Behavioral optometry: a historical perspective

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Abstract

Background: The term behavioral optometry is often used to refer to all aspects of practice associated with case analysis and vision therapy. Practitioners with differing backgrounds and perspectives may use the term differently, resulting in poor communication.

Methods: The evolution of behavioral optometry is reviewed from a historical perspective, to identify the various lines along which the field has developed and to clarify the differing perspectives that result.

Results: Behavioral optometry had its origins in strabismus orthoptics and in case analysis systems developed to resolve asthenopic complaints in nonstrabismic individuals. From these roots, behavioral optometry has evolved along two complementary lines. Traditional, physiologically-based models emphasize accommodation-convergence relationships and the mechanisms of vergence dysfunction. Behavioral approaches emphasize the influence of environment and experience upon visual function, the relationship of vision to other aspects of organismic behavior, and the role of vision as a modality for gathering and processing information.

Conclusions: The past 50 years has brought substantial growth in the scope of behavioral optometric care, with consideration of the role of vision in relation to school achievement, VDT use, sports, spatial and motor organization, and information-processing. Models of care emphasize prevention, remediation, rehabilitation, and enhancement. Behavioral optometry is an integral component of optometric education and practice.

Key Words: behavioral optometry, historical, orthoptics, vision therapy, strabismus, case analysis, Skellington model, developmental vision


Optometry has been long in its evolution. Although legal recognition and regulation began in 1901, the profession's heritage was centuries in the making. Cox¹ traces the evolution of the science of refraction through four great epochs: 1) the early astronomers, mathematicians, and philosophers such as Aristotle and Alhazen; 2) the invention of spectacles and advances in optical research by medieval churchmen such as Bacon and Scheiner; 3) the contributions of more recent spectacle and instrument makers; and 4) the contributions of the great scientists, including Galileo, Newton, Helmholtz, and Young. Cox traces the origin of the clinical profession of optometry to its roots in the original optical families, the microscope makers, the optical manufacturers, the influence of the jewelry trade, and the era of the spectacle peddlers.

The purpose of this paper is to similarly review the evolution of behavioral optometry from a historical perspective, and to trace the two distinct, complementary lines along which the field has developed. In looking at the origins of modern behavioral optometry, one finds two major strands, one rooted in classical strabismus orthoptics, and the other arising from the need to resolve symptoms and complaints not satisfied by simple optical correction.

Origins in strabismus orthoptics

The history of strabismus orthoptics, described by Revell,² dates back to the use of squint masks as early as the seventh century. Modern strabismus orthoptics is rooted in the work of Donders³ and Javal.⁴ Donders,³ a professor of physiology and ophthalmology, was the first to clearly differentiate and describe the various forms of refractive error, and to link convergent squint with hyperopia.

Javal was spurred to seek alternative means of treating strabismus following his sister's unsuccessful surgery, which converted an esotrope to a cosmically unsightly divergent squint. His private practice was largely devoted to the treatment of squint. Javal was the first to emphasize the elimination of suppression. He was also the first to utilize the esotrope's centration point in real space. Javal is known as the father of modern orthoptics because of his recognition of the importance of functional binocularity, his espousal of orthoptics to achieve binocular function, and the Herculean efforts he demanded of himself and his patients to obtain binocular vision. As an example of the intensity required by Javal, a letter from one of his cured patients to a young child being treated indicated that she had worked for 14 to 18 hours daily to be able to see with both eyes together, and that although this might be too much for a young child, 10 or 12 hours at least would be expected.⁵

Worth,⁶ in his classic Squint, put forth his "fusion faculty" theory, suggesting that strabismus is caused by a congenital absence of fusion. He categorized binocular vision into grades I, II, and III, representing simultaneous perception, flat fusion, and stereopsis respectively. Contribution to the theory and management of squint by subsequent theorist/clinicians such as Chavasse, Remy, and

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Cantonnet were paralleled by the development of amblyoscopes and other equipment for treating squint. Revell traces the development of orthoptics clinics and of trained non-medical orthoptists.

Arneson was the first American optometrist to have a major impact on strabismus therapy. He introduced the Korector, a rotating device involving movement, color, and peripheral stimulation. The innovative techniques and principles introduced by Fred Brock, beginning about 1935, significantly influenced optometric management of strabismus, and pervade many aspects of non-strabismus treatment as well. Brock emphasized training in the normal environment, in free space, with devices simulating reality, at a level within the patient's capacity for achievement. Brock emphasized the use of peripheral fusion to achieve binocular alignment, and pioneered the use of large targets that stimulate the retinal periphery to obtain fusion and stereopsis. He introduced the concept that targets requiring stereoscopic perception (Worth's 3rd degree fusion) could provide a stronger stimulus to fusion and alignment than flat (first or second degree) fusion targets.

Revell credits Le Cat, in the 18th century, with the first description of amblyopia. The use of occlusion was first described in 1743 by Buffon. Revell traces the subsequent development of ambylopa therapy techniques. Numerous techniques were developed involving active stimulation of the ambyopic eye.

Smith emphasized the equalization of monocular visual skills, including ocular motility, accommodative, and eye-hand coordination skills. Smith, like Brock, had significant impact on non-strabismus as well as strabismus therapy. The principle of monocular skills equalization is widely accepted as an integral component of optometric vision therapy.

The modern optometric literature on results of strabismus orthoptics would make Javal proud of the discipline he fathered. Studies by Ludlam, Ludlam and Kleinman, Flax and Duckman, Etting, and Hoffman et al. indicate achievement of functional binocularity via optometric vision training, without surgery, in over 70 percent of non-accommodative strabisms.

Origins in refractive analysis

The other major thread in the development of behavioral optometry has its origins in case analysis systems that evolved as an extension of refraction. It was noted that distance refractive correction did not always alleviate symptoms of discomfort. Wells noted that heterophoria, which interferes with visual comfort, is more common than strabismus but that many ophthalmologists ignore binocular function unless strabismus exists. His comprehensive text on stereoscopic exercises is devoted to the treatment of non-strabismic binocular problems as well as strabismus. Snell suggested that asthenopia and headaches often occur due to interference in binocular function, since such symptoms are more prevalent in non-strabismic than in strabismic or monocular patients. Marlow proposed occlusion as a diagnostic aid, to determine the true imbalance between the two eyes by uncovering latency, and to determine whether symptoms are binocular in origin.

Cross introduced dynamic skiascopy as a procedure to more accurately determine distance refraction by revealing the full hyperopic error. Sheard and Taylor introduced additional dynamic retinoscopy techniques to determine optimal nearpoint correction as well as to uncover latent hyperopia.

Donders graphed the limits of accommodation for given amounts of convergence, initiating the study of accommodation-convergence relationships and providing the foundation for graphical analysis of these functions. Landolt added tests of convergence function to the graph. Percival and Sheard postulated criteria for lateral prism prescription to provide comfort, based on the relationship between fusional demand and reserves. Sheard introduced the concept of compensating ductions, considering the phoria as a fusional demand to be compared to the opposing duction, which was viewed as the fusional reserve.

Neumuller, Hofstetter, Pry, and Morgan further investigated the relationship between accommodation and convergence. They developed sophisticated methods of graphical analysis of phorometric measures in relation to an expected zone of clear, single binocular vision. Normative or expected phorometric values were derived by Haines, Shepard and Morgan. Borish presented guidelines for prescription of lenses, prisms, and orthoptics, based on analysis of phorometric and accommodative findings.

In recent years, research in fixation disparity, vergence adaptation, and accommodative convergence–convergence accommodation interactions has led to a trend to analyze binocular vision through the use of findings obtained under fused rather than dissociated conditions. Case analysis systems derived from this research are based on the assessment of forced vergence fixation disparity curves, mutual interactions between vergence and accommodation under binocular conditions, and other measures of vergence and accommodative function obtained during binocular viewing.

AM Skeffington and the behavioral concept

Although the term behavioral optometry is often used to refer to all aspects of practice associated with case
analysis and vision therapy, at least two major schools or approaches exist: the physiologically based, traditional models described above, that emphasize accommodation-convergence relationships and mechanisms of vergence dysfunction; and the behavioral concept, which emphasizes the influence of environment and experience on visual function, the plasticity of the visual system, the relationship of vision to other aspects of organismic function, and the role of vision as a modality for gathering and processing information. The behavioral concept had its origins in the theories and concepts of A.M. Skeffington, and the teachings of the Optometric Extension Program.

The Optometric Extension Program (O.E.P.) was founded in 1928. O.E.P. developed as an expansion of the Oklahoma Optometric Association's education program for its members. Skeffington became director of education, a post he held for some 50 years, traveling around the country each year to meet with optometrists at Congresses, seminars, and study group meetings, to spread the word about functional optometric vision care. In 1928, the Optometric Extension Program began publishing monthly post-graduate education texts. Skeffington described the O.E.P. system of case analysis, and for many years presented a case example each month.44

Skeffington is recognized as the father of behavioral optometry (Fig. 1). He was the rare individual who was able to integrate knowledge of his profession with that of other disciplines, to examine the extant body of knowledge from a totally different point of view, and ultimately to revolutionize concepts of clinical care. Skeffington's early influence was marked by the publication in 1928 and 1931 of companion textbooks on ocular examination and functional diagnosis.45,46 These texts introduced the O.E.P. Analytical Examination, presented standardized procedures and norms, discussed the significance of the various tests, and grouped findings into diagnostic syndromes or case types.

Skeffington introduced the four circles concept, in which vision, held to be the dominant mode for information-processing, is viewed as an emergent of four underlying sub-processes: anti-gravity, centering, identification, and speech-auditory. Vision is considered not primarily in terms of optics or accommodation-convergence relationships, but rather as an organismic process involved with movement, orientation and localization in space, language, and information-processing.44,47

Skeffington's impact was revolutionary. In contrast with traditional models that hold that refractive and phorometric deviations arise from heredity, growth, and random biologic variation, Skeffington proposed that the nearpoint task demands of our society cause a broad variety of ocular, binocular, and behavioral problems. He suggested that mankind is not biologically suit-

Figure 1: Dr. A.M. Skeffington and the four circles (photo courtesy Optometric Extension Program Foundation.)

ed for these culturally imposed near work demands, and that such tasks consequently provoke a biological stress response, characterized in the visual system by a drive for convergence to localize closer than accommodation. The resulting effector system mismatch causes visual inefficiency that may lead to discomfort, avoidance of near work, or adaptation within the visual system. Skeffington viewed myopia, which some medical workers had earlier attributed to excessive close work,48 as one of many possible adaptations to the stress imposed by near work. Skeffington emphasized the use of appropriate stress-relieving low plus lenses to eliminate the mismatch between vergence and accommodation, prevent the development of vision disorders, relieve discomfort, and permit optimal visual efficiency.44,49-51

Contributions from allied disciplines

Contributions from many visual and behavioral scientists influenced the course and development of behavioral optometry. Samuel Renshaw, Ph.D., professor of experimental psychology at The Ohio State University, served as a member of the O.E.P. writing staff for more than 25 years, authoring series on psychology and vision beginning in 1939.52-54 In his papers and in annual meetings with behavioral optometrists, Renshaw introduced the perspectives of experimental psychology to optometry. His research on the use of the tachistoscope to expand speed and span of perception led to optometry's initial involvement with perceptual skills training. His influence led optometry to broaden its thinking beyond refraction and accommodation-convergence relationships to perception, information-processing, and behavior. Earlier work had largely stressed the afferent phase of the visual process. Renshaw emphasized the importance of feedback and motor output; hence the behav-
ioral maxims, “vision is motor” and “vision is learned.” These maxims were reactions to earlier notions that vision was purely sensory and largely innate, with little capacity for learning. Today we understand that sensory and motor visual processes are so intertwined that it is inappropriate to speak of purely sensory and motor processes. Much is innate in visual function, but substantial evidence, including the Nobel Prize-winning research of Wiesel and Hubel, documents the modifiability of visual function.

Darrell Boyd Harmon, Ph.D., was an educator and kinesiologist (Fig. 2). In a longitudinal study, he reported an increased prevalence of visual problems among Texas elementary school children, from 20 percent among those entering school to 80 percent after 5 years of elementary school. He found no increase in prevalence of visual problems in children of migratory workers, who spent little time in school. Harmon was led to investigate factors in the school environment that might generate visual disorder. He studied the role of vision in orientation and localization in space, and postulated that the primary biological function of vision is its role in organizing spatial relationships, rather than image formation. Harmon suggested that classroom environmental factors such as contrast, glare, and design of classroom furniture impact upon posture; when postural skews arise as a result of such environmental factors, binocular and refractive deviations result from the need to match visual with gravitational and kinesthetic inputs.

Harmon described an optimal classroom environment to minimize development of visual and other problems. His work led to heightened optometric consideration of the environmental factors involved in the development of vision problems, and to understanding the relationships between movement, posture, and vision.

Skeffington was deeply influenced by his contact with Renshaw and Harmon, and was influenced by a host of other non-optometric scientists, including Kurt Goldstein, Vasco Ronchi, Ward Halstead, Hans Selye, Gray Walter, Walter Lancaster, Emmett Betts, Arnold Gesell, and S. Howard Bartley. These influences led to an ever-broadening model of vision and of optometry’s role.

Developmental vision

Greater knowledge of visual development came from the work of Gesell, Getman, and others at the Gesell Institute of Child Development in New Haven. Observations of the development of ocular fixation, accommodation, and binocularity were interpreted behaviorally in relation to general organismic development. Greater emphasis was placed on the motor aspects of visual function, and on the role of vision in the development of general motor function and behavior. This work gave impetus to the idea that vision is much more than the camera-like action of a sense organ.

Getman’s retinoscopic observations, particularly his development of the technique of book retinoscopy, led to increased awareness of the relationship between problem-solving and vision, and gave impetus to the use of lenses to facilitate learning. Getman developed techniques for clinical evaluation of visual development in infants and children, and developed therapeutic regimens for care and guidance to achieve maximum potential in children with developmental vision lags or deficits.

Learning-related vision care

As models emerged for the use of lenses, guidance, and vision training to facilitate visual development, optometrists became increasingly aware of the relationship between visual performance and efficient learning, and of the potential for developing enhanced learning
ability in those with visual problems. As early as the
1930s and 1940s, Skedington lectured and wrote of the
relationship between vision problems, learning, and
reading.65 A noted reading authority, Dr. Helen
Robinson, contributed monthly chapters to the O.E.P.
papers, indicating optometry's early interest in the rela-
tionship between vision and learning.66

Optometry joined education and psychology as pro-
fessions concerned with learning. Kephart,67 a psychol-
ogist, and Barsch,68,69 a special educator, interacted exten-
sively with Getman. Both were influenced by
developmental optometry, and each created programs
for the learning disabled that reflected this influence.
Kephart and Barsch each, in turn, influenced optometric
thinking through their textbooks and their writings for
the Optometric Extension Program. Strauss and
Kephart70 and Delacato71 developed therapeutic regi-
mens grounded in motor development, to maximize per-
formance of the brain-injured and mentally retarded.
Developmental optometrists contributed to and drew
heavily upon these sources, and the scope of optometric
involvement with learning problems broadened.

As optometrists became increasingly involved with
the management of vision disorders in the learning dis-
abled, treatment approaches became increasingly
sophisticated. Flax72,73 and Peiser24 analyzed the visual
skills necessary for adequate performance on the vari-
ous demands of the classroom. Flax emphasized the dif-
f erences in the visual abilities necessary for achieve-
ment in reading in the early and later grades. In the
early grades, "learning to read" is dependent on ade-
quate visual form perception and visual memory skills,
which allow appropriate letter discrimination and sight
recognition for words. In the later grades, once one has
learned the rudiments of reading, efficiency of "reading
to learn" is related to efficiency of eye movement,
accommodative, and binocular eye coordination skills.

Awareness of the relation of specific visual abilities
to specific academic tasks led to a more analytical opto-
metric approach to learning-related visual problems.
Optometrists began to seek more detailed information
about academic deficits from patients, families, and
schools, to better assess the relationship between such
academic problems and the visual problems discovered
during optometric evaluation. The optometrist became
better able to predict the degree to which specific acad-
emic gains might or might not follow remediation of
vision disorder.

Woolf75 compared the new thinking in optometry
with the older conventional wisdom. He described a
syndrome of visual disability that is common among
children who have reading problems in spite of healthy
eyes, 20/20 acuity, and no binocular problems according
to the Sheard and Percival discomfort criteria. Woolf's
syndrome of visual disability includes disorders in many
areas of visual function, including pursuit, saccadic, and
fixation ability; accommodative amplitude and facility;
binocularity, including stereopsis, fusion and conver-
gence; visual perception, recognition, and recall of
forms; visual perception of space and direction; visual
monitoring of body movement patterns and manipula-
tion; visualization of body movements for efficient pro-
gramming; span of perception; and ability to process
information over a wide area in a minimal time.

Visual skills training

Vision therapy to remediate visual skills disorders and
improve visual efficiency gained major impetus with the
publication, in 1937 through 1939, of an O.E.P. series
authored by Crow and Fuog.76 This series was devoted
exclusively to visual skills training for nonstrabismics,
and was thus a major departure from classical orthop-
tics texts that were concerned primarily with treatment
of strabismus and high heterophoria.

Crow and Fuog were significantly influenced by
Arneson7 and Peckham,77 who treated strabismics and
high heterophorias and emphasized the use of monocular
skills training even for non-amblyopes. Arneson
and Peckham used monocular calisthenics and monocular
rotations with peripheral stimulation, while delaying
binocular vision training.

Non-strabismic visual skills training as taught by
Crow and Fuog was incorporated in Skedington's
model as a means of improving performance and sup-
plementing nearpoint lens application. Training empha-
sized development of monocular pursuits, saccades,
and rotations, with manual association, and of accom-
modative facility, leading to binocular re-education after
achievement of adequate monocular visual skills. In
1939, Lesser began a series of O.E.P. chapters that con-
tinued through 1951, presenting vision training tech-
niques based on a similar sequence.78

The emerging concepts of developmental vision in
the 1950s fostered growth in the scope of optometric
vision therapy. Getman stressed the significance of gross
motor organization as a basis for the development of
efficient fine motor, eye movement, visual form percep-
tion, and visualization abilities. Developmental vision
treatment programs emphasized development of gross
motor skills, organization, and awareness, in order to
facilitate development of higher level visual functions.63

Ann Sutton Nichols was among the earliest
optometrists to relate clinical optometric findings to
general organismic behavior. Using Sheldon's work on
body build and personality as a base, she related refrac-
tive and binocular status to personality and tempera-
ment. She also developed and described vision training
procedures that emphasized hand-eye coordination and
perceptual orientation.79
Concepts of optometric vision therapy continued to expand, and visual skills training for nonstrabismics, introduced by Crow and Faqir,75 reached higher levels of sophistication. Procedures were introduced not only to remediate oculosensory and oculomotor disorders, but to expand visual perceptual and visual information-processing abilities as well.63,80–89 Texts by MacDonald,80 Kraskin,81 Schrock,82 and Greenstein83 described specific therapy procedures and their sequencing into overall treatment programs. Lyons and Lyons84 and Forrest85 emphasized the role of visualization and visual imagery in information processing, and described methods to develop visualization skills. Furth and Wachs86 described procedures, based on Piaget’s theories, to develop visual thinking. Pepper87 introduced vision therapy procedures that incorporate multisensory involvement and increasingly difficult cognitive and motor demands, in order to integrate and automate visual function and develop more adequate visual information-processing abilities. Sutor88 and Shankman89 introduced procedures that emphasize visual awareness and spatial judgments.

MacDonald80 introduced the notion of central-peripheral organization, noting that some individuals attend primarily to detail but lose meaning in terms of relationships, while others process more globally but are less efficient with regard to detail. MacDonald,80 Forrest,80 and Birnbaum81 described styles of visual-information processing, and organized vision therapy procedures in relation to these styles to develop more effective information processing.

Forrest80 related visual development, visual information processing, and academic performance to research and theory in psychology, physiology, and education. He explored the theoretic basis for the major tenets of behavioral optometry, including the significance of stress,70 the relationship between movement and vision,82 and the relationships between academic achievement and visual information processing.55,80 Forrest79,83 suggested that vision disorders frequently arise in relation to visual information-processing style and underlying mental states.

Concurrent with the evolution of modern vision therapy, optometrists have explored various methods of using lenses and prisms to affect vision, posture, spatial organization, and behavior. Skeffington44,49 suggested that low plus lenses, when indicated on the basis of the analytical findings, serve to relieve the mismatch between vergence and accommodation intrinsic to the nearpoint tasks of our culture, and hence reduce stress on the visual system, permit efficient visual and cognitive function, and eliminate the need for avoidance and for adaptation within the visual system. Harmon,84 Pierce,85,86 and Greenspan87,88 reported research that indicates that, for many individuals, there exists a specific optimal nearpoint lens prescription that fosters maintenance of an optimal near working distance and minimizes general muscular tension and physiological activation. Dynamic retinoscopy procedures such as book,59,61,64 bell,99–101 stress point,102 and monocular estimate method103,104 retinoscopy were developed and used to assist in the determination of the optimal nearpoint lens. Apell and Steff56 and Horner106 described various methods of modifying lens prescriptions for distance and near in relation to visual performance. Kaplan107 and Kraskin108 described the use of yoked prisms to influence posture and spatial organization, and hence to affect visual function. Recent years have also seen increased interest in synoptics, the therapeutic use of light and color to influence vision and systemic functions.109

Behavioral optometry today

The past 50 years have brought substantial growth in the scope of behavioral optometric care. This growth has taken place largely through clinical practice, clinical research, and clinical application of behavioral research, rather than through major technological advances. As indicated earlier, modern behavioral optometry has developed along two lines, one more traditional and physiologic, and the other more behavioral in outlook. These approaches are mutually complementary: the former is based on clinical research, and emphasizes the mechanisms involved in oculosensory and oculomotor disorders; the latter is derived largely from clinical insight and experience, and emphasizes the relationships between vision and organismic processes, the role of environmental interaction, the plasticity of the visual system, and the impact of vision disorders on human performance and behavior.

In recent years, the emphasis of the traditional models has been on the analysis of binocular vision through evaluation of forced vergence fixation disparity curves, assessment of mutual interactions between vergence and accommodation, and other measures obtained during fused conditions. Research in binocular vision has provided greater understanding of the mechanisms that underlie binocular disorders.

The behavioral concept has evolved from its origins in the models of Skeffington, Harmon, and Getman, to encompass the following key tenets:

1. Vision is an organismic process involved not only with optical functions, but with movement, posture, spatial relations, language, and information processing.
2. The visual process is highly plastic, and skews in its structure and function frequently result from environmental factors. Primary visual skills, high
level visual cognitive abilities, and integration of vision with other modalities are dependent on both maturation and experience. Vision disorders may be categorized as developmental or stress-induced. Developmental vision disorders occur when environmental conditions do not provide adequate opportunity for learning, or otherwise interfere with development. Stress-induced vision disorders occur when stressor agents, particularly the nearpoint visual demands of our culture, cause a breakdown of visual skills and abilities that have already developed, or lead to adaptation within the visual system.  

3. Developmental and stress-induced vision disorders can frequently be prevented through appropriate optometric intervention. The behavioral optometrist seeks to provide guidance regarding desirable environmental conditions, and to prescribe appropriate lenses and vision therapy, when indicated, to foster optimal development and minimize stress on the visual system.  

4. Appreciation of the complexity of the visual process and its integration with other systems leads to the use of vision therapy not only to prevent and remEDIATE vision disorders, but to enhance visual function as well. The most notable examples of enhancement therapy are in the management of learning-related vision disorders and sports vision therapy, where treatment may be organized not only to remEDIATE dysfunction, but also to enhance and expand normal visual-cognitive and visual-motor function.  

5. Visual function plays a role not only in information-gathering, but in information processing as well. Visual imagery and visualization contribute significantly to everyday thinking. Vision disorders that interfere with efficient visual function may interfere with high level visual thinking and restrict information-processing capacity.  

Thus, optometrists have moved from a limited concept of vision care emphasizing the provision of clear, comfortable vision, to models that encompass prevention and enhancement as well as remEDIATE.
Cognizant of relationships between vision and school achievement, sports performance, spatial and motor organization, cognitive-perceptual style, and personality, the behavioral optometrist treats a broad array of visual disorders to improve visual information processing and to maximize human potential and achievement. Perhaps the most radical departure from traditional thinking is that the behavioral clinician views vision and vision disorders functionally, in terms of their effects upon the individual. Relatively subtle vision problems may cause major academic difficulty or disinterest in reading, and may ultimately shape the nature and extent of one’s education, career, and socialization patterns. The behavioral optometrist measures the severity of visual problems based upon the impaired potential for achievement, rather than on a dioptric or eye health scale.

In recent years, optometrists have devoted considerable attention to the amelioration of visual problems associated with use of video display terminals, and to the rehabilitation of vision disorders associated with stroke and closed head trauma. Vision therapy has been used to optimize performance of athletes, and to maximize visual function in the visually impaired low-vision population.

Today, behavioral vision care is an integral component of optometric practice. An extensive literature documents the efficacy of vision therapy and of nearpoint lens application. Vision training and orthoptics are specifically mentioned in the legal definition of optometry in many states. Knowledge in behavioral optometry is tested on state and national licensing examinations, and preparation for behavioral vision care occupies a significant portion of the undergraduate education at each of the schools and colleges of optometry. The Association of Schools and Colleges of Optometry has developed a comprehensive curriculum model for oculomotor, binocular, and visual perception dysfunctions. Residency programs in vision therapy and pediatri optometry exist at many optometric institutions, and post-graduate educational opportunities are numerous. The Optometric Extension Program, which has grown to a membership of 3,000, publishes the Journal of Behavioral Optometry and hosts numerous annual conferences and seminars devoted to continuing education in behavioral optometry. The College of Optometrists in Vision Development certifies individuals qualified to be Fellows, hosts an annual educational meeting, and publishes the Journal of Optometric Vision Development. Numerous papers on behavioral optometry appear in the journals of the American Optometric Association and the American Academy of Optometry. The American Academy of Optometry has a section on Binocular Vision and Perception, devoted to the dissemination of research in this area of optometric practice. In 1973, the section established a Diplomate program to certify Academicians who demonstrate expertise in both theoretic and clinical aspects.

Today, behavioral optometry is a vibrant, expanding discipline. Behavioral vision care originated in clinical practice, as optometrists sought to resolve patient complaints, enhance visual performance, and prevent the development of vision disorders. Extensive research at the schools and colleges of optometry has documented many of the concepts and procedures that developed through clinical practice. It is expected that the efforts of clinicians and researchers will lead to continued expansion of our understanding of vision and its relationship to human potential, and our ability to minister to the visual process to optimize visual function and performance.

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