impaired by another series of painful and ineffectual efforts.

Mischief of its neglect.

The use of a single eye-glass does but partially relieve

* To illustrate this effect, it is only necessary to interpose a slightly concave glass between the window and the magnifier, in the experiment before recommended, when it will be found necessary to remove the paper *further from* the magnifier before the distinct image of the window can be obtained.

† Except in the instance of music, or such other reading as cannot be conveniently approximated.

‡ It is indeed delightful to witness the gratification felt by very near-sighted persons on the first application of these glasses, and the sense of their being beneficial adds much to this enjoyment.

Disadvantages of the single eye-glass :

occasions a difference of sight in the two eyes.

Superiority of spectacles :

only requires to be experienced.

Their use improves this description of sight ;

protects the retina from fatigue.

the inconvenience felt, and is too often an aggravation of the mischief by its *sudden* application and removal; the former stimulating the retina to instantaneous exertion, and the latter throwing it into a state of immediate relaxation: it is further injurious by begetting a *difference in the sight of the two eyes*, so that an object can never be seen by both together in perfection afterwards. The employment of one eye singly also renders us less capable of judging of the distances of objects, and requires in the near-sighted the use of a glass of stronger power than when both eyes are employed together.

It is very desirable that near-sighted persons should use the weakest glasses capable of giving the necessary assistance. Spectacles afford this great advantage, in addition to the following:—they sit firmly on the head, partake of all its motions, and maintain the glasses in the due position;—when properly adapted to the sight, they improve the powers of vision, by calling them from a state of inactivity to a permanent state of easy and grateful excitation: they open sources of information and enjoyment, the benefits of which require only to be known to be duly estimated, and which are, in truth, so highly prized by those who experience them, that they thereby become armed against all the attacks of prejudice and ignorance*, and would be just as easily induced to lay aside their understanding as their spectacles.

Let it not be imagined that such persons, by the confirmed use of spectacles, become *incapable* of laying them aside; for the contrary, as stated in former instances, is really the fact, and by a judicious selection and employment of them, not only are they more *capable* of seeing without them than before, but the retina being guarded against all occasions of violent excitement, its powers become exercised with a wholesome economy, and are thus perpetuated to old age. The writer is inclined to think that much further improvement may be effected in the condition of this species of sight, at a late period of life, by a

* It is hoped that this will not be thought too harsh a term, when it is considered that the mere trial of the spectacles of near-sighted persons would convince any one of the injustice of ascribing their use to affectation. While upon this subject, the writer cannot refrain from adding a remark made to him by one of these *judicious* critics:—“What a strange fellow **** is; he wears spectacles when he comes into church, and as soon as he begins to read he takes them off!”

very gradual diminution in the power of the glasses employed: he has himself advised this diminution in many young near-sighted cases, and earnestly recommends it to general consideration.

As it is here that that happy capacity which our sight possesses of adapting itself to the circumstances imposed upon it may be made available towards its improvement, a familiar description of this capacity shall be now attempted. If a person, of ordinary sight, look steadfastly at a near object, and from it to a distant one, he will observe the first appearance of the latter to be slightly indistinct: this indistinctness, however, only exists during the adjustment of the interior humour of the eye, which adapts it to the new distance and reproduces distinct vision*.

Adjustment of the sight to different distances explained:

This valuable faculty is quite adequate to the accommodation of an ordinary sight to all distances beyond five or six inches, and to the adaptation of what is called a long sight to all distances beyond twenty or thirty inches from the eye: but a near sight is extremely limited in this respect, being incapable of adapting itself to the distance of any object which exceeds twelve or eighteen inches from the eye; and as all objects within this distance may be conveniently approximated, the muscular energies involuntarily bring the objects or the eye to the *required distance* at which they are seen best, and this capacity of adaptation remains unexercised. The interposition of glasses of a proper figure affords distinct vision of objects at a variety of inaccessible distances†, and therefore calls this capacity of adjustment into action; the exercise of which, in youth particularly, improves the faculty itself, enlarges its sphere of action, and by the proposed *gradual diminution* in the power of the

much limited in the near-sighted.

The use of proper glasses

greatly extends these limits,

* This is performed with such rapidity in a good sight, that it is scarcely perceptible, even when one eye is closed. It is a matter of controversy whether this adjustment be effected by an alteration in the *figure* or in the *place* of the crystalline humour: both hypotheses may be illustrated by a recurrence to our experiment; the latter by approximating the posterior lens or magnifier to the anterior one, and the former by exchanging it for one of somewhat greater focal length.

† This view of distant objects is not perfect through all varieties of distance with one power of glass, but, combined with the internal adjustment described, it is very nearly so; and with two, or at the utmost three varieties of powers, the sphere of distinct vision may be indefinitely extended. Dr. Franklin's arrangement of the glasses in his spectacles may be made available to this purpose; two pair of glasses being fitted to the same frame, those in the upper part of it adapted to distant objects, and those in the lower part adapted to near ones.

glass employed, may be made conducive to the adaptation of the sight to somewhat increased distances.

but should not be applied too soon.

As, however, a *premature* application of glasses will confirm and even induce this habit of short-sightedness, its confirmation should be fully ascertained before they are applied; and when it is so, they cannot be applied too soon. Much may be done to prevent or to retard the formation of this habit, particularly in infancy*, by out-door exercise, using all occasions to excite attention to remote objects, and when in-doors, by placing the most attractive at the greatest distance.

Disadvantages of near-sightedness when unassisted:

The reader will, it is hoped, be now convinced of the injustice of ridiculing or discouraging the use of spectacles in near-sighted persons, especially when he considers that the beauties of nature are shut out from *many* of them†; that to such the stars are indistinguishable, and the moon appears a mass of luminous vapour of indeterminable form, varying only its quantity of light, instead of exhibiting that beautiful variety of phases which awakens inquiry into the construction of our system, and which affords to the learned, as well as to the unlearned, one of the most ready confirmations of the great truths which science has demonstrated: when he likewise considers that the variations of landscape and perspective are almost lost to them, and that the *judicious use* of spectacles, whilst it displays all these, will *improve* instead of *injuring* the sight, he will rather be disposed to applaud and recommend it.

its advantages when properly assisted.

It is also hoped that the near-sighted himself will not regret his condition, when he finds that, with proper aid, he can equally command the view of distant objects; while, without aid, he possesses a better view of near ones than those whose sight is *called* perfect. And it is hoped that the mischievous consequences resulting from the use of one eye only will deter all persons of this description of sight from persevering in such practice, and induce those who will not be persuaded to the use of spectacles to comply with the custom, now so happily prevalent, of using *folding*

Both eyes should be employed.

* This may be thought too soon by those who are unacquainted with the numerous instances in which this habit is a family complaint.

† We may obtain a very correct idea of the condition of any near-sighted person, by selecting a magnifying glass of such power as, when held close to the eye, will enable us to read a small print at the distance which such person reads at without a glass, the image of the print will then appear of the same size to us as it appears to him, and *distant objects will be equally indistinct.*

eye-glasses; the most compact and simple forms of which are now rendered capable of being thrown open by a spring, which movement adapts them to immediate use and to those sudden emergencies, the want of preparation for which so greatly harasses near-sighted persons*.

The writer thinks it would be culpable in him to neglect this opportunity of offering some practical suggestions for the further guidance of the reader.—With respect to the choice of spectacles, where he has access to an experienced optician, he may rely upon the judgement of such a person as fully adequate and competent; but where he has to select for himself, he should see that the glasses are well polished and free from veins, and also of a regular curvature†. Having already stated that, with some few exceptions, glasses should not be used until the focal length of the eye exceeds the average distance, and that they should not magnify so much as to diminish such average distance by their use, it may be only necessary to add that, where the reader has to send for spectacles, he should accurately observe the length at which he holds the paper from the eye when he can read it best without spectacles, and state this length in his written order, to enable the optician to judge of what will suit him. The prominence of the nose should be stated, if considerable, in order that the spectacles may be made capable of being worn as nearly as possible to the eyes without touching the eye-lashes‡: they should also be so placed upon the head that the glasses may be parallel to the paper when held in an easy position. To accomplish this, let the sides of the spectacles bear upon the swell of the head, about midway between the top of it and the ear, the eyes will then look *directly* through the glasses to the paper, and make the most advantageous use of them, instead of looking *obliquely* through them to the paper, as in those

How to choose spectacles,

and examine the glasses :

when to adopt them :

how to order them :

should be worn very near the eyes,

and parallel to the paper.

* One of these sudden emergencies may be a nod or some such movement from a person whom they are passing, evidently intended to attract their notice, but which they cannot return or even recognise until all opportunity is lost of doing either.

† This may be ascertained by observing the similarity, in figure and dimensions, of a reflected image in different parts of the surface of the glass; a badly worked surface varies these dimensions.

‡ There are other circumstances to be attended to which render it highly desirable that recourse should be had to the eye of experience; such as the width of the face and the distance between the centres of the eyes, which if a person have to ascertain for himself, will be best determined by holding the measure as nearly as possible to the eye and observing its reflection in a mirror.

cases, still so numerous, where persons place the sides of their spectacles in contact with, or very near, their ears; in which position they produce a distorted image on the retina*. The sides of the spectacles should be also placed at an equal height upon the head; and the hands, being applied to the *points* of the sides, will generally direct this equal height as well as allow of their opening to the utmost without injury.

Pebbles.

Pebbles have the advantage of being more transparent than glass, since, being much harder, they take a higher polish and are not liable to be scratched; they are also more dense, and are said to retain their coolness longer than glass; but they have many imperfections, only to be detected by persons well experienced, therefore great caution should be exercised by those who purchase them.

The light should be uniformly moderate.

Reading should always be abstained from in a bad light; it is no less necessary to avoid reading with sunshine on the paper; the immediate vicinity of a large flame of gas is also mischievous: in short, an *equality or UNIFORMITY of light* should be observed and all *extremes* avoided†. Lamps are generally to be preferred to candles for the greater *uniformity* of their light, and on account of the intense observance of the flame required in snuffing‡ the latter; but the flame of lamps should be as white as possible, and when brilliant, should be softened to those in its immediate vicinity by interposing semi-transparent media, which, however, should not intercept the light from the distant parts of the room or

Lamps.

* This may be illustrated by again having recourse to our experiments with the magnifying glass; when it will appear that, by holding the glass *obliquely* to the paper, the image of the window becomes distorted.—The indistinctness sidewise, arising from this obliquity, generally begets a vibrating motion of the head in reading. *Periscopic* glasses, when correctly made, allow of distinct vision through all their parts, and therefore when properly placed upon the head do not produce this motion.

† Persons whose sight is beginning to fail find that they can read best in a *strong* light, and are therefore tempted to employ it: they would find *proper* spectacles much less fatiguing and more effective as an auxiliary.

‡ It is curious to observe the care with which nature has defended the eye from an excess of light, by the contraction of the pupil when exposed to it; this is very obvious in the pupil of a person's eye employed in snuffing a candle: the pupil is also capable of extraordinary dilatation in very dark situations, for the purpose of admitting all the light which can be then obtained. This faculty is always sufficiently exercised, and therefore should not be unnecessarily exerted. It is then obvious that sudden changes from light to dark objects should be avoided, and on this account the writer is anxious to discourage the use of slates, particularly in copying from on paper.

ceiling* ; for the more nearly artificial light resembles that of day, the nearer does it approach perfection.

The writer is no friend to shades or coloured glasses, especially in reading † ; but the artificial state in which we are placed by civilization, requires the occasional employment of artificial defences from the injury which this state would otherwise occasion. It is the light reflected towards the eyes, from the surfaces of roads and pavements ‡, instead of the refreshing green in which Nature decks her surface, which begets the necessity for these defences ; but no one should employ them who does not suffer from this reflected light, and those who do should use them only when exposed to it, perhaps only when proceeding in a direction towards it : moreover, all unnecessary depth of colour should be carefully avoided, in order that the eyes may not suffer from the light on their removal.

Shades and coloured glasses should be very sparingly employed.

White walls, white blinds, when near the eye or fronting it, should be avoided, particularly in sunshine : in the same circumstances, white parasols and veils are equally objectionable, also very light or bright coloured fronts and even linings to the bonnets of females ; in short, every thing which tends to aggravate the great change all at once experienced in going out of doors, particularly in sunny weather, a time when we are so apt to indulge in the use of blinds and other means of excluding light within, and which change is so completely at variance with *uniformity*.

Reflected or strong light should be avoided.

There is an analogy between the experiment in the third note, page 9, of this essay and the manner in which vision is really produced, which the writer thinks it right to explain, for the sake of the analogy itself and the considerations to which it leads ; but more particularly *here* because the appearance may when noticed, otherwise occasion some embarrassment to the observer.

If the reader has performed the experiment alluded to and has not already observed that the image of the window is *inverted*, that is to say, that the top of the window is represented at the bottom of its picture upon the paper, and

Inverted position of the image or picture in the eye

* Ground glass is not smooth enough, and has too many luminous points for this medium.

† He thinks few persons can seriously imagine that they would see the print better if it were on coloured paper ! and this is the effect of such glasses. The only medium which appears beneficial is a very pale blue glass, which reduces the yellowness of artificial light, and makes it more nearly resemble that of day.

‡ To these may be added the light we meet with on the sea-coast, reflected directly towards the eye from water, sands, white cliffs, &c., as also in hot climates.

its right side upon the left, he is requested to repeat the experiment, when he will immediately perceive this effect, which, being the result of the refractive principle of optics, is universal, and therefore extends *to the eye itself*.

almost incredible :

That we should not be sensible of this effect appears at first sight so incredible, that the reader will be very excusable if he should doubt its reality: he may however convince himself of its truth by observing the picture of external objects in the eye of a sheep or other animal soon after death. There has always been some difficulty in reconciling this contradiction to the evidence of our senses; it is however best reconciled in its effects, which are by no means paradoxical, but do in fact compel us to look upwards to obtain distinct vision of the top of objects, and downwards for the bottom; to our right hand for such as are on that side of us, and to our left for such as are there.

its consequences

This principle of optics was one of the first discovered, and is one of the first treated of in the science: the writer has never seen any remark upon its important consequences to the animal kingdom, but he considers it as one of those numerous instances of contrivance which irresistibly impress the mind with the conviction of the presence of an over-ruling power, ever bountiful towards its creatures, and anticipating all their wants! It is only necessary to call the *effect* of this inversion of the picture in the eye to the notice of the intelligent observer, to convince him that without it the objects to which the pupil is directed only could be seen, and no more with two eyes than with one, while simply by means of this arrangement our sphere of vision is enlarged to one fourth of the whole circumference in each; so that with two eyes we command one half of the hemisphere surrounding us.

highly advantageous,

and should be gratefully acknowledged.

Let us acknowledge this truth with thankfulness, and it will prove an augmentation of our happiness, as affording us additional evidence that we are the objects of a providential care, not less attentive to our wants than able to supply them.

THE END.