

"FLASHES" OF CLEAR VISION AND NEGATIVE ACCOMMODATION WITH REFERENCE TO THE BATES METHOD OF VISUAL TRAINING*

Elwin Marg†

School of Optometry, University of California
Berkeley, California

On rare occasions in clinical practice, a myopic patient is seen who relates that every once in awhile his usually blurred vision suddenly and briefly becomes beautifully sharp without glasses. This evanescent clarity, termed "flashes" of clear vision, cannot be elicited at will in the refracting room and demonstrated with a visual acuity test chart. The skeptical refractionist who wants to believe the patient, has no opportunity to measure this reported will-o'-the-wisp phenomenon.

What are these flashes? Do they occur as a result of a change of the refractive power of the eye (negative accommodation)? How much do they improve vision? These are some of the questions this investigation will attempt to answer.

BATES AND HIS DISCIPLES

Dr. William Horatio Bates, a New York ophthalmologist, was a maverick in his profession. In 1920 he published a book entitled "The Cure of Imperfect Sight by Treatment Without Glasses"¹ and started a school of vision practitioners (or educators) which is vigorous today.

Most of his claims and all of his theories have been considered false by practically all visual scientists. The quotations taken from throughout his book give, in substance, some of his principal ideas.

[In retinoscopy] the observer is so near the subject that the latter is made nervous, and this changes the refraction. . . . This means that it must not be brought nearer to the eye than six feet; otherwise the subject will be made nervous, the refraction for reasons which will be explained later, will be changed, and no reliable observations will be possible.

Bates did not believe that the crystalline lens is the agent of accommodation because of two pieces of evidence. First, after four years of effort, he failed to find alterations in curvature of the anterior

*Read before the annual meeting of the American Academy of Optometry, New York, New York, December 10, 1951. For publication in the April, 1952 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Assistant Professor of Optometry, Ph.D. Fellow, American Academy of Optometry. On military leave to the Aero Medical Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio.

surface of the lens during accommodation as indicated by changes in the size of the image of a reflected light source. §

His other evidence against lenticular accommodation was the occasional cases of apparent accommodation in aphakics. ‡ It seemed evident to him that accommodation was effected by changes in the length of the eyeball. **

Let us return to quotations from Bates.¹

The obliques are the muscles of accommodation; the recti are concerned in the production of hypermetropia and astigmatism.

Straining to see at the near point produces hypermetropia.

Myopia produced by unconscious strain to see at the distance is increased by conscious strain.

A person may have good vision when he is telling the truth; but if he states what is not true an error of refraction will be produced, because it is impossible to state or imagine what is not true without an effort.

I may claim to have discovered that telling lies is bad for the eyes . . . [causing a change of refraction seen by retinoscopy].

With such a [practically perfect or normal] memory of black, the retinoscope shows that all errors of refraction are corrected.

Persons with normal sight have been able to look at the sun for an indefinite length of time, even an hour or longer, without any discomfort or loss of vision. . . . Even total blindness lasting a few hours has been produced. Organic changes may also be produced. Inflammation, redness of the conjunctiva, cloudiness of the lens and of the aqueous and vitreous humors, congestion and cloudiness of the retina, optic nerve and choroid, have all resulted from sun-gazing. These effects, however, are always temporary. . . . Some persons who have believed their eyes to have been permanently injured by the sun have been promptly cured by central fixation, indicating that their blindness had been simply functional.

In his book, Bates reported some experiments on animals, which have been criticized for their lack of proper techniques and a flouting of basic facts of anatomy and pharmacology.

Later editions of his book were published by his wife after his death in 1931. They were watered-down and more cautious.^{6, 7} In the latter it was no longer claimed that imagining black could be used as a substitute for anesthesia in surgery, nor was it specifically stated that one should look directly at the sun. The original theories and most claims remained.

The fundamental principles of treatment are based on relaxation which, it is implied, is supposed to reduce to the vanishing point, all types of ametropia and ideally beget permanent emmetropia for its

§ Many investigators including Helmholtz had observed the phenomenon and in more recent years Kirchoff² made dynamic recordings of this third Purkinje image. Allen³ has developed the technique still further.

‡ The rarity of these cases should be sufficient to make them suspect as a normal method of accommodation. Excellent evidence has been presented that there is no change in the refractive power of the eye in these cases.^{4, 5}

** It is interesting to note that it would take about one millimeter change in axial length of the eyeball for each three diopters change of refractive power. Hence a youth accommodating 15 D. would shorten his globe by five millimeters. To the writer's knowledge, no corresponding anterior-posterior corneal movement has ever been reported.

fortunate follower. Relaxation is gained as follows:⁷ 1. Resting the eyes. 2. Palming (excluding light and seeing maximum black). 3. Swinging (a gentle rotary motion of the trunk with the toes fixed). 4. Memory. 5. Imagination. 6. Flashing* or blinking (furtive glances and blinking from an eyes-closed position). 7. Central fixation (opposite of staring—looking all about an object). 8. Sun treatment (eyes closed, later open them but look downward).

Many other books have been published on the Bates method but few of them have offered anything original.⁸⁻¹² Most authors since Bates have leaned on him completely for scientific backing. In England, Price¹³ followed the basic practices of Bates but did not adopt all of his theory. Price's book is moderate. While he does believe that strain is the basis of poor vision, he does not take sides in the accommodative theory by which poor vision is supposed to improve. Furthermore he made none of the extraordinary claims found in Bates' original book. One cannot help but feel that an honest attempt was made by Price to get to the basis of the reported phenomenon of flashing.

Mrs. Margaret Darst Corbett of Los Angeles, California, is a widely known, active and enthusiastic Bates practitioner who has developed a new group of teachers of the Bates method. Her two books^{14, 15} show that she has experimented and adopted new techniques. The theory of Bates is at the core of her practices and she eulogizes it. A few quotations will illustrate her viewpoint.

. . . vision is *nine-tenths* mental and only one-tenth physical.

Near-sighted eyes need much done for them to bring them to normalcy. First they must have their tension relaxed so that the oblique muscles that belt the eye too tightly about the middle will let go. Then, the recti muscles must be strengthened so that they can flatten the eyeball for the distant focus: and in addition their endurance must be built up so that they can maintain their hold on the eyeball longer than a mere second or "flash" which most near-sighted eyes can get after just a little relaxation.

Myopic eyes of clients get a flash—a touch of normal vision. Suddenly the oblique muscles let go and the recti contract, shaping the eyeball normally for a moment or two so that the entire panorama stands out perfectly just as with normal vision.

It would seem that in Mrs. Corbett's view, the "nine-tenths mental" part of vision acts to bring about changes in its "one-tenth physical" part.

. . . carefully avoid squinting, or squeezing the lids, to clear vision. This is trick vision and injures the eyes. We want only normalcy, no tricks.

Hold in the fingers of both hands a soft rubber ball. Squeeze it flat from front to back. Let it swell out round again. Then squeeze it around the middle so that it bulges long from front to back. Let it come round again. Watch the ball change shape from a lozenge to an eggshape. Do this repeatedly, rhythmically, saying aloud

Squeeze it flat from front to back

let it come round again

Squeeze it long from front to back

let it come round again

*It is to be noted that Bates did not use the term "flash" as it is used in this paper, to denote a sudden transient increase of visual acuity.

This doggerel by Mrs. Corbett presumably suggests the changing shape of the eyeball and through autosuggestion, a better control of ametropia is supposed to be gained.*

The intellectual giant of the Bates group is the well-known expatriate British author, Aldous Huxley. Whereas the books of Mrs. Corbett are best for learning the practice in cookbook fashion, the book of Huxley¹⁶ is, without question, the best written and the most profound. It is relatively cautious in regard to the theories and to some of the claims of Bates.

Huxley had two reasons for writing this book. First as a debt of gratitude to Bates and to Corbett who, he believed, helped him to improve his own vision which was poor as a result of a bilateral keratitis acquired at the age of 16. His second reason was to "correlate the methods of visual education with the findings of modern psychology and critical philosophy." Huxley speaks thus:

Vision is not won by making an effort to get it; it comes to those who have learned to put their minds and eyes into a state of alert passivity, of dynamic relaxation.

This guess [The Bates theory of the mechanism of accommodation] may be correct; or it may be incorrect. I do not greatly care. For my concern is not with the anatomical mechanism of accommodation, but with the art of seeing—and the art of seeing does not stand or fall with any particular physiological hypothesis. Believing that Bates' theory of accommodation was untrue, the orthodox have concluded that his technique of visual education must be unsound. Once again this is an unwarranted conclusion, due to a failure to understand the nature of an art, or psychophysical skill.

Huxley, then, while showing respect for Bates, is not tied to his theories as most of the others appear to be. He seems willing to stand on improved visual acuity as the important demonstrable phenomenon in the Bates method.

ORTHODOX REACTION TO BATES AND DISCIPLES

Most visual scientists who read Bates or his disciples have immediately rebelled. The theories appear so wild, the evidence so poor, or lacking, in contrast to abundant and strong evidence by investigators of known scrupulous honesty and carefulness that the Bates techniques are thought to be unscientific.

This understandable reaction is seen in an answer to the Bates method by Sorsby,¹⁷ a well-known British ophthalmologist. One by one he pointed out the flaws in the theories of Bates and criticized his experimental techniques with complete justification. Huxley's rebuttal was sharp and to the point.

... Sorsby entirely fails to distinguish between two totally different things: the primary evidence confirming the existence of certain phenomena, and the secondary

*Not one to be limited to visual horizons, Mrs. Corbett now applies the Bates techniques to deaf ears.

evidence adduced to substantiate the hypothesis, in terms of which these phenomena are explained. The phenomena, which Bates sought to explain in terms of his unorthodox theory of accommodation, were those marked improvements in vision, which regularly followed the practice of certain educational techniques. The evidence for the occurrence of such phenomena can be supplied by thousands of persons who, like myself, have derived benefit from following the procedures in question, and by the scores of conscientious and experienced instructors who teach the method. If Mr. Sorsby really wanted to know about this evidence, he would get in touch with a few reliable teachers, ask permission to watch them at work and, if his own vision is defective, take a course of visual re-education. Instead of that he seeks to discredit the whole idea of visual re-education by denying the validity of the experiments used by Bates to support his explanatory hypothesis.

. . . Even if this secondary evidence were untrustworthy, even if the hypothesis supported by that evidence could be proved to be incorrect, this would make absolutely no difference to the facts which that hypothesis was originally intended to explain.

Duke-Elder,¹⁸ in reviewing Huxley's book, was strong in condemnation of its theories but allowed the practice to a limited degree.

Whatever be the value of the exercises, it is quite unintelligent of Huxley to have confused their advocacy with so many misstatements regarding known scientific facts. It has been shown that the hypothesis upon which these methods of treatment are based is wrong; but Huxley, while admitting he is ignorant of the matter and unqualified to speak, contends that this is of no importance because the method works in practice and gives good results; it comes into the category of "art" not of "science." The argument is perfectly allowable, for in other spheres than medicine empirical methods have often produced effective results the rationale of which may be mysterious. The most stupid feature about his book, however, is that he insists throughout on the physiological mechanism whereby these exercises are supposed to work. It would at least have been logical if he had continued to allow the reader to assume that he was speaking in ignorance of anything except results. . . .

There would appear to be no doubt that these exercises have done Aldous Huxley himself a great deal of good. Every ophthalmologist knows that they have made quite a number of people with a similar functional affliction happy. And every ophthalmologist equally knows that his consulting-room has long been haunted by people whom they have not helped at all.

Duke-Elder concluded by saying,

For the simple neurotic who has abundance of time to play with, Huxley's antics of palming, shifting, flashing, and the rest are probably as good treatment as any other system of Yogi or Coué-ism. To these the book may be of value. It is hardly possible that it will impress anyone endowed with common sense and a critical faculty. It may be dangerous in the hands of the impressionable who happen to suffer from glaucoma or detachment of the retina. . . .

Lancaster, the late dean of American ophthalmologists, did not believe that any change takes place in the size or shape of the eyeball with exercise. In discussing eye exercises for the improvement of visual function, he said:¹⁹

If one studies the various publications with an open mind, searching for the things which will explain why the public wants this treatment, one will be forced to admit that buried in a mass of what to ophthalmologists seem foolish gestures and performances, best defined as hocus-pocus, there are sound and fruitful ideas. It is these that account for the survival and spread of the cult. It is certainly not foolish to believe that people can be taught to use their vocal organs in speaking or in singing, that they can be taught to play musical instruments, to dance, to skate and to play games, such as billiards or golf, and, as a result of teaching, can learn to perform better than they can without instruction and training. In the same way, the public argues, they should be instructed in the use of their eyes. They consult the ophthalmologist and are provided with glasses, but are given little information about the nature of their trouble or about measures which might help them to use their eyes successfully. Yet

they hear of some one who went to a follower of Bates and got plenty of instruction. There are many, very many, patients who do not want to wear glasses, who would go to almost any length to escape that fate.

. . . the . . . well-trained ophthalmologist is often ignorant of certain phases of the art and science of which he is supposed to be master. He is apt to make the mistake of arguing that because Bates' theory of accommodation is incorrect, his whole program is unsound. The history of medicine is a long list of tentative theories later proved to be erroneous, but the facts they tried to explain remain firmly established, though the theories are swept away.

It is often pointed out that Huxley's visual acuity has not improved in any extraordinary way. He admits that. The point is that he has learned how to use what he has to better advantage. It is not the primary retinal sensation that is improved; it is the neglected, but vitally important, cerebral part of seeing that has been trained.

Beach makes a distinction between two phenomena.²⁰ The first is the skill, for example, of the sailor who has been trained in the observation of marine objects. At discerning letters he is no better than the land-lubber. This sort of facility, Beach claims, is acquired slowly and is permanent when once learned. Hence these skills are distinguished from fleeting episodes of visual improvement which is the second phenomenon.

An example of the second visual acuity phenomenon, according to Beach, is the World War II Air Force student pilots who passed the visual acuity examination as a result of visual training. Under the stress of flying many lost this ability and had to be grounded. Beach's distinction, however, may be of degree rather than kind. The mariner may have had many years of experience watching the horizon while the student pilot but a few months of special visual practice.

Beach does not believe that flashes of clear vision are the result of training in observation.

The essence of the popular courses for discarding glasses is of this transitory character. Devotees describe blinks of intensely vivid vision which they can elicit. They claim acuity at times of 20/10. They are impatient with ophthalmologists for neglecting this experience which to them is all-important. This keenness of vision may occur in one eye, and later be found to have shifted to the other eye. It may occur in both eyes. When binocular, one eye may predominate at one time, the other eye at a later time. This seems to place it on the ocular level. *To be accepted as entirely due to the improved cerebral interpretation of blurred retinal images, gain in sight should (1) be a permanent skill and (2) not be found to shift from one eye to the other.*

Beach believes that the eye may change its length in accommodation. His evidence consisted of 14 cases in which the visual acuity is compared without correction, "squeezing" with a one mm. pinhole and finally by both squeezing and a one mm. pinhole. "Squeezing" is an effort to increase visual acuity by narrowing the palpebral aperture and/or by increasing pressure on the globe similar to accidental squeezing which is fatal to cataract operations. In his experiments, about half the eyes (14) showed apparent improvement in visual acuity by squeezing but all of the cases of improvement were probably not significant, amounting to one line on the acuity chart. About 18 eyes showed

further improvement in visual acuity, some of questionable significance, when a pinhole replaced squeezing. If there should be an increase of visual acuity by squeezing after the pinhole is in place, it may be reasoned that the squeezing cannot further reduce the blur circles by narrowing the palpebral fissure but must change the state of refraction of the eye. This occurred in about 15 eyes but many of the changes were of questionable significance. Furthermore it is misleading as will be evident later to reason that a change of visual acuity must mean a change in the refractive state.

Beach concludes:

Presumably the globe has shortened. This does not determine whether the assumed shortening of the globe is due to compression by the lids, or to influence of the extra-ocular eye muscles. Nor does it indicate whether the action of the extrinsic muscles is squeezing according to my patient or relaxation of the obliques as maintained by Bates. It is customary to deride this notion of squeezing with the extra-ocular. Yet such a possibility is not wholly fantastic. Some such action has to be assumed to explain the squeezing in cataract patients which can take place even after the lids are paralyzed by akinesis.

Beach pointed out the great subjective value to myopes of seeing clearly without glasses.

It is customary to ridicule these sight-training exercises as a waste of time. The patient who attained the remarkable improvement by squeezing did not agree with this [probably Case 1, from 20/200 to 20/30]. He was delighted to be able to discard glasses in a number of common situations like recognizing friends on the street and reading signs. He valued it most in sailing. He pointed out that it is useful to be able to sail without having to keep wiping spray off glasses. It might be lifesaving to be able to recognize landmarks and pick up buoys if his glasses blew off. Such advantages are too real to be laughed off, and may account for some of the popularity of this system of training. Yet I understand he is likely to use his glasses much of the time.

In the discussion afterward Beach offered some strong words in defense of a refractive change causing flashes of clear vision.

I think there is a tendency to examine great numbers of patients and find out many of them do not do anything except improve their observation, whereas if we could devote a little time to some of these cases who do gain actual increase in acuity, and try to find out what makes them tick, we might get some sort of answer to the questions which are being asked by the persons who take these sight training courses. As a matter of fact, they are smart enough to know when they see vividly, as they do during what Bates calls central fixation, which is simply another name for these flashes that they get. They know if they see 20/10 vividly they are not getting a simple method of better distinguishing blurred images, and they are discounting statements that are made by oculists whom they feel ought to be stuffed and put in museums.

THE NEGATIVE ACCOMMODATION OF YVES LE GRAND

Le Grand²¹ has presented evidence which indicates that some subjects are able to invoke accommodation in a negative direction. For example, a myope or an emmetrope made optically myopic with convex lenses can, in some instances, decrease his myopia with effort. Changes up to three diopters in a negative direction determined by skiascopy (taking ordinary accommodation to be positive in direction) were reported in five subjects. A summary of his results are seen in Table 1.^{21, 22}

TABLE 1
RESULTS OF THE INVESTIGATION OF LE GRAND

Subject	Age	Refractive Error (Sph.)	Negative Accommodation	Lens Before Fixating Eye	Flash Visual Acuity
A	24-26	plano	2.50	+ 4.00	20/100 to 20/67
B	24-26	plano	2.25	+ 3.00	20/100 to 20/67
C	24-26	plano	2.25	+ 3.00	20/100 to 20/67
D	24-26	— 4.00	2.75	none	20/100 to 20/67
E	> 26	— 5.50	2.75	none	20/25*

*Subject E, skilled in the Bates method, can maintain this acuteness of vision several minutes in contrast to the other subjects who can hold their flashes for only a few seconds.

If these results could be confirmed,* they would demonstrate a mechanism whereby myopes trained by the Bates method obtain flashes of clear vision. Furthermore these results would lead one to expect that myopia of up to three diopters could be compensated for by negative accommodation much as hypermetropia, may be compensated for by positive accommodation.

It is not to be implied that Le Grand agrees with the theories of Bates. His work merely indicates a possible mechanism which could account for some of the results claimed by Bates practitioners. Le Grand's evidence would not change the site of the accommodative mechanism from its generally accepted place, that of the crystalline lens and ciliary muscle.

At this point it seems clear that there should be an investigation which would attempt to confirm the findings of Le Grand, and determine if negative accommodation is the phenomenon which could account for the reported large increases in visual acuity which are claimed to be obtained by the myopic followers of Bates.

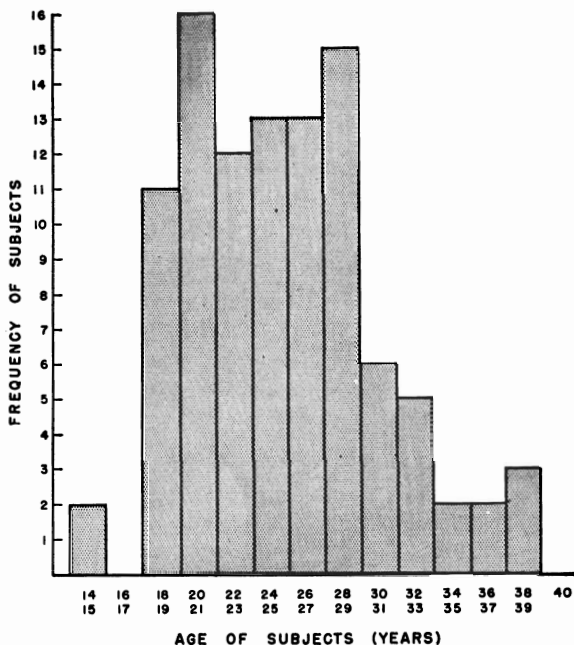
*There is some independent evidence which would seem to support Le Grand's finding of negative accommodation. The investigations of night ametropia of Otero and his collaborators^{23, 24} have shown that the eye has about 1.25 D. more refractive power in total darkness than with distance fixation in light. The change of power is accommodative, i.e., the result of an increase in the curvature of the crystalline lens. Since he believes that accommodation is at rest in the dark and is therefore at its zero point, Otero uses the term "negative accommodation" for the range from what is generally considered 1.25 D. to zero accommodation. Whatever the merits of Otero's view, this is not negative accommodation in the sense used by Le Grand or in this paper. An eye examined in photopia has a refractive state which is its generally accepted zero point. Increase of refractive power in scotopia is *positive* accommodation. The refractive power of the eye must decrease from its generally accepted zero point to exhibit negative accommodation as defined here. Otero and his colleagues also claim to have demonstrated true negative accommodation of 1.0 to 1.5 D. in subjective experiments in which targets were viewed through a telescope. As yet there has been no confirmation of this phenomenon in their objective measurements of accommodation with Purkinje image photographs.

Also because of the definition of the zero point, the term "negative voluntary accommodation" used by Marg²⁵ does not apply here.

INCIDENCES OF FLASHES

The following experiment was performed in order to get some estimate of the incidence of those people who without regard to previous training or experience could obtain unusually clear vision, despite myopia.

One hundred clinical patients between the ages of 14 and 40 years were taken at random. The distribution of age is given in Figure 1. It



may be seen that the median age corresponds to that of Le Grand's subjects. They were refracted and a new prescription found. Those with a corrected Snellen acuity of less than 20/30 each eye as taken with a modern projector chart were rejected as subjects. The correction was put in a trial frame with a +3.00 D.S. add which blurred distance vision. Visual acuity was now taken at 20 feet with a Clason visual acuity meter. This instrument projects letters which may be varied in size while remaining in focus.

An occluder was held over the left eye and the subject was asked to read the letters as soon as he could without "squinting" or partly closing his eyelids. The size of the letters was increased until the subject could read more than half of the line presented. The same procedure was followed for the other eye and for both eyes together.

The subject was then instructed as follows:

Please try to see if you can clear up the blurred letters which you can now just make out while you are wearing these glasses. You can try anything you wish except

squinting your lids, looking by the edge of your glasses or moving closer to the chart. For example you may try such techniques as trying to relax while remaining alert, blinking, opening your eyes widely, looking to one side of the letters, making your eyes feel as if they were about to cross, or anything else you may think of within the restrictions mentioned. You will have about five minutes in which to develop some technique to make the letters clearer and, if possible, perfectly clear.

After about three minutes the subject was informally questioned about the techniques he had tried and his estimate of his success. As long as the subject believed that he could substantially improve his acuity he was allowed to keep trying.

Visual acuity was taken again, following the same procedure as formerly. If the subject showed a significantly high visual acuity with effort he was asked to return at another time when he would be examined by skiametry and with the coincidence optometer of Fry. If the acuity was not significantly improved, the subject was dismissed.

The limit of significantly high visual acuity was based on a study of Hirsch.²⁶ He found that for myopia of 3.00 D., the upper 95 per cent confidence limit was 20/130; that is, assuming normal distribution, only 2½ per cent of the subjects would be expected to show 20/130 or better. This is indeed a conservative limit since the Bates literature speaks freely of "perfect" sight and Le Grand found far better acuity in his subjects under conditions similar to those described below.

RESULTS

Of the 100 subjects with the +3.00 D.S. add to their distance correction, 99 could not show a visual acuity of 20/130 or better either before or after the period of attempted improvement. Many subjects thought they were improving their visual acuity but measurements indicated little or no change.

One subject, Miss R. D., a 19-year-old university sophomore, did show a remarkable transient increase in acuity. Her correction for maximum visual acuity was as follows:

R. E. —0.75 D.S. \ominus —0.50 D.C. axis 155°, 20/25

L. E. —0.75 D.S. \ominus —0.50 D.C. axis 75°, 20/25

Her visual fields were normal and her zone of single clear binocular vision was slightly narrow but otherwise normal. She had never taken any training to improve her vision either alone or under supervision.

When the new prescription was combined with a +3.00 D. add to both eyes in a trial frame, the subject had a visual acuity of R. E. 20/160, L. E. 20/145, B. E. 20/145. After about five minutes of attempting to see clearly, the subject was tested again, showing R. E. 20/33, L. E. 20/33. Before both eyes could be tested together, her vision returned to

the previous blurred state and no measurements could be taken by skiametry or coincidence optometry.

The subject returned in a week for another attempt but she could not flash again. Still another attempt was made a week later but without success. Hence it was not possible to investigate the mechanism of the original flash of clear vision.

Rather than speculate on the basis of flashes from this one uninformative case, it was decided to select a group of subjects who could flash at will so that any conclusions as to the mechanism of flashes could be based on the evidence of actual measurements.

ACCOMMODATION AND FLASHING

Two procedures were used to obtain subjects who could meet the necessary requirements for this experiment. The first was to place a classified advertisement in the personal column of *The Daily Californian*, a student newspaper. The notice read as follows:

MYOPES! Do you have "flashes" of clear vision which you can MAINTAIN at will for at least several seconds without your glasses? If so, volunteer for a scientific investigation of this phenomenon. Telephone for appointments, University of California School of Optometry, AS 3-6000, local 301 or call at appointment desk, Optometry Bldg. Please mention this announcement.

It ran for three days with an average circulation of 17,000 copies per day. About 20 persons made appointments and were given a preliminary examination.

The other procedure used to obtain this specially selected population was to request of the various Bates eye training schools or studios in the San Francisco Bay area the opportunity to examine some of their successful students. The response ran the gamut from interest and cooperation to distrust and suspicion. Three subjects were thus obtained and their data will be given presently.

Of the 20 people who responded to the newspaper announcement most were rejected for various reasons after a preliminary examination. Some apparently came solely out of curiosity. Others found it impossible to produce a flash at will or sustain it long enough for measurement to be made. Still others could show no significantly good acuity using the 95 per cent confidence level already mentioned for the ametropia concerned. A few could improve their vision by half closing the eyelids or putting pressure on the globe with a finger, but these were rejected. Two of the 20 did show a remarkable increase in acuity with effort and were accepted as subjects.

RESULTS

Mr. J. H. J., age 32 years.

History: In 1943 this subject took training for the improvement

TABLE 2

EXPERIMENTAL RESULTS

REFRACTIVE STATE DETERMINED FROM MEAN OF FIVE READINGS OF THE COINCIDENCE OPTOMETER OF FRY

Subject	Normal Vision D.	Flash Vision D.	Difference	t*	P	— Visual Acuity —		Expected D. changes for the acuity difference	Age
						Normal	Flash		
Mr. J. H. J.						20/200	20/50	1.37	32
L. E. occluded	3.70	3.92	— 0.22	2.76	< .05				
B. E. fixating	3.84	3.71	+ 0.14	.78	< .05				
Miss S. S.	5.23	5.43	— 0.20	.54	< .05	20/200	20/70	1.12	19
Miss E. F.	5.77	5.56	+ 0.21	1.88	< .05	20/200	20/50	1.37	13
Mr. J. Y.	5.17	5.37	— 0.20	2.62	< .05	20/400	20/50	2.63	26
Mr. J. B.	7.14	6.87	+ 0.27	1.75	< .05	20/300	20/60	2.00	39

*Based on the difference between the means of two groups of five readings each. Four degrees of freedom.

of his myopia from a member and follower of the Optometric Extension Program. The subject believed that he still retained the ability to reduce his myopia with effort although not as well as originally. He claimed that he could read 20/25 without glasses at one time.

The following prescription was found to give maximum acuity:

R. E. —2.50 D.S. \ominus —0.50 D.C. axis 67°, 20/20

L. E. —3.25 D.S. \ominus —0.25 D.C. axis 170°, 20/20

Without lenses he exhibited 20/200 acuity in each eye and with both eyes together. With effort, visual acuity was increased to 20/50. The skiascope did not indicate any change of power before or after acuity was changed. Measurement was then made with the coincidence optometer of Fry. This instrument, which works on the Scheiner double pinhole principle, was introduced to the eye from the side through a half-silvered mirror which allowed a Snellen chart to be seen. Thus, the subject could make a vernier setting of the optometer images while fixating the Snellen chart. Five readings were taken with normal vision and the mean was found. Then five readings were taken with flash vision and they were averaged. The means and their differences are recorded in Table 2. The t test for the difference between means when the groups are correlated²⁷ showed that the value was not significant at the 95 per cent confidence level.

In order to see the effect of binocular relative to monocular fixation, both were used with this subject. The right eye fixating alone showed —0.22 D. (change in the myopic direction) which was not significant at the 95 per cent level. With both eyes fixating, the right eye measured +0.14 D. change (in the opposite direction) which is also not significant.* These two measurements were taken on different days.

From the increase of visual acuity alone one would expect a negative accommodation of about +1.37 D.

Miss S. S., age 19 years.

History: When she was 12 years old, this subject took Bates training and was able to get flashes easily. She stated that she could no longer get flashes as well as formerly.

The following prescription was found to give maximum visual acuity:

R. E. —4.75 D.S. \ominus —0.50 D.C. axis 75°, 20/15

L. E. —5.00 D.S. , 20/15

*To avoid any possible confusion it should be stated that the minus sign is used to indicate *positive* accommodation which increases the power of the eye, in the direction of myopia. Contrariwise, the plus sign identifies *negative* accommodation which decreases the refractive power, in the hypermetropic direction. The signs represent the type of correction lens which would neutralize the accommodation.

Without lenses, the acuity was, R. E. 20/400 and L. E. 20/200. However, with effort (and initially using a "long swing") the subject was able to read 20/70 slowly. Skiametry of the right eye while the left eye fixated showed no change of refractive power from before the flash to after the flash had occurred.

On the coincidence optometer, five readings of the refractive state of the right eye were taken with normal vision and averaged. Then five readings were taken during flashes of clear vision and averaged. As may be seen in Table 2, the subject showed -0.20 D. change of refractive power with flashes (the minus sign signifies that the change is in the myopic direction). The increase in power was not statistically significant at the 95 per cent confidence level. To account for the increase of visual acuity a change of about $+1.12$ D. would have been expected.

Three subjects were obtained from the office of a practitioner of the Bates technique.*

Miss E. F., age 13 years. R. E. 20/400, L. E. 20/200, B. E. 20/200.

A subjective refraction yielded the following:

R. E. -5.50 D.S. \ominus -0.50 D.C. axis 180° , 20/20

L. E. -5.25 D.S. , 20/20

With time and effort the visual acuity without glasses was raised to 20/50. Again there was no skiascopic indication of a change in the refraction.

The coincidence optometer indicated a change of only $+0.21$ D. as may be seen in Table 2. This change of power was not statistically significant at the 95 per cent level. It would have taken about $+1.37$ D. change to account for the increased acuity on the basis of retinal image sharpness.

Mr. J. Y., age 26 years. R. E., L. E. and B. E., 20/400.

A subjective refraction showed the following:

R. E. -4.75 D.S. \ominus -0.75 D.C. axis 90° , 20/15+

L. E. -4.75 D.S. \ominus -0.75 D.C. axis 90° , 20/15+

When this subject attempted to see clearly, he could read 20/50 with his naked eyes. No indication of a change in the refractive state was to be found with the skiascope. A change of -0.20 D. was found with the coincidence optometer as may be seen in Table 2. The change, as indicated by the minus sign, was in the myopic direction. The statistical significance of this change is below the 95 per cent level. The change did not attain the expected $+2.63$ D. if the increase of acuity is

*We are grateful to Mrs. Beatrice Clarke of the Berkeley Studio of Eye Education and to Mr. James Yandel for their co-operation in obtaining these subjects.

to be attributed to negative accommodation.

Mr. J. B., age 39 years. R. E. 20/400, L. E. 20/300, B. E. 20/300. This subject had a refractive error of the order of seven diopters of myopia but he was not available for a full subjective refraction.

The skiascope showed no change of refractive state when the subject attempted to read 20/60 and succeeded. The optometer showed $+0.27$ D. (change in the hypermetropic direction) without statistical significance at the 95 per cent level. This small value is not great enough to explain the large increase in visual acuity on the basis of a sharpening of the optical image on the retina. It would require about a $+2.00$ D. change in this case.

DISCUSSION AND CONCLUSIONS

From the results of the experiments reported here, one would not expect to find more than one person in a hundred capable of flashing without some special training.

It was further demonstrated that in all five specially selected subjects who could flash there was no change in the refractive power of the eyes which could account for the increase of visual acuity. Changes in the dioptics of the eye ranged from $+0.27$ D. to -0.22 D. and none were statistically significant. Even the largest positive change (a decrease of refractive power) was not large enough to account for the great improvement in visual acuity (20/300 to 20/60).

The quality of the visual acuity was not as good as one would expect from the Snellen fractions given. It is frequently a slow process to get a flash and there was usually some stumbling over the letters. In the investigation of the five flashers, visual acuity was measured with a chart which was not familiar to the subjects. It was noted that familiar charts similar to the ones the flashers had practiced on gave better vision than 20/50.

Several questions arise regarding the increase of acuity exhibited by flashers. First what is the mechanism of the flash? All that can be said at this time is that the experimental evidence offered here indicates that there is no change of refractive power of the eye which is large enough and in the proper direction to provide a refractive basis for a flash. In other words, there is no evidence of a negative accommodation except perhaps in insignificantly minute and uncontrollable amounts.

It would seem that unless the phenomenon is attributable to extraordinary optical aberrations of the eye, for which there is no evidence, the increase in visual acuity exhibited by flashers must be central to the retinal image, i.e., in the physiological or perceptual image. The phenomenon seems similar to that of apparent accommodation in aphakia

where no change of refractive power of the eye has been found.^{4, 5} It is likely that the perceptual image is improved by training and by the temporal accumulation of information of the visual apparatus during some of the ritual of swinging, blinking, etc. There is also presumably a better organization with time of the information which goes to make up the perceptual image.

Another question involves the retention of the skill of flashing. Most subjects were apologetic about the quality of their flashes, explaining that at one time they could clear up everything perfectly but at present the flashes were poor because of a lack of practice. Actually even the best subject could read no better than 20/50 with an unfamiliar chart. It appears that the Bates techniques are therefore limited both as to retention of the skill and to its ability to provide "perfect sight" even for short periods of time.

There are some further interesting points that should be mentioned. Although the visual acuity during a flash may not be better than 20/50, the subjective experience of the flasher is that he is seeing more clearly than he has ever seen with glasses that correct him to a visual acuity of 20/15. As Scholz¹² has said:

When you get a flash of perfect sight, you know it, it is a revelation.

Every flash convinces you more of the fact that there is nothing wrong with the eye itself, and this conviction, increasing patience and confidence, helps the treatment a good deal. [Italics mine.]

It is this strong introspective but psycho-physically erroneous evidence that helps keep the Bates technique alive.

Other interesting subjective phenomena are reported. The flasher may feel his flash of clear vision shift from its locus in one eye to the other or back again. He may feel a burning or stinging sensation in his corneas during flashes as if sand or wind had blown into his eyes. He may have illusions of form such as seeing a fan-like distribution of the letter he is trying to read. It merges and the letter becomes clear. These are but a few of the more generally reported phenomenological observations.

As a final word, the Bates and other similar visual training techniques should not be dismissed entirely. There are conceivable uses for them by those who will not or cannot wear optical corrections for their vision, or by those, such as Aldous Huxley where no optical device or orthodox treatment will help.

SUMMARY

The claims and counterclaims of Bates practitioners and orthodox eye specialists have been reviewed in detail. Particular attention has been

given to the report of negative accommodation by Le Grand which could provide a basis for some of the claims of the Bates school.

Two experiments were performed. A hundred clinic patients between 14 and 40 years of age were measured for visual acuity wearing their newly determined prescription combined with a +3.00 D.S. lens before each eye. Then after instructions on how to see more clearly followed by a short practice period they were again measured. Only one subject of the hundred demonstrated unusually good transient acuity (a flash) but she was unable to maintain it or repeat it for measurement of refraction. This experiment indicated that "flashers" (those who can obtain remarkably large transient increases in visual acuity) are uncommon. The next experiment consisted of five specially selected subjects who could flash. Some of them were undergoing Bates training at the time. Visual acuity was improved from around 20/200 to 20/50. The refractive state of the eye was measured by skiametry at one time and with the coincidence optometer of Fry at another. No change in power was found by skiametry from normal to flash vision. The optometer indicated changes of -0.22 D. to $+0.27$ D. none of which were significant at the 95 per cent confidence level. For the changes in acuity to be attributable to negative accommodation, the dioptric change would need to be from about plus 1 to 2.5 diopters, depending on the subject.

The finding of negative accommodation by Le Grand could not be confirmed.

It is suggested that the Bates method improves the perceptual image by training interpretation of blurs, and by the accumulation of visual information during the relatively long time required for the eliciting of flashes.

The introspective feeling not borne out by measurement, of a clarity during flashes greater than that experienced when allowed to have 20/15 vision with glasses is an important factor in explaining the popularity of the Bates school.

The Bates method and other similar visual training techniques have conceivable uses, but they are no substitute for helpful optical correction of the eyes.

Since this paper was written, it has been brought to the writer's attention that an article entitled "Variable Acuity" by James R. Gregg has appeared in an unabstracted journal (*Jour. Amer. Optom. Assn.*, 18, 432-435, March, 1947). The results of this paper essentially agree with the data presented here in relation to the increase of visual acuity and the lack of change of accommodation as measured by skiametry. Two of the three subjects had a very low degree of myopia and were able to flash to 20/20. The third subject who was a myope of about -4.50 D. could flash only to 20/50.

REFERENCES

- ¹Bates, W. H. *The Cure of Imperfect Sight by Treatment Without Glasses*. Central Fixation Publishing Co., New York City, 1920.
- ²Kirchhof, Herman. *A Method for the Objective Measurement of Accommodation Speed of the Human Eye. The Accommodation Speed and Its Modification Due to Fatigue, Eserine, Pilocarpine and Homatropine*. Translated by H. A. Knoll and M. J. Allen from the *Zeitschrift für Biologie* 100, 1940. *Amer. Jour. Optom. and Arch. Amer. Acad. Optom.*, 27, 163-178, 1950.
- ³Allen, Merrill J. *An Objective High Speed Photographic Technique for Simultaneously Recording Changes in Accommodation and Convergence*. *Amer. Jour. Optom. and Arch. Amer. Acad. Optom.*, 26, 279-289, 1949.
- ⁴Bettman, J. W. *Apparent Accommodation in Aphakic Eyes*. *Amer. Jour. Ophthal.* 33, 921-928, June, 1950.
- ⁵Hirsch, Monroe J. *Apparent Accommodation in Aphakia*. *Amer. Jour. Optom. and Arch. Amer. Acad. Optom.* 27, 412-414, August, 1950.
- ⁶Bates, W. H. *The Cure of Imperfect Sight by Treatment Without Glasses*. Emily A. Bates Publisher, New York City, 1940.
- ⁷Bates, William H. *The Bates Method for Better Eyesight Without Glasses*. Henry Holt & Co., New York, 1943.
- ⁸Peppard, Harold M. *Sight Without Glasses*. Permabooks, New York City, 1948.
- ⁹MacCracken, W. B. *Use Your Own Eyes*. Published by the author, Berkeley, Calif., 1937.
- ¹⁰MacCracken, W. B. *Normal Sight Without Glasses*. Published by the author, Berkeley, California, 1945.
- ¹¹MacFadyen, Ralph. *See Without Glasses. The Correction of Eye Strain and the Science of Sight*. Grosset and Dunlap, New York City, 1948.
- ¹²Scholz, Alfred P. *Defective Sight and How to Cure It. Discard Your Glasses, Learn to See*. Published by the author, Brooklyn, N. Y., 1929.
- ¹³Price, C. S. *The Improvement of Sight by Natural Methods*. 3rd ed., 1940, Northumberland Press, Ltd., Gateshead on Tyne, England.
- ¹⁴Corbett, Margaret Darst. *How to Improve Your Eyes. (Simple daily drills in relaxation.)* Willing Publishing Co., Los Angeles, Calif., 1938, 6th ed., 1942.
- ¹⁵Corbett, Margaret Darst. *Help Yourself to Better Sight*. Prentice-Hall, Inc., New York, 1949.
- ¹⁶Huxley, Aldous. *The Art of Seeing*. Harper and Brothers, New York and London, 1942.
- ¹⁷Sorsby, Arnold. Quoted in A. Huxley, *The Art of Seeing* (see above), Appendix I, pp. 263-267.
- ¹⁸Duke-Elder, Stewart. Book review of Huxley's, *The Art of Seeing* (see above). *British Medical Journal*, 365-366, May 22, 1943. (Reprinted in *Arch. Ophth.* 30, 582, 1943.)
- ¹⁹Lancaster, Walter B. *Present Status of Eye Exercises for Improvement of Visual Function*. *Arch. Ophth.* 32, 167-172, 1944.
- ²⁰Beach, S. Judd. "Myopia Cures." *Trans. Amer. Ophth. Soc.*, 46, 284-294, 1948.
- ²¹Le Grand, Yves. *The Presence of Negative Accommodation in Certain Subjects*. (Translated by Elwin Marg) *Amer. Jour. Optom. & Arch. Amer. Acad. Optom.*, 29, 134-136, 1952.
- ²²LeGrand, Yves. *Personal Communication*.
- ²³Otero, J. M. *Sobre las Causas de las ametropías naturales de la visión nocturna*. Publicaciones de la Real Academia de Ciencias Exactas, Físicas y Naturales de Madrid, con motivo de su centenario. Tomo I: *Trabajos de los Academicos Numerarios*. 18 pp., 1949.
- ²⁴Otero, J. M., et al. *Sobre la posición natural del cristalino y la causa principal de las ametropías nocturnas*. *Anales de la Real Sociedad Española de Física y Química Series A*, 46, July-August, 1950.
- ²⁵Marg, Elwin. *An Investigation of Voluntary as Distinguished from Reflex Accommodation*. *Amer. Jour. Optom. and Arch. Amer. Acad. Optom.*, 28, 347-356, 1951.
- ²⁶Hirsch, Monroe J. *Relation of Visual Acuity to Myopia*. *Arch. Ophth.* 34, 418-421, 1945.
- ²⁷Guilford, J. P. *Fundamental Statistics in Psychology and Education*, p. 228, McGraw-Hill, Inc., N. Y., 1950.