Biofeedback for Better Vision

It is estimated that about 150 million people in the United States are myopes or hyperopes. Myopes are people with myopia, or nearsightedness; they tend to overfocus when they look at distant objects and that causes blurry distant vision although near vision is clear. The opposite is true of people with hyperopia, or farsightedness; their near vision blurs when they look at close objects because they tend to underfocus.

Because those afflicted constitute some 60 percent of the national population, there is naturally great interest in new devices or systems intended to correct focusing problems, especially ways of correcting them without lenses or surgery. Such a system is the Accommotrac® Vision Trainer, a spinoff aid to natural rather than artificial vision improvement.

The Accommotrac system was invented by Dr. Joseph N. Trachtman, Doctor of Optometry, Ph.D. and a Fellow of the American Academy of Optometry. It is based on vision research performed by Ames Research Center and a special optometer developed for the Ames program by Stanford Research Institute.

Dr. Trachtman's Vision Trainer is intended to improve certain vision defects by teaching the patient to control the ciliary body, the focusing muscle of the eye. The key is biofeedback, defined as a technique wherein a patient learns to control a bodily process or function of which he is not normally aware. Blood pressure and heart rate, for example, can be controlled voluntarily; so can the ciliary body.

The Accommotrac Vision Trainer is an optical/electronic system used by a doctor as an aid in teaching a patient how to contract and relax the focusing muscle. In a darkened room, the patient—wearing a headset—looks into the optical part of the system. Harmless infrared light is directed into the eye and focusing status of the eye is measured 40 times a second. In the

Heading spinoffs in health and medicine is a training aid for lensless correction of eye focusing disorders

At left, Dr. Sanford Cohen, a Silver Spring, Maryland optometrist, is using the Accommotrac Vision Trainer to teach a patient how to improve his vision by controlling and relaxing the focusing muscle of the eye. Above, Dr. Cohen is moving a joystick to change the view the patient sees and maintain alignment of the patient's eye with the instrument; through the headset, the patient hears a signal that tells him how successfully he is controlling focus. Shown in closeup below are the two elements of the Accommotrac system, the optical subsystem that measures the eye's focusing status, and the electronic subsystem (box) that converts the measurements to sound signals and provides a digital display of information.

electronic segment of the system, the measurements are converted to sound signals audible to the patient through the headset.

As the patient opens and closes the eye, the auditory tone tells him how successfully he is controlling the focusing muscle. A nearsighted person, for example, would want the tone to go higher, because that means he is relaxing the muscle and therefore bringing about vision improvement, since it is the inability of the eye muscle to relax that causes the blurry vision of many nearsighted persons. A farsighted person would want to hear the tone drop to a deeper pitch, signifying that the muscle is contracting, causing the lens to change shape and focus on near objects.

Through repeated one-hour sessions, the patient gradually learns to control relaxation or contraction of the eye muscle—hence the eye's focus—by auditory feedback. "It is," says Dr. Trachtman, "a retraining program for learning to see clearly without lenses."

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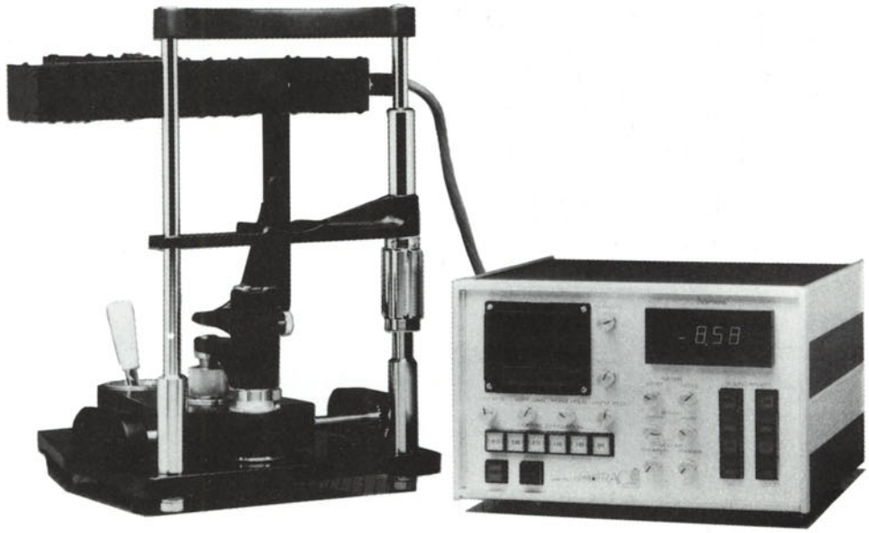

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It takes a lot of practice and a great deal of motivation to learn to control the focusing muscle of the eye, but many doctors are now using the Accommotrac Vision Trainer with consistent success. Not all patients can throw away their corrective lenses, says the system's inventor, Dr. Joseph N. Trachtman, but most achieve improvement of some sort, such as halting or reversing their needs for increased lens prescription. Trachtman claims a 90 percent success rate for correcting, improving or stopping focusing problems.

The Accommotrac Vision Trainer has also proved effective in treating eye movement problems, such as nystagmus (eye oscillation), strabismus (cross eyes or wall eyes) and amblyopia (lazy eye). Recently, Trachtman has been introducing his Accommotrac/biofeedback technique to professional sports teams, because it has demonstrated ability to help increase peripheral visual awareness and therefore improve athletic performance.

There is still another important application, Trachtman believes: the Accommotrac Vision Trainer can help children develop stronger focusing muscles and foster greater attention spans in the classroom, possibly decreasing juvenile delinquency that often occurs when children are frustrated in school.

Dr. Trachtman's exciting invention had its origin more than 20 years ago, when Ames Research Center contracted with Stanford Research Institute (SRI) for studies of pilots' visual accommodation, the ability of the eye to adapt to distinct vision at different distances. Ames scientist and human factors engineer Robert J. Randle, Jr. was assigned as NASA's technical monitor of the contract; the principal investigators were Drs. Hewitt D. Crane and Thomas N. Cornsweet of SRI.

Crane and Cornsweet were assigned the job of developing an optometer, a means of objectively measuring visual accommodation, and a high accuracy eye position tracker. In 1968, they delivered what Randle describes as "the first usable, automatic, objective research optometer."

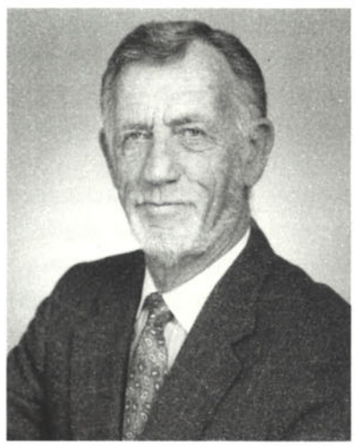
While running experiments with the optometer on pilot subjects, Randle discovered that humans could learn to control eye focus. He employed the auditory biofeedback technique as a learning enhancement measure and conducted accommodation experiments with college students and airline pilots.

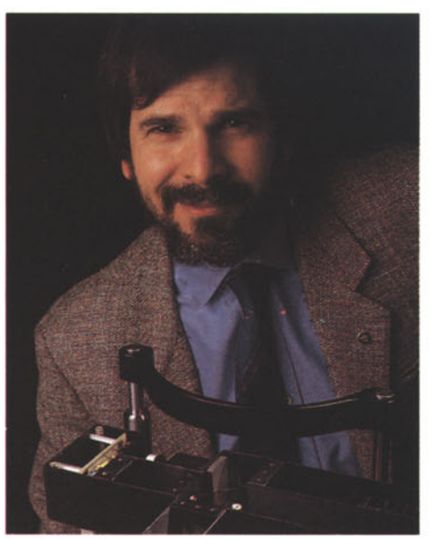
Their success in controlling focus was a finding of some significance, since optometer/biofeedback training offered a potential means of overcoming an aviation phenomenon known as "empty field myopia," the tendency of a pilot's focus at high altitude in empty, featureless skies, to stop about a yard in front of the eye and wander there; in other words, the pilot absently focuses on the windscreen when he should be focused at distance, scanning the sky for hazards.

In 1970, Randle presented papers on the NASA research, the first literature on biofeedback control of accommodation, at meetings of the aerospace medical community in the U.S., Germany and France. Crane and Cornsweet subsequently published a training study confirming the NASA results using a different biofeedback technique.

At an early age, Joseph Trachtman developed a fascination for the human eye and the possibility of controlling the human nervous system by concentration and training. After earning degrees at the Pennsyslvania College of Optometry, The Johns Hopkins University and the State College of Optometry, State University of New York, Dr. Trachtman learned of the Randle/SRI research while taking postgraduate study at Yeshiva University. Armed with Randle's papers and the Crane/Cornsweet reports of the instrumentation they had developed for NASA, Trachtman chose the application of biofeedback of accommodation to reduce myopia as the subject of his doctoral dissertation. He then proceeded to develop a prototype version of the Accommotrac Vision Trainer.

The Vision Trainer is used by a number of professional sports organizations to improve athletes' peripheral vision and reaction time. Above, sports vision specialist Dr. Harvey Schneider is shown with his Vision Trainer and John Carter, one of several Vision Trainer users on the squad of professional hockey's Boston Bruins. There may be no connection, but the Bruins went all the way to the Stanley Cup finals in 1990. The Vision Trainer's inventor, Dr. Joseph N. Trachtman, has worked with the Pittsburgh Pirates of baseball's National League and sports vision specialists have conducted Accommotrac training for several other major baseball teams.





The inventors: Ames Research Center scientist Robert J. Randle, Jr. (top), who conducted the original NASA experiments in controlling human eye focus, and optometrist Dr. Joseph N. Trachtman, who developed the spinoff Accommotrac Vision Trainer as a means of correcting eye focus problems.

Using himself as the initial subject for Accommotrac experiments, Trachtman was able to effect a significant improvement in his own myopia. Continuing research and development over a span of seven years refined and greatly improved the Accommotrac. In 1984, Trachtman began marketing the Vision Trainer and the system is now in use in more than 200 practices in the United States and abroad.