HINDSIGHT

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Jay Enoch's Column:

The Use of Past History to Build Current Knowledge! Referring Back to Elschnig in 1901: Super-Traction/Super-Involute in the Myopias.

No doubt in this group, everyone knows the classic Santayana quotation, "Those who cannot remember the past are condemned to repeat it." In a more immediate sense, currently, *knowledge from the past is not being utilized adequately* by many, even a meaningful majority of current college students. As but one example, I encounter this behavior in the approximate 40 term papers I review each semester in my Freshman/Sophomore Seminar Course. Even with emphasis on the use of archival resources, few of these students refer to items not found currently on the "web", and fewer yet cite works 5 years or older, either on or off the web. A number of web sources cannot be considered as archival repositories, and a number of such resources have questionable reliability. Here, I do not consider use of proper format(s) for citations. The limited consideration of past literature by the current generation of students has important implications for all of us.

In this column, I examine a different form of failure to utilize historical scientific sources - a lack of interdisciplinary communication. Simply put, I present evidence of data/findings known to ocular pathologists for a century or more which have been overlooked by the vision science community and clinicians in both optometry and ophthalmology! This has occurred in an area clearly within our purview, but one which has been generally under-considered for a long time period. These disorders remain a major cause of visual impairment and blindness. The areas considered are the middle to high myopias.

Most of us are not familiar with the presence of meaningful tractional strains occurring in the region of the optic nerve head in eyes with higher myopias and in long eyes without high myopia. We all know of the ubiquitous myopic crescents, posterior pole thinning, increased presence of staphylomas, tilted-discs, etc., which are

encountered in the mid- to high myopias, but we have rarely considered the etiology of these phenomenon, nor questioned whether there is more taking place in the areas of the optic nerve head and posterior pole in these patients.

My interest in this topic has origin in the dissertation of Dr. Stacey Choi, a very able optometrist, PhD, who was then at the School of Optometry, U. of Auckland in New Zealand. Stacey looked at the Stiles Crawford effect (SCE-I or directional sensitivity of the retina) in myopes. Westheimer had been the first to note the presence of anomalous SCE-I data in myopic observers. Choi demonstrated characteristic alterations in determinations of retinal receptor orientations and sensitivities in mid- to highly myopic observers without staphylomas and with near-normal vision. She and I expanded these studies to include areas all around the optic nerve head, modeled these effects, demonstrated rather marked stable and transient traction effects, and mapped the extent of these manifestations visually and spatially upon retinas in affected eyes. These effects extend across a sizeable region of the posterior pole and have their greatest effects at or near the horizontal raphé close to the nasal side of the optic disc. And we found similar effects in individuals with large or long eyes with modest myopia. Thus, both myopia and long eyes contribute to the observed physical and visual alterations recorded. And we have read, in detail, the histo-pathology of the myopias. It is the latter aspect of the research to which I draw attention here.

We have been presenting most of this work at ARVO (also talks have been given by either one of us [or associates located in Spain] in Auckland, New Zealand; Melbourne and Brisbane, Australia; Kyoto, Japan; Geneva and Zurich, Switzerland; Terrassa [Barcelona] and Madrid, Spain; London, England; Florence, Italy; at Rochester in the USA, etc. Formal papers have been presented at a rate of 1 or 2 /year for three years at ARVO. Most of these studies are in various stages of publication at this time, so only Stacey's dissertation and a paper presented by me a few years ago in Halifax have been published to date.[1, 2]

A bit more than 100 years ago, in 1901, Anton Elschnig (of "Elschnig Pearl" fame!) wrote a masterly manuscript[3] on the contour(s) and histology of the "normal" optic nerve head. As regards the higher myopias, this is best described as histo-pathology. While Elschnig did not have all the facts in myopia, he clearly showed what he called "the conus" on the nasal side of the disc in the mid- to high myopias. Elschnig's manuscript was passed on to me by Prof. Baldur Gloor of Zurich. While this document has text, figures and tables, it does not have the reference list, which I am seeking to obtain at this time. Thus, I cannot state whether this is the first word on the subject. The remainder of citations appended here are relatively modern.

Basically, what happens in these patients is as follows: Traction, translational or rotational, which is known respectively as super-traction or super-involute, occurs on the nasal side of many mid- to highly myopic optic discs. *The retina, Bruch's membrane, and choroid* ***ride up-over and on top*** *of the nasal side of the optic nerve*

head. On the temporal side of the disc, the retina, Bruch's membrane, and choroid pull away from the myopic disc revealing the whitish sclera and residual pigment cells observed in the myopic crescent. Grossnicklaus and Green (Johns Hopkins) in a retrospective histo-pathological study of disc areas of their ample myopic population (refractive error greater than -5.00 D.) showed that this over-ride was present in 37-38% of observed specimens.[4] Dr. William Spencer, recently retired optometrist (U.C. Berkeley) and ophthalmologist and ocular pathologist at California-Pacific Medical Center has shown that the over-ride can extend as much as 2/3 of the way across the disc surface.[5] Amazing! Some other pertinent references are found in References 6-10.

It is curious that in 100 years no-one ever asked the question, is the over-ride or conus or super-traction area on top of the optic nerve head active visually? After all, there is a full retina, Bruch's membrane and choroid present - why would it not be reponsive? In my laboratory there is a prototype Canon Fundus Camera Perimeter (pity it wasn't marketed broadly by Canon!). This device allows simultaneous direct observation of the retina and testing of visual function at defined loci. A Scanning Laser Ophthalmoscope can also be used. I recruited some able students led by Dong-Anh Le to help with the task, and we found visual responses in the nasal areas of over-ride in 37-38% in 20+ eyes of patients/observers examined with refractions over -5.00 D. error!

At this point in time, we don't want to make too much of this remarkable coincidence, but it is of great interest. There is more, and this is not a stray light effect. Thus, by reading the pertinent history we were able to seek out and help clarify functional features of this unusual manifestation found in the higher-myopias. This work has been submitted for presentation at the 2003 ARVO meeting. This is not the most earth-shaking finding, but it is another piece of the puzzle comprising the myopias.

I am sure many more disconnects exist awaiting utilization. While failures of utilization of interdisciplinary studies are not limited to the past, in this article, the point is made that failure to pursue past literature can lead to substantial oversights or mistakes! Hence, studies of history are not in any sense an inactive or non-pertinent component of modern science. Rather, there exists a living trust from the past offering guidance and opportunities for future studies.

References

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nerve head in normal human eyes: A clinical and anatomical investigation.) *Denkschrift der kaiserlichen Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Classe Wein* 1901; 70: 219-278.

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5. Spencer WH. *Ophthalmic Pathology: An Atlas and Textbook, 4th Edition.* Philadelphia: Saunders, 1990: 964-973. (This figure is not found in subsequent editions)

6. Apple DJ, Rabb MF. *Clinico-Pathological Correlation of Ocular Disease: A Text and Stereoscopic Atlas, 2nd Edition.* St. Louis, MO: Mosby, 1978: 39-44.

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J.M.E.

Belated obituaries – Morgan and Alpern:

While searching on the internet for items of potential historical interest concerning optometry, I happened upon the obituaries of two optometric notables. Of particular note was the obituary of Meredith Morgan. Morgan was a long time member of OHS and was OHS president for a few years. At www.berkeley.edu/news/media/releases/99legacy/5-3-1999b.html, I found the following news release written by Pat McBroom, of the University of California, Berkeley Public Affairs office; dated May 3, 1999:

> Berkeley – Meredith W. Morgan, who, as professor, dean, and professor emeritus, helped guide the School of Optometry at the University of California, Berkeley, through 67 of its 75 years, died peacefully in the early morning hours of May 1. He was 87. Morgan had been terminally ill with lung cancer for a year.
>
> Known for his research into basic mechanisms of eye focus and alignment, Morgan was a beloved professor for 33 years and dean of the School of Optometry for 13, during which time he carried the school to international prominence.

Grateful successors named the school's clinic after him and made him honorary chairman of last year's 75th anniversary celebrations. Throughout 1998, after he knew that lung cancer had reappeared, Morgan continued to be actively involved with the school, even writing the lead chapter in the recent book "Cal Optometry – The First 75 Years."

"He was quite remarkable," said current dean of optometry, Anthony Adams. "Hardly anyone came through this school who didn't have contact of some kind with Morgan. An unbelievable number of optometrists view him as a mentor, colleague or model; many others simply think of him as a father or grandfather."

"He was a direct, very genuine man. His integrity was obvious, and he had this booming, contagious laugh," said Adams. The laugh was so famous among those who knew Morgan that the school played a tape recording of the sound at clinic dedicating ceremonies last year.

Born in Kingman, Arizona, on March 22, 1912, Morgan moved to California as a young boy, his family settling in Richmond, a city near Berkeley. Morgan attended Richmond Union High School and later established an optometry practice in that area. Graduating with honors from UC Berkeley in physics-optometry in 1934, Morgan earned a PhD in physiology here in 1942, after which he began to teach, earning professor rank in 1951.

His research into the elements of binocular vision resulted in two dozen papers laying out a basic understanding of how the eyes work in synchrony to focus and converge on objects at close range. He also contributed to textbooks on the vision of children and aging patients.

During his years as Dean of the School of Optometry (1960-73), Morgan expanded the curriculum to include a doctoral program and recruited world-renowned vision scientists to the campus. He also was instrumental earlier in establishing a graduate program in physiological optics in 1946, one of the first such PhD programs in the country and the training ground for many future leaders in optometry.

In 1967, he received the prestigious Charles F. Prentice Medal from the American Academy of Optometry, and in 1975, Morgan was awarded a Berkeley Citation for service to the university. In announcing the Prentice Medal, the American Academy of Optometry said it was based not only on his scientific achievements in vision research but on "his life as a teacher, scientist and man."

Morgan was diagnosed and treated for lung cancer five years ago. When the condition recurred last year, he declined further treatment and spent his final months of life in a celebration of the school he helped build. Morgan is survived

by a daughter, Linda Morgan, of San Pablo, California, and two grandchildren, Lauren, 16, and Colin, 14, also of San Pablo. Morgan's wife, Ida, died in the late 1980s.

I also ran across an obituary of Mathew Alpern. I met Alpern only once and only briefly. My personal knowledge of his work comes mainly from his book *Muscular Mechanisms,* 2nd edition (volume 3 of *The Eye*, edited by Hugh Davson). That book was one of my textbooks in both optometry school and graduate school, and I later used it as a textbook for several years when I taught Ocular Motility. It is a clearly written comprehensive book. Alpern wrote the material on eye movements, anatomy and physiology of the extraocular muscles, accommodation and vergence, which comprised about two-thirds of the book. Other authors contributed sections on the pupil, secretion of tears, and blinking. At www.umich.edu/~urecord/9596/May21_96/artc108.htm, the following from the University of Michigan was dated May 21, 1996:

> Mathew Alpern, professor emeritus of physiological optics in ophthalmology in the Medical School and professor emeritus of psychology, died May 16 at U-M Hospitals. One of the world's foremost experts on color vision, Alpern was 77 years old.
>
> A gifted scientist, educator and member of the National Academy of Sciences, Alpern made major contributions to scientific understanding of the mechanisms of human vision during 50 years of research in the field. "Dr. Alpern was a devoted scientist who continued to work well past his official retirement in spite of health problems," says Alan Sugar, professor of ophthalmology. "He was a penetrating questioner who in recent years sometimes appeared to sleep through presentations at scientific conferences, but whose questions made it obvious that he had heard every important point and knew more about the topic than the presenter."
>
> Alpern began his academic career in 1951 as an assistant professor of optometry at Pacific University in Forest Grove, Ore. In 1955, he joined the U-M faculty as an instructor in ophthalmology and research associate in the Vision Research Laboratory. He was promoted to assistant professor in 1956 and associate professor in 1958, and received additional appointments as associate professor of psychology in 1959 and associate professor of physiology in 1960. In 1963, he was named professor of physiological optics in the Departments of Ophthalmology and Physiology, and professor of psychology.
>
> During his long and distinguished career, Alpern received many scientific awards, including election in 1991 to the National Academy of Sciences. He was also the recipient of the Jonas Stein Friedenwald Award from the Association for Research in Vision and Ophthalmology, the Edgar D. Tillyer Medal of the Optical

Society of America, the Research to Prevent Blindness Senior Scientific Investigator Award, the Charles F. Prentice Medal, and an Honorary Doctor of Science degree from the State University of New York's College of Optometry.

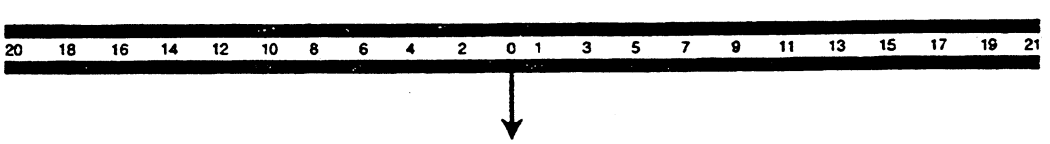
Alpern was born in Akron, Ohio in 1920. He received his O.D. degree in 1941 from Northern Illinois College of Optometry. After spending a brief period in private practice, he served in the U.S. Army from 1942-46. He received his B.M.E. degree from the University of Florida in 1944, and his M.S. (1948) and Ph.D. (1950) degrees in physiological optics from Ohio State University. He was a member of many professional organizations, including the American Physiological Society, American Psychological Society, Association for Research in Vision and Ophthalmology, Optical Society of America and Sigma Xi.

D.A.G.

Phoria card design attributed to Thorington and Prentice:

A recent paper in the journal *Optometry and Vision Science* (Wong EPF, Fricke TR, Dinardo C. Interexaminer repeatability of a new, modified Prentice card compared with established phoria tests. Optom Vis Sci 2002; 79:370-375) reported on the repeatability of a dissociated phoria test card marketed by the Australian equipment supply company Cyclopean Design. This version of the test card was designed by Edwin Howell, Australian optometrist.

The card has a horizontal scale of numbers with zero in the middle and with a vertical arrow projecting downward from the zero. The patient views the card with a vertical prism over one eye for prism dissociation. When the patient is 3 meters from the distance card or 33 centimeters from the near card, the number to which the arrow points is the magnitude of the dissociated phoria in prism diopters. Exophoria or esophoria is indicated by the direction of lateral displacement of the arrow. The following is a photocopy of the features on Howell's near phoria card (the photocopy does not show that the even numbers are on a blue field and the odd numbers are on a yellow field):



The paper in *Optometry and Vision Science* attributes this test design to Thorington and Prentice. This led me to try to find the connection of the Thorington and Prentice designs with Howell's test card. By emails from Tim Fricke, co-author of the

paper noted above, and from Edwin Howell, I have found out a little about the development of Howell's phoria test card. Howell notes that another Australian optometrist, Peter Dwyer, used the Thorington/Prentice design for a card used in vision screening of children in Australia. In an email from Tim Fricke, I learned that Dwyer found the idea for the card in Borish's Clinical Refraction.

The normal values given by Howell for the near card were based on a vision screening of over 5,000 children in Australia. That screening test battery and results were described in the following publications:
Dwyer PS. The Portsea Lord Mayor's Children's Camp vision screening: a rationale and protocol for optometric screening. Aust J Optom 1983;66(5):178-185.
Walters J. Portsea modified clinical technique: results from an expanded optometric screening protocol for children. Aust J Optom 1984;67(5):176-186.
Walters J. Portsea modified clinical technique: evaluation of an expanded optometric screening protocol for children. Aust J Optom 1984;67(6):212-220.
In the first of these papers Dwyer talked about the phoria test being a "modified Prentice test". The initial version and the present version incorporates an oval shape, which Howell recommended to try to avoid any fusional stimuli that may result from straight edges on a doubled target. Later additions by Howell were odd and even numbers and yellow and blue color coding to reduce ambiguity in distinguishing eso from exo.

In each of three editions of *Clinical Refraction,* Irvin M. Borish talks about the Thorington (Prentice) phoria test and gives an illustration of the Prentice card. The following is the illustration of the Prentice card from the third edition of *Clinical Refraction* by Borish (Chicago: Professional Press, 1970, page 817):

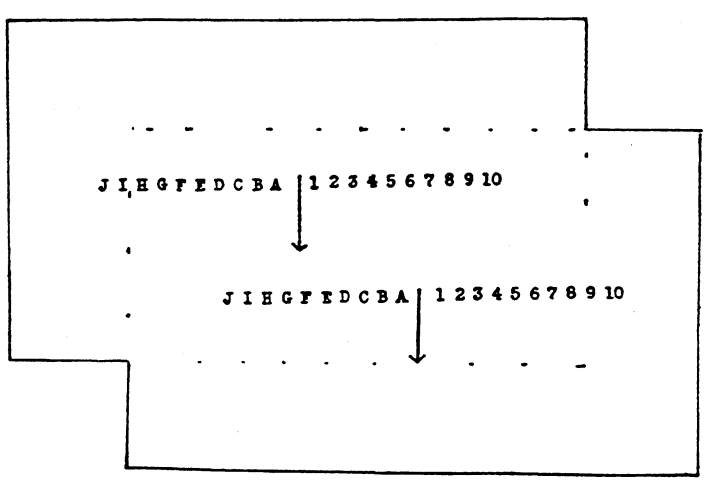


Figure XX-4 - Prentice phoria test. Upper chart seen by right eye. Displacement to left indicating eye turns to right, or exophoria exists. Each symbol represents 1 prism diopter, indicating 6½ exophoria.

I found a description of the test in a book by Thorington (Thorington J. Refraction and How to Refract, 5th ed. Philadelphia: Blakiston, 1914). The following is Thorington's illustration of the test card:

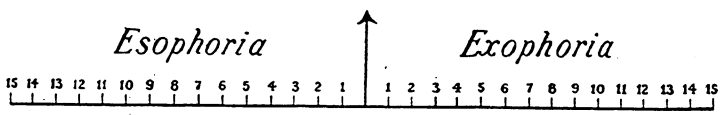


FIG. 190.—Scale for testing lateral insufficiency at 13 inches.

I haven't been able to find anything written by Prentice about this phoria test. I made a quick pass through Prentice's books, *Legalized Optometry and the Memoirs of its Founder* and *Ophthalmic Lenses, Dioptric Formulae for Combined Cylindrical Lenses, The Prism-Dioptry and Other Optical Papers*, 2nd edition, but I didn't see anything about the phoria test which is illustrated above. However, in the latter book, on page 121, Prentice mentions a different phoria test for which he "preferably uses a +12 D cylindrical lens, which produces a much heavier line of light than the Maddox rod."

So I have question for our readers: do you know if and where Prentice may have published about the test illustrated above or do you know how the test may have come to be attributed to Prentice?

D.A.G.

History of tachistoscope training and research:

The history of the use of the tachistoscope in training and research is the topic of an article in a recent issue of *Journal of Behavioral Optometry* (Godnig EC. The tachistoscope – its history and uses. J Behav Optom 2003; 14(2):39-42). Tachistoscope training is sometimes known as flash recognition training. The author identifies four areas of use of the tachistoscope: training to improve reading skills, military and police training, use as a research tool in psychology, and sports vision testing and training.

The author's earliest citations were publications by Bender in 1938 and Renshaw in 1945. The author described the first tachistoscopes as "...shutter aperture devices that allowed precise brief exposures of images to appear on a screen," and noted that these early devices "...have been replaced with computer programs that generate exposure times with more gradations and variable time intervals..."

I can recall tachistoscope training being taught as a technique for improving reading skills when I attended optometry school in the early 1970s. However, the publications the author cites regarding this purpose range in time from 1985 to 1994.

In 1945 Renshaw wrote about using tachistoscope training to help U.S. Navy pilots recognize airplanes quickly and correctly. The author cites a 1959 article on flash recognition training in the law enforcement area. The author discussed tachistoscope training in one police training program in the 1980s. He also pointed out several psychology studies in the 1980s and 1990s that used the tachistoscope as a research tool, and briefly discussed the use of the tachistoscope in sports vision.

D.A.G.

British Optical Association Museum website:

The British Optical Association Museum has an extensive website. Some of the items available and the URLs are:

The British Optical Association Museum,
www.college-optometrists.org/college/museum/index.htm

A brief history of The British Optical Association Museum 1901-2002,
www.college-optometrists.org/college/museum/mushist.htm
At the end of this article, it is stated that "Accounts of the museum's history from which most of this article are drawn, are to be found in an article by J.H. Sutcliffe in the 1932 catalogue and in the *History of the British Optical Association 1895-1978*, by Margaret Mitchell. Some of this information is repeated, more briefly, together with some updated information in the *History of The College of Optometrists*, by Philip Cole and Martin Lynch (published 1999).

Aperture (links to optical history sites),
www.college-optometrists.org/college/museum/aperture.htm
Of particular note is a link that they referred to as "an American article by Dr. Richard Drewery. The best general chronological account of the development of spectacles on the web." The URL for that website is:
www.eye.utmem.edu/history/glass.html

D.A.G.