CJO RCO

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Vol. 49 No. 2 Summer/Été 1987

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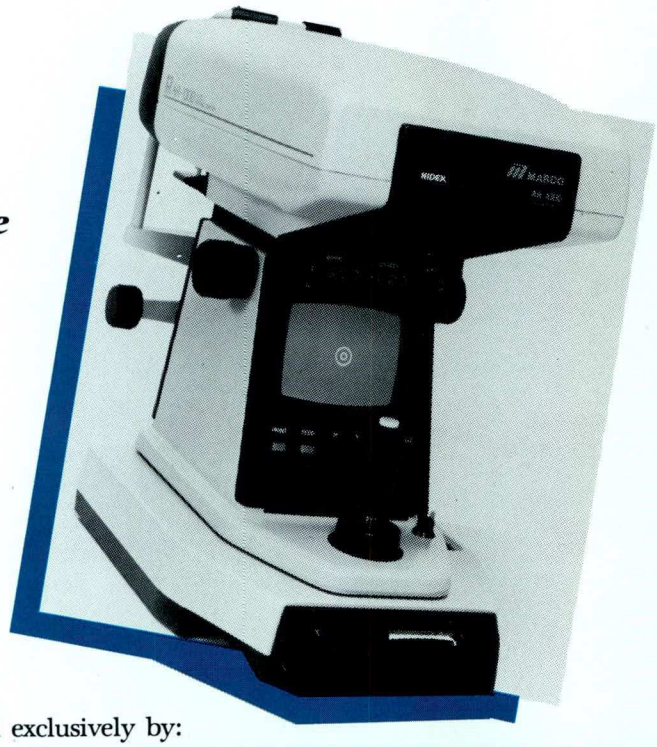

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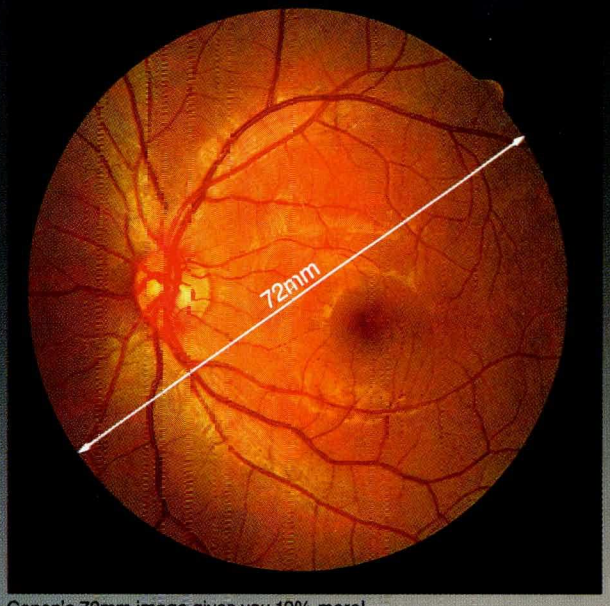

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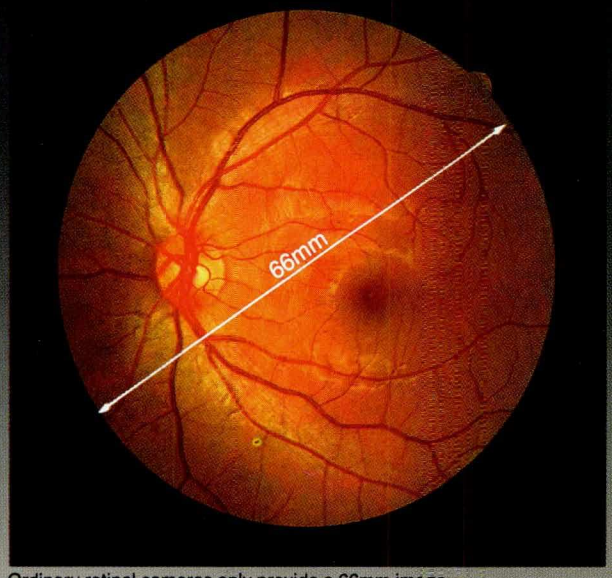

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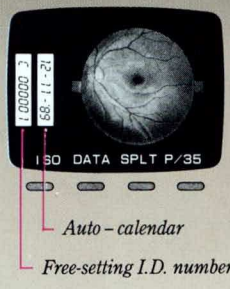

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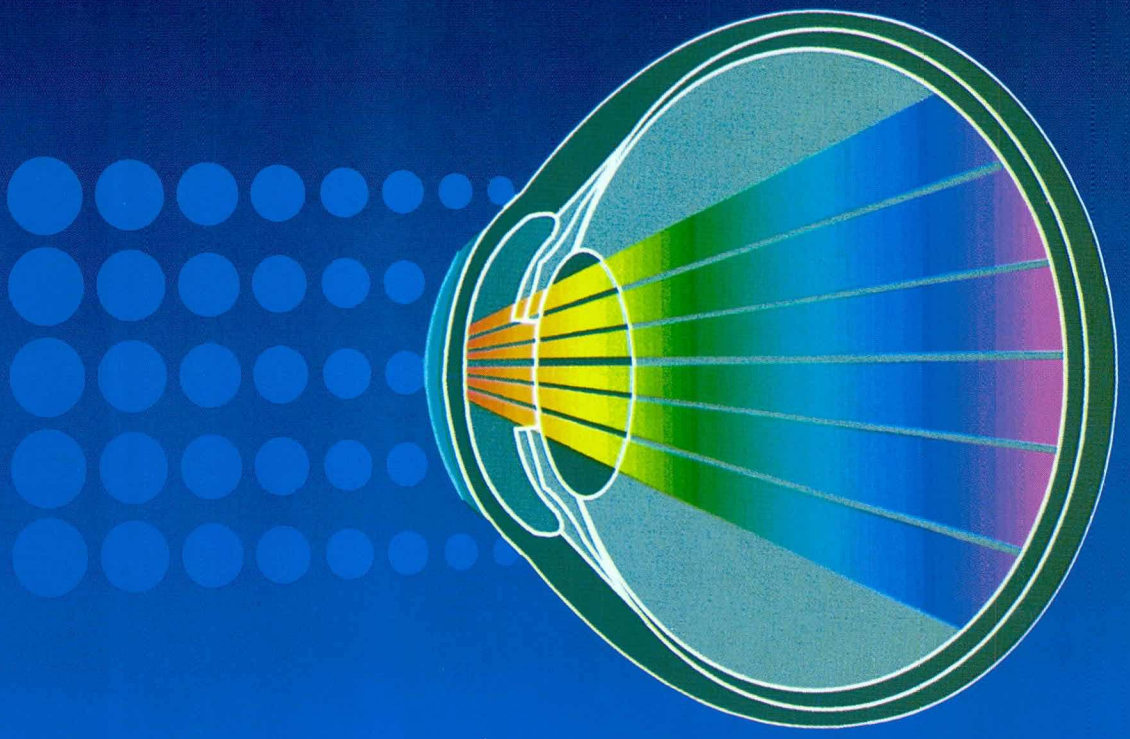

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EDITORIAL/ÉDITORIAL

Low Vision Care

Low Vision Care is based on the fundamental aspects of our training as Doctors of Optometry.

This writer can recall, during his undergraduate years at the College of Optometry of Ontario, that course content was a frequent subject of discussion among members of the student body.

There were the "pragmatists" who argued that a three-year course (as it was then) was too long, that it should be reduced, that only refraction, recognition of disease and practical optics (lenses and dispensing) should be taught.

Then there were the "visionaries" who, with the encouragement of the teaching faculty, maintained that the course was, in fact, too *short* to educate optometrists to care for all the public's vision and eye care needs.

In hindsight, even these thoughts fall short of where optometric education has evolved, but they did confirm a trend, already in its embryonic stages, which ultimately shaped Optometry's role as a primary health care discipline through the next several decades.

Perhaps the idea of a four year course had more to do with attaining a Doctorate degree than with health care *per se*, but it did imply that, the better the training, the more solid the recognition of the profession's services and, as a corollary, the stronger the integrity of its claims to becoming a true, primary health care profession.

We will not at this time even attempt to explain the rationale which caused the various modifications, deletions and additions to our educational programs, but will point out simply that, if any one aspect can be said to call upon the very fundamentals of all our training — it is Low Vision Care.

First, there is the recognition of pathology in either its covert or overt stages, to include subtle changes in colour vision and/or retinal dysfunction, whether detected by electrophysiological or other means.

Of course, one cannot omit the refractive and optical considerations in the form of regular spectacles, special lenses, prescribed optical vision aids and appliances.

But it is in the **human** aspects of Low Vision Care that the optometrist manifests understanding and sympathy, not to mention diplomacy. The fear of blindness or an impending vision impairment is one of the deepest and strongest emotions to which an individual can be subjected.

The psychological trauma which follows demands both comprehension and empathy.

The practitioner who deals with Low Vision patients must necessarily become no less scientific in the course of becoming more human.

There is no need to abandon one's knowledge of perception, vision and eyesight. One, however, must avoid overwhelming the patient with technical explanations. In essence, the practitioner's thinking must change from the concepts of blindness and impaired vision to the concept of Low Vision, which can be helped. The thinking must start from the scientific perspective and extend to the human level . . .

From Low Vision patient to low vision Patient.

Such an attitude demands that the practitioners realize that other health care workers have parts to play in the rehabilitation of the low vision Patient. One needs to understand the nature and the effects of the contributions of these personnel. Once again, the concept of co-operation comes to the forefront as a criterion for the most effective delivery of care to the low vision Patient.

Low Vision Care will become more important as the mean age of our population increases year by year. Optometry is the best trained discipline to care for the modality of human vision. The challenge is there and we *must* accept it as primary health care providers!

GMB

Acknowledgement/ Introduction

As is evident from a glance at the Table of Contents, this issue of the *CJO * RCO* is devoted to the field of Low Vision care.

The profession of Optometry and other ophthalmic disciplines are indebted to Professor George Woo who, last year, saw the realization of a worldwide International Symposium on Low Vision. Conceived and organized by Drs. Woo and Graham Strong of the University of Waterloo's Sight Enhancement Centre, the Symposium proved to be an outstanding success from both the technical and human perspective, reflecting a great interdisciplinary concern for patients with low vision problems.

The papers presented at the Symposium are being published *in toto* in a single volume which will be provided to all registrants who attended the full three days of the Symposium. For practitioners who were unable to attend, or able to attend only part of the program, a copy can be ordered directly from the publisher — a half-page advertisement elsewhere in this issue includes ordering information. The planners displayed great foresight by publishing these papers and making them available to interested individuals.

As the selected papers which appear in this special theme issue of the *CJO* RCO* reveal, concern for the Low Vision patient trancends professional boundaries. They also relate the opinion that Low Vision Services in Canada and, indeed, worldwide, are far from perfect.

Dr. Woo and his colleagues have taken a major step towards improving the lot of the Low Vision patient through this international Symposium and we thank all concerned for their part in this issue's advance look at the published proceedings.

Accompanying one of his early communications on the proposed papers which now appear in this issue, Dr. Woo included a summary of highlights of his own and the Centre for Sight Enhancement's activities at the School of Optometry, University of Waterloo in the area of Low Vision.

It is reprinted in this issue for the interest and information of our historically minded readers.


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Featured in this issue of the
Canadian J. of Optometry

Low Vision

Principles and Applications

Proceedings of the International Symposium on Low Vision, June 1986
Edited by
George C. Woo, O.D., Ph.D.,
Centre for Sight Enhancement, University of Waterloo, Canada

An International Symposium on Low Vision was sponsored by the Centre for Sight Enhancement of the School of Optometry, University of Waterloo, in June 1986, bringing low vision researchers and clinicians together from a number of countries. A total of 44 papers were presented by speakers of note, including Faye, Fonda, and Lovie-Kitchin. The unique feature of the conference is the multi-disciplinary approach towards low vision care—presentations are made from the fields of optometry, opthalmology, psychophysics, special education, nursing and vision rehabilitation. The papers deal with issues in diagnostic science, low vision assessment and rehabilitation. The proceedings volume is ideal for clinicians and vision scientists to update their understanding of low vision research and clinical practice.

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You Can't Score if You Won't Shoot the Puck! or Are We Even in the Game?

A year ago, in Vancouver, optometric leaders from across the country met to explore the implications of innovative marketing, including franchising, on health care professions. Some of the phenomena just then appearing on the Canadian horizon have since developed significantly, as forces to be reckoned with, and Optometry has begun to take a look at what other professions are facing in our attempts to predict and govern our own future.

How prophetic our Vancouver deliberations now appear. We heard and talked about "capitation", a method of financing professional services which has become a "buzz word" in dental meetings this year. It has prompted that profession to mount a million dollar campaign to combat what the Canadian Dental Association (CDA) feels is a major threat to quality dental care.

What is capitation?

Proponents of capitation argue that it offers a realistic control to health care costs and encourages preventive care. Opponents, on the other hand, such as the CDA, are convinced that capitation discourages excellence and ultimately and inevitably will lower the quality of care.

Simply put, it is a sort of global financing concept whereby a funding agency (eg. an insurance company) contracts with a specific group of professionals to provide a complete range of services (eg. dental care) to a closed segment of the population (eg. members of a particular union) for a set amount of money. Payment is based on the number of *potential* participants (total number of insured persons) rather than on the number who *utilize* the service or services provided. Proponents of capitation argue that it offers a realistic control to health care costs and encourages preventive care. Opponents, on the other hand, such as the CDA, are convinced that capitation discourages excellence and ultimately and inevitably will lower the quality of care. There are also horror stories of professionals being stampeded into signing on as "panel doctors" for ridiculously low remuneration out of fear of being cut off from their current patient base. They are then caught in the impos-

Pour compter, il faut lancer! ou Sommes-nous dans le jeu?

Il y a un an, se réunissaient à Vancouver les meneurs de l'optométrie de toutes les régions du pays, dans le but d'explorer les conséquences des nouvelles techniques de commercialisation, notamment le franchisage, sur les professions liées aux soins de santé. Certains des phénomènes qui faisaient alors à peine leur entrée sur la scène canadienne ont depuis connu une expansion considérable et sont devenus des forces à ne pas négliger. Voilà pourquoi les professionnels de l'optométrie ont commencé à étudier ce qui arrivait aux autres professions, afin d'essayer de prévoir et d'orienter notre propre avenir.

Les tenants de la capitation disent, pour appuyer leur thèse, que celle-ci est un moyen réaliste de maîtriser les coûts des soins de santé et qu'elle favorise les soins préventifs.

À la lumière des événements actuels, il semble que les discussions de Vancouver se soient déroulées sous le signe de la prophétie. Il s'est beaucoup parlé de "capitation", une méthode de rétribution des services professionnels qui est devenue très à la mode cette année dans les assemblées de dentistes. C'est ce qui a incité cette profession à mettre sur pied une campagne qui frise le million de dollars, afin de combattre ce que l'Association dentaire canadienne (ADC) considère comme une menace majeure à la qualité des soins dentaires.

Qu'est-ce que la capitation?

C'est tout simplement un concept de rémunération globale par lequel un organisme de financement (p. ex., une société d'assurance) passe, avec un certain groupe de spécialistes, un marché portant sur la prestation d'une gamme complète de services (les soins dentaires, par exemple) à un petit segment de la population (les membres d'un syndicat, par exemple) en contrepartie d'un montant préétabli. Le paiement est fondé sur le nombre **possible** de participants (le nombre total de personnes assurées), plutôt que sur le nombre réel de personnes qui **ont recours** à ces services. Les tenants de la capitation disent, pour appuyer leur thèse, que celle-ci est un moyen réaliste de maîtriser les coûts des soins de santé et qu'elle favorise les soins préventifs. Par ailleurs, les opposants, notamment l'ADC, sont convaincus que la capitation est loin de favoriser l'excellence et, ultimement, qu'elle entraînera inévitablement une baisse de la qualité des soins. On entend aussi des histoires

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sible situation of being unable to afford to provide the care for which they had contracted without a considerable compromise in the quality they are used to providing. To make matters worse, they often find that the fear which forced them to sign on the dotted line was ill founded. Other doctors in the area did not capitulate, as they had been led to believe. Big business can be a rough game which many solo practitioners are ill prepared to play.

Is capitation a dental aberration? Much of what I have just described is happening right now in Optometry south of the border. I heard story after story of the results of such creative health care financing at a primary vision care symposium organized by the American Optometric Association in Atlanta last September. Like it or not, capitation is something which will affect optometry in this country and we can learn much by keeping our eyes open and our heads out of the sand in the months to come.

Medicine is not immune to the entrepreneurial touch either. *Venture*, a CBC TV program, this spring featured a segment on storefront medical centres opening up across the country. Family practitioners, viewers were told, are feeling the effects of these "Muffler Shops" of the medical field and are having to offer extended hours, more accessible locations and higher profiles in the community in order to compete. Such changes are not in themselves bad. But new practitioners complain that the entrepreneurs are skimming off the lucrative "quick fix" procedures, leaving the less profitable, more difficult cases that may require extensive follow-up time being spent by the private practice family physician.

> We are lucky enough to be still in a position to take rational and positive action to secure our future.

It sounds all too familiar, doesn't it?

Many times, as I've spoken with other optometrists, I have heard the lament, "I only get to fit toric and bifocal contacts these days — cases the price advertisers wouldn't touch!".

So what can we do about these problems? Gnashing our teeth won't help. Ignoring them won't make them go away. We are lucky enough to be still in a position to take rational and positive action to secure our future. Our profession is forever facing one crisis or another, but many can be avoided if we *act* before we have to *react*.

When I first mentioned the impact that big business and governments would have on vision care delivery in a President's Podium last fall, I said that "marketing" is a word with which we still have to learn to deal. Once again, we can learn from another profession. The American Dental Association has a film entitled "If I Don't Speak For Myself, Who Will?". In it, a number of missed opportunities for the main character (a dentist in private practice) to inform the public about his profession are dramatized. The chance to speak at a career day at the local high school, to give a talk at the local service club luncheon, to respond in a carefully thought out, positive way to a patient's enquiries and leading questions, to be interviewed on local radio and television were all passed over by our hero. He laments

un peu tristes de spécialistes qu'on a fini par convaincre de signer un contrat moyennant une rémunération ridicule, par crainte d'être coupés de leur clientèle actuelle. Par la suite, ils se trouvent prisonniers d'une situation invivable: ils ne peuvent se permettre de dispenser les soins pour lesquels ils ont signé sans déroger considérablement à la qualité des services qu'ils sont habitués à fournir. Et le pire est qu'ils découvrent souvent que cette crainte, qui les a forcés à signer un contrat n'était pas fondée. Les autres médecins de la région n'ont pas capitulé, contrairement à ce qu'on leur avait fait croire. Dans la grande entreprise, on "joue dur" et les professionnels habitués à travailler seuls y sont mal préparés.

> Dans la grande entreprise, on "joue dur" et les professionnels habitués à travailler seuls y sont mal préparés.

La capitation est-elle une aberration, en dentisterie? Une bonne partie de ce que je viens de décrire se produit actuellement dans le domaine de l'optométrie, au sud de la frontière. J'ai entendu tant et tant d'histoires sur les résultats de ces nouveaux programmes de financement des soins de santé, en septembre dernier, lors d'un colloque sur les soins primaires de la vue organisé par l'American Optometric Association, à Atlanta. Que cela nous plaise ou non, la capitation est un phénomène auquel l'optométrie candienne devra faire face. Dans les mois qui viennent, nous pouvons en apprendre beaucoup sur le sujet, en restant vigilants et aux aguets, au lieu de fermer les yeux et de fuir le problème.

La médecine n'est pas plus à l'abri de l'esprit d'entreprise que les autres secteurs. Dans l'émission *Venture*, télédiffusée au cours du printemps par le réseau d'État, il y avait un reportage sur les «supermarchés médicaux» qui s'ouvrent un peu partout au pays. Les médecins de famille, disait-on aux téléspectateurs, ressentent les effets de ces boutiques «M. Silencieux» du domaine médical et doivent être mieux situés, prolonger leurs horaires de travail et être plus visibles dans la collectivité, pour soutenir la concurrence. En soi, rien, dans ces changements, n'est mauvais. Cependant, les nouveaux professionnels se plaignent que les entrepreneurs absorbent les procédures les plus lucratives, c'est-à-dire les «solutions rapides», laissant aux médecins de famille en pratique privée les cas plus difficiles, offrant moins de bénéfices et exigeant souvent un long suivi.

Cela ne vous semble-t-il pas familier? Quand je discute avec d'autres optométristes, j'entends des plaintes du genre: «Depuis quelques temps, je ne fais que des lentilles toriques et bifocales, des cas que les coupeurs de prix se gardent bien de prendre!»

Que pouvons-nous faire? Il ne sert à rien de grincer des dents. Ignorer les problèmes ne les fera pas s'envoler. Nous avons quand même la chance de pouvoir encore prendre des mesures rationnelles et positives pour garantir notre avenir. Dans notre profession, il en a toujours été ainsi: une crise n'attend pas l'autre, mais nous pouvons éviter bon nombre d'entre elles si nous **agissons** avant de devoir **réagir**.

La première fois que j'ai parlé des effets des grandes entreprises et des gouvernements sur la prestation des soins de la

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about how his profession is not viewed in the public mind in the manner it deserves. The message was subtle, but direct, and it was easier to take when applied to another professional. But it was clear enough. We must start to take the marketing of ourselves and our profession seriously. We must all take a *proactive* approach to let the public know what a caring and cost effective provider of quality vision care is their optometrist.

There are all sorts of ways to market our profession without losing our professional perspective. Tasteless and misleading advertising by "professionals" in jurisdictions where all restraints have been lifted create a mental paralysis which prevents many of us from taking positive steps toward responsible, controlled marketing, so essential if we are to match the efforts of corporate and government entities.

Many marketing projects require only time. Others require an outlay of dollars. Professionals have traditionally viewed the business aspects of their practices as a necessary evil they'd do best to ignore as much as possible. Traditional businesses, however, have a significant portion of their budgets (from 5–50%) set aside for marketing. What do optometrists spend to educate their potential patients? A little fantasizing with a calculator about the untapped potential for an optometric marketing offensive can boggle the mind. For example, if (for ease of calculation) we assume the average optometric practice grosses $200,000.00 and each practitioner budgets a conservative 3% for his or her personal marketing program and contributes an additional 1% toward an institutional marketing campaign, the resulting $30,000,000.00 could go a long way toward getting Optometry's message into the Canadian public's consciousness. A $5,000,000.00 institutional advertising initiative alone could have a phenomenal impact. Maybe all it will take to secure our futures is a little basic business sense.

Dr. Scott D. Brisbin
President

vue, l'automne dernier, dans la Tribune du Président, je disais que nous devions apprendre la signification et l'utilité du terme «commercialisation». Encore là, nous pouvons tirer parti de l'expérience d'une autre profession. L'American Dental Association a un film intitulé *If I Don't Speak For Myself, Who Will?* qui présente, sous forme théâtrale, un certain nombre d'occasions ratées par le personnage principal (un dentiste en cabinet privé) d'informer la population au sujet de sa profession. Le héros du film manque toutes sortes d'occasions de prendre la parole au cours d'une journée des professions, à l'école secondaire locale; de prononcer une allocution au déjeuner d'un organisme local de service; de répondre de façon positive et en pesant ses mots aux demandes d'un malade et à ses questions inductives et d'être interviewé par la radio et la télévision locales. Il se plaint de ce que sa profession n'est pas perçue comme elle le mérite par la population. Le message était subtil, mais direct, et plus facile à saisir en l'appliquant à une autre profession. Ce message était pourtant assez clair. Nous devons prendre sérieusement en main la commercialisation de notre profession . . . et de nous-mêmes. Nous devons tous devancer les événements et faire savoir à la population à quel point leur optométriste se soucie de sa clientèle et est capable de lui fournir de façon rentable des soins de la vue de qualité.

Il existe toutes sortes de moyens de faire la promotion de notre profession, sans perdre de vue notre professionnalisme. La publicité trompeuse et dénuée de goût menée par des "professionnels", là où toutes les restrictions ont été levées, crée une paralysie intellectuelle qui empêche beacoup d'entre nous de prendre des mesures positives vers une commercialisation responsable et contrôlée, absolument essentielle pour contrebalancer les efforts des grandes sociétés et des organismes gouvernementaux.

Nombre de projets de commercialisation n'exigent que du temps. D'autres impliquent une mise de fonds. Les spécialistes ont toujours considéré l'aspect affaires de leur profession comme un mal nécessaire qu'il vaut mieux ignorer dans la mesure du possible. Cependant, les entreprises traditionnelles consacrent une part considérable de leur budget (de 5% à 50%) à la commercialisation. Que dépensent les optométristes pour éduquer leurs clients éventuels? Il suffit de prendre une calculette et de poser quelques hypothèses sur le potentiel, encore inutilisé, d'une offensive de commercialisation de la part des optométristes: c'est à couper le souffle!

Pour faciliter les calculs, supposons, par exemple, que le chiffre d'affaires brut d'un cabinet d'optométrie se situe en moyenne à 200 000 $ et que chaque optométriste budgétise un modeste 3% pour son propre programme de commercialisation, tout en réservant un autre 1% à une campagne menée par la profession: les 30 millions de dollars qui en résulteraient permettraient certainement de faire passer le message des optométristes dans la population canadienne. À lui seul, un programme de publicité de 5 millions de dollars pour la profession dans son ensemble pourrait avoir un effet phénoménal. Il est possible que tout ce dont nous ayons besoin pour assurer notre avenir se résume à ceci: une petite dose de gros bon sens en affaires.

Le président,
Dr Scott D. Brisbin

Some Selected Dates and Events from the History of the Centre for Sight Enhancement

George C. Woo, O.D., Ph.D.

July 1967: The School of Optometry became a reality. The formerly independent College of Optometry of Ontario moved from Toronto, and became an integral part of the Faculty of Science, University of Waterloo.

July 1970: Dr. George Woo was appointed as an Assistant Professor at the University of Waterloo. After graduating from the College of Optometry of Ontario in 1964, he practised Optometry with The Canadian Red Cross Society for two years. Subsequently he enrolled as a graduate student at Indiana University where he received his M.Sc. (1968) and Ph.D. (1970) degrees in Physiological Optics.

September 1971: Through several discussions with Dr. E.J. Fisher, the Director of the School, and Dr. M.E. Woodruff, the Clinic Director, it was decided that Dr. Woo should be responsible for a specialty area in the School of Optometry called low vision. He was to commence work in this area as a consultant.

May 1972: Dr. W. Feinbloom visited the University of Waterloo. There were several evening clinics held. A large number of patients attended these clinics, and after Dr. Feinbloom's departure, Dr. Woo was asked to follow up these low vision patients. This was the beginning of an active low vision clinic at the school.

September 1972: After a year's experience in the low vision area, a half day clinic was set aside to serve the partially sighted. Students were scheduled to rotate through this clinic whenever possible.

January 1974: A didactic course on low vision was initiated at the School of Optometry. Dr. Woo has been the sole instructor for the course, except for 1984 when he was on a sabbatical leave and the course was taught by Dr. Graham Strong.

June 1974: To further his interest in low vision, Dr. Woo visited Professor Louise Sloan at the Wilmer Institute of Ophthalmology at the Johns Hopkins University for an extended period of time. Throughout this time Drs. Sloan and Woo conferred daily, looking after low vision patients' needs.

December 1975: Dr. Woo completed the requirements for the diplomate in low vision, sponsored by the American Academy of Optometry. The program included written, oral, clinical and practical examinations. He wrote his final examination at the College of Optometry of the Ohio State University, and became the only Canadian optometrist to hold this qualification in the last decade.

September 1976: Dr. John Jantzi became a clinician at the School of Optometry with part time duties in the low vision clinic. He graduated from the School in 1974, winning the first general proficiency prize. After a year of private practice, he returned to the University. In the next four years, he completed a residency in low vision and an M.Sc. degree in Physiological Optics, in addition to serving as a low vision clinician. He moved to Vancouver, British Columbia in 1980, where he maintains a low vision practice.

January 1977: Dr. Woo took a sabbatical leave for six months. He visited the University of Melbourne, the University of New South Wales and Queensland Institute of Technology. In addition, he served as a consultant optometrist at Kooyong's Low Vision Clinic of the Association of the Blind in Victoria. The Kooyong Clinic is generally regarded as the best interdisciplinary low vision clinic in the world.

September 1979: Dr. Dagmar Lutzi, a 1978 graduate of the School of Optometry, served as a part time low vision clinician for two academic years. Dr. William Bobier, also a 1978 graduate of the School of Optometry, served as a part time low vision clinician for an academic year.

September 1978: Dr. Woo was invited to become a member of the Waterloo Regional Advisory Board of the CNIB. He remained in that position for five years before Dr. Strong replaced him in June, 1983.

September 1979: Dr. J. Graham Strong, who graduated from the School of Optometry at the University of Waterloo in 1970, returned to Waterloo to become a clinic supervisor in 1979. He served part time as a low vision clinician. In 1983, he completed an M.Sc. degree in Physiological Optics. A year later he became an assistant professor. In 1985, he became the Chief of Clinics at the School of Optometry. He is still maintaining an interest in low vision.

September 1981: Dr. Rodger Pace, who graduated from the School of Optometry in 1974, has been a clinical supervisor for a number of years. After graduation, he served as a resident in the clinic, then in private practice and subsequently returned to clinical duties in the School. While he was a student, he earned top honours in his year. In 1985, he enrolled in the diplomate program in low vision. Most likely, he will be the second Canadian optometrist possessing a diplomate in low vision.

June 1982: Dr. Eleanor Faye visited our low vision clinic and gave continuing education courses.

August 1982: Dr. Woo was invited to serve as a consultant to the Optometric Institute of Toronto. He served as the chief of low vision for three years until August 1985. During this period, he spent one day each month attending low vision patients at the Institute.

June 1983: The Ministry of Health of the Government of Ontario invited Dr. Woo to become a member of the Assistive Devices Program. Due to his sabbatical leave, he was unable to serve. Dr. Strong was invited to take up the position on the ADP committee. Shortly afterwards, the ADP program for optical aids was implemented and an ADP high technology

equipment grant was awarded to the Centre for Sight Enhancement in September 1984.

June 1983: Dr. William F. Long, associate professor of Optometry at the University of Missouri worked with Dr. Woo at the Low Vision Clinic for a period of six weeks. A joint research project was completed in that period.

August 1983: The Saskatchewan Association of Optometrists invited Dr. Woo to serve as a consultant to the establishment of an interdisciplinary low vision clinic. Subsequent to his visits, the first Canadian Ophthalmology-Optometry Low Vision Clinic was in operation at Regina's Pasqual Hospital. Drs. D. Turnbull and D. Monea are low vision clinicians having full hospital privileges.

September 1983: Dr. Woo took his second sabbatical leave, as a visiting professor at the Pennsylvania College of Optometry, and a consultant to the various low vision units attached to the College until December 1984. From January 1984 to April 1984, he was a visiting scholar at Cambridge University's Department of Physiology, and the Addenbroke Hospital.

September 1983: Dr. Keith Ames, a graduate from the College of Optometry, The Ohio State University, served as a low vision clinician until May 1984.

August 1984: Dr. Ann Plotkin, a graduate of Pennsylvania College of Optometry, completed her low vision residency at the Eye Institute of PCO in 1984 and joined our school as a clinical supervisor. Dr. Lois Calder, a 1980 graduate of the School served as part-time clinician in the Low Vision Clinic until May 1985. She served as a low vision clinician in the month of December 1985.

October 1984: Dr. Lea Hyvarinen visited the Low Vision Clinic and gave continuing education courses in June 1985 and 1986.

October 1984: The Kurzweil reading machine was relocated from the University library to our Opto-Electronic Sensory Aids room. Room 149 was added to the Clinic. The donor, Mrs. Elizabeth Burton, visited the area several times in early 1986.

October 1984: Dr. Woo was invited to become a member of the Committee on Low Vision of the Ministry of Community and Social Services. In the following 6 months, a series of meetings was held. Subsequently, 3 positions at the Centre for Sight Enhancement were funded by the Ministry of Community and Social Services.

January 1985: An official opening of the Centre for Sight Enhancement was conducted by Mr. Dennis Timbrell, former Ontario Minister of Health responsible for setting up funds for the Assistive Devices Program. Others in attendance included The Honorable Walter McLean, Secretary of State of the Federal Government, Herb Epp, M.P.P. for Waterloo, and Dr. D. T. Wright, President of the University. Within the Centre, there are three components: clinical services, research and opto-electronic sensory aids.

January 1985: The CNIB provided a part time nurse to serve at our Centre for Sight Enhancement, on a six month experimental basis. Mrs. Claudia Day filled that position.

February 1985: Mrs. Mary Hall, a secretary typist funded by The Ministry of Community and Social Services, joined the Centre for Sight Enhancement. She left the Centre in March 1986. Mrs. Judy Li replaced her in May 1986.

April 1985: Mr. Alan Pope, then the Ontario Minister of Health, visited the Centre for Sight Enhancement with many encouraging remarks.

May 1985: Ms. Kris Trotter, a technologist funded by The Ministry of Community and Social Services was hired for our Centre. She continued to serve as a part time technologist at the Centre until December 1986.

June 1985: Ms. Karen Cassidy, our interim social worker, funded by The Ministry of Community and Social Services, joined our Centre. She has been replaced by a permanent social worker, Mrs. M. Visser, on July 22, 1985.

June 1985: Dr. Jan Kitchin from Queensland Institute of Technology conducted a joint research project with Dr. Woo. In addition she served as a consultant to our Centre for Sight Enhancement. She also participated in our Continuing Education program.

July 1985: Ms. Lynne Hanna, our first administrator for the Centre for Sight Enhancement, joined us on July 15th, replacing Mrs. G. Smith, who shall be working in the School part time.

January 1986: Barry Turner, a physics student, conducted a research project on the Magnilink under the supervision of Dr. George Woo (January to April 1986).

April 1986: Funding from the Ministry of Community and Social Services was renewed for an additional year.

May 1986: Judy Li joined the Centre as our new Secretary, funded by the Ministry of Community and Social Services. She resigned in April 1987 to join her husband in Montreal.

June 1986: The Centre for Sight Enhancement was host to the first Canadian Iternational Symposium on Low Vision. This three day event attracted 170 registrants from 10 countries and speakers of international repute in Optometry, Ophthalmology and Vision Rehabilitation. The organizers of the event included Drs. G. Woo, R. Pace and Ms. Hanna.

October 1986: Pauline Bevers joined the Centre staff as the Low Vision Assistant, funded by the Ministry of Community and Social Services. She replaces Kris Trotter.

October 1986: Terry Bray, a blind individual, came to the Centre from Vocational Rehabilitation Services for a six week occupational assessment. During this period, he wrote a report on the use of the Kurzweil Reading Machine for the Blind.

April 1987: Ms. Lynne Hanna resigned her position as Co-ordinator of the Centre.

A Hierarchy of Perceptual Training in Low Vision

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1. Introduction

A growing concern in low vision care is whether people afflicted with a visual impairment can adapt to their condition and relearn to perform lost functional abilities. A purely sensory-physiological approach to this issue is restricted because 1) low vision patients often have below what is normally assumed as the basic necessary sensory input for many functional tasks (e.g. reading) and 2) in many cases, such an approach assumes a lack of plasticity past a critical period of acquisition. An alternative approach is that there is some useful plasticity or ability to relearn at all ages even though they may differ quantitatively and/or qualitatively.

> The low vision patient is often faced with the dual task of coping with the onset of visual loss and the adaptation to visual aids.

In 1950 Gibson[1] summarized many studies demonstrating that perceptual judgement tasks can be improved either by practice or training for adult observers. Other reports in the perceptual literature show that the visual system has a remarkable ability to compensate for artificially distorted images[2,3]. The low vision patient is often faced with the dual task of coping with the onset of visual loss and the adaptation to visual aids. A recent report[4] has demonstrated that an individual, restored from blindness in adulthood, can readjust and acquire limited perceptual abilities at a time in life which is long past the critical period of childhood visual development. It is also well accepted in the field of low vision, though not well researched, that some training programs can help a number of individuals to use visual aids more efficiently and perform perceptual tasks with better ease. In the late 1970's Goodrich and coworkers[5,6] demonstrated with a variety of techniques that low vision patients can use to improve the use of their residual vision.

> The question we asked was whether a hierarchical model such as the one proposed by Barraga and her colleagues has any implications for the impaired adult visual system.

Quillman *et al.*[7] demonstrated that the Frostig Figure Ground test was a useful predictor of reading efficiency. This prompted researchers from our laboratories to look into the efficiency of this test in predicting perceptual function capabilities under training and non-training conditions[8,9]. An interesting finding was that the Frostig Figure Ground was a good predictor of how well patients will adapt to their visual aids. For instance two females of the same age with visual acuities of 6/21 (20/70) in the better eye and under 6/60 (20/200) in the worse eye, who were prescribed the same correction upon a clinical assessment (+8.00 D spectacles), scored very differently on the Frostig. The one who scored best came back a few weeks later very satisfied with the prescription while the other was quite dissatisfied with the aid. A possible explanation for these results is that some kind of functional hierarchy is present where the ability to perform a "lower" level visual task is a precondition and/or a predictor of "higher" levels of visual performance.

Barraga and her colleagues[10,11] have attempted to systematize the study of visual impairment in childhood development. They proposed a hierarchy of perceptual development in the normally sighted child. They also state that the visually impaired individual follows the same pattern but is slower to progress from one level to another. The question we asked was whether a hierarchical model such as the one proposed by Barraga and her colleagues has any implications for the impaired adult visual system and whether it could explain some of the results mentioned above. To determine this the following steps are warranted. First, the development of testing and training materials which are specific to the different levels. Second, it is important to determine what level or levels of the visual hierarchy are affected by visual pathology. Thirdly, whether such a functional model is sequential in the adult system is of theoretical and practical interest. In other words, if an observer is functionally impaired at level 5, does this presuppose a functional impairment at all subsequent levels or is it level/task specific? If sequential, it is theoretically possible that training one level may improve the adjustment of subsequent levels.

Recently an attempt has been made to develop testing and training materials which represent 8 stages based on Barraga's hierarchy[12,13]. This report is a description of the testing materials developed so far and some preliminary findings. The following stages represent the hierarchy in question:

1. Visual attention: the ability to localize visual targets is tested.
2. Efficient eye movements: the patient's ability to track a moving light is tested.
3. Manipulation of concrete objects to match model: an example of this kind of task can be represented by the block

design subtest of the Weschler Adult Intelligence Scale (WAIS).

4. Copy/draw shapes from a model: stimulus configurations from the Bender Gestalt test of visual perception and similar test patterns can be used.
5. Match single element picture to complex picture: elements such as the picture completion subtest from the WAIS can be used in a modified fashion so that the test is multiple choice.
6. Figure-Ground discrimination: the baseline measure for this level is the Frostig Figure Ground test.
7. Letter and word recognition: materials have been specifically developed for the last two levels.
8. Reading efficiency.

2. Methods and Results

The first two levels of the hierarchy are essential for any progress in functional vision to occur. What is assessed by these levels is the patient's ability to perceive gross targets such as a card or bright light. On the second level a basic assessment is made of the ability of the patient to follow the target mentioned. The task does not involve sophisticated eye movement analysis such as saccades but rather the test is one of smooth pursuit. The question is whether there is enough light perception and visual stability to perform this task. The great majority of the people seen so far can perform these tasks without great difficulty. The third level is presently in development but a task such as the block design subtest of the WAIS fits the description of this level well. The unique difficulty present at this level is the concept of 3 dimensions and handling of concrete objects on several planes simultaneously. It is often the case in low vision patients that binocular vision is not the best functional vision to use. Perhaps assessment of depth perception may be required for this level.

From the third level on, many sublevels of difficulty can be envisaged in the hierarchy. For instance at the fourth level (copy/draw), the reproduction of a dot pattern (see Fig. 1) was designed along with a straight line pattern demonstrated in Fig. 2 and part of the Bender Gestalt test (see Fig. 3) has also been used.

Clearly the difficulty level is different for each test pattern. This represents one of the main difficulties in designing testing and training materials of different levels. A consensus of what is difficult or not warrants a large amount of data collection.

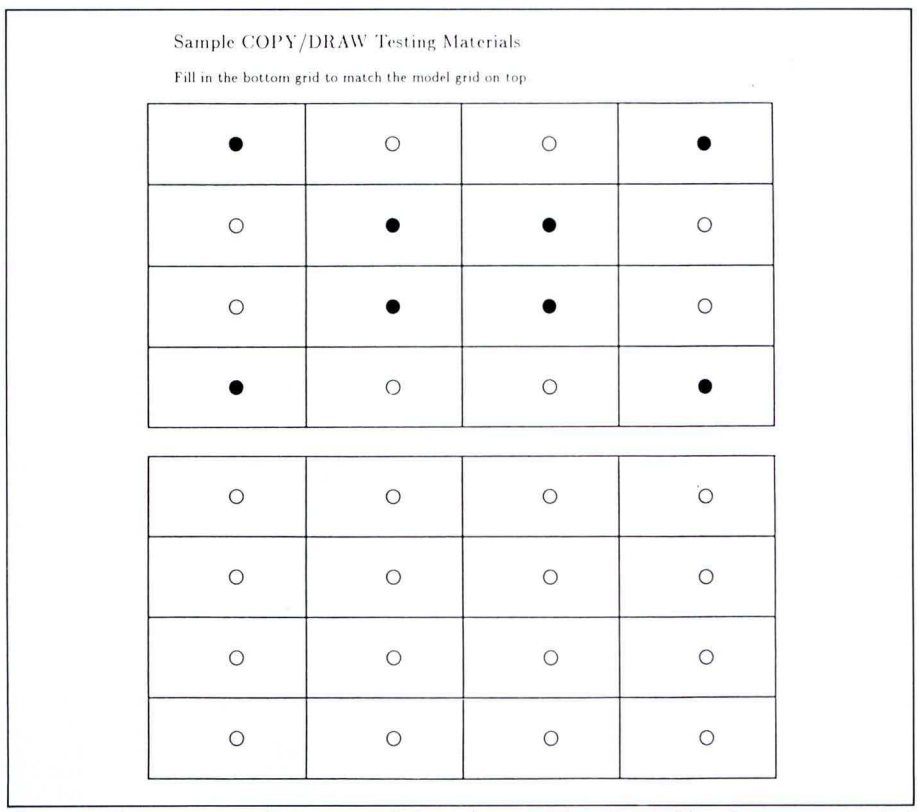


Figure 1. Dot matrix configuration task from the copy/draw level. The observers are asked to reproduce the pattern seen in the upper grid in the bottom one.

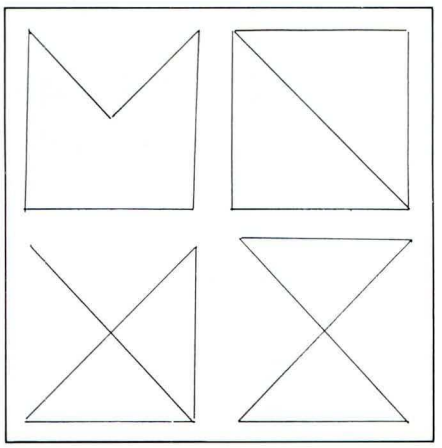


Figure 2. Straight line configuration task from the copy/draw level. The observers are asked to reproduce these 4 patterns on a separate sheet of paper.

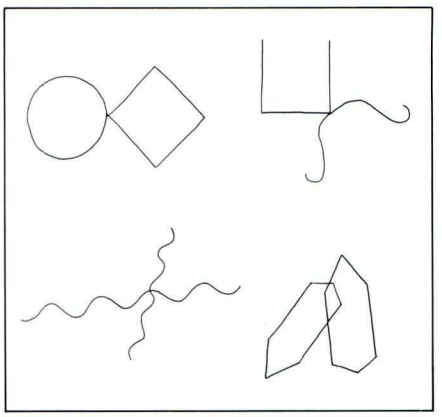


Figure 3. Bender configuration task from the copy/draw level. The observers are asked to reproduce these 4 patterns on a separate sheet of paper.

Several testing materials have been developed for the fifth stage of the hierarchy. Figures 4, 5, 6 and 7 demonstrate some of the tasks of various difficulty.

The bars test (Fig. 4) should be the easiest to perform followed by the target match (Fig. 5) and the tests derived from the WAIS picture completion test which we transformed into a multiple choice task (Figs. 6 and 7).

The sixth level inevitably involves the Frostig Figure Ground test mentioned previously. An example of a different type of figure-ground task is given in Fig. 8. This is a sample of the usual test which contains 25 numbers.

The task is to trace with a pencil from one circled number to another. At a given time the target number becomes the "figure" and the surround is the "ground". The "figure" and "ground" components in this test interchange roles during testing.

Figures 9 and 10 demonstrate letter recognition tasks and Fig. 11 is a word recognition task.

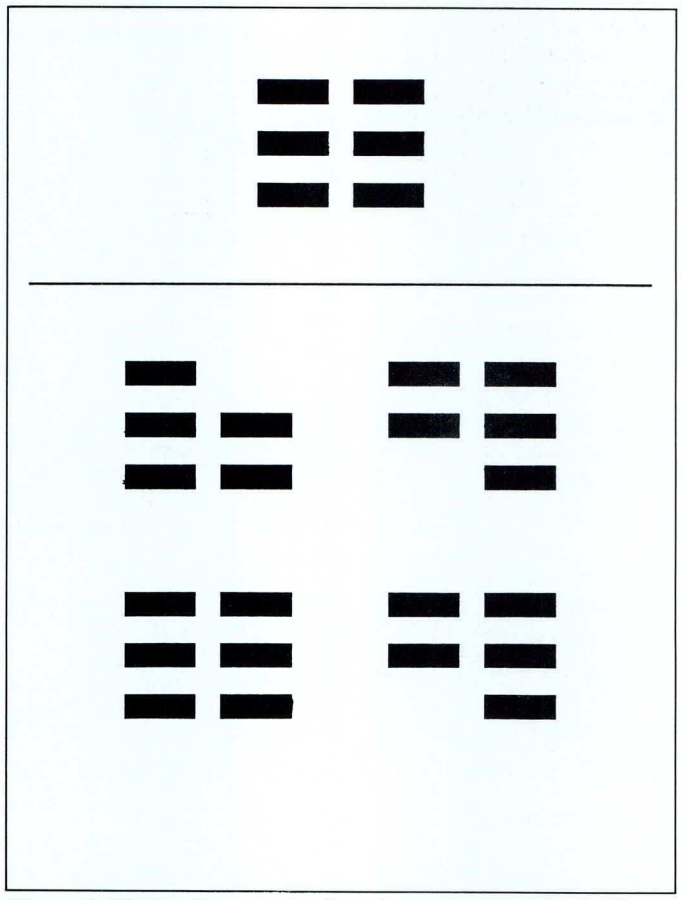


Figure 4. Missing line exercise from the target match level. The observers must identify the pattern in the 4 bottom choices which match the top pattern.

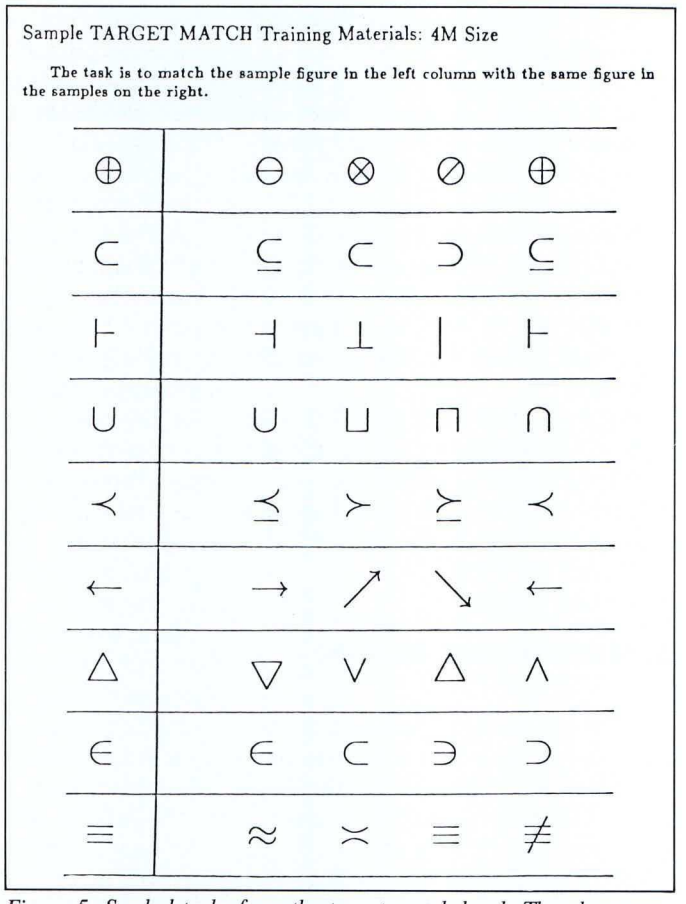


Figure 5. Symbol tasks from the target match level. The observers must identify the correct symbol in the 4 choices on the right to match the target symbol on the left (from Goodrich and Mehr[14]).

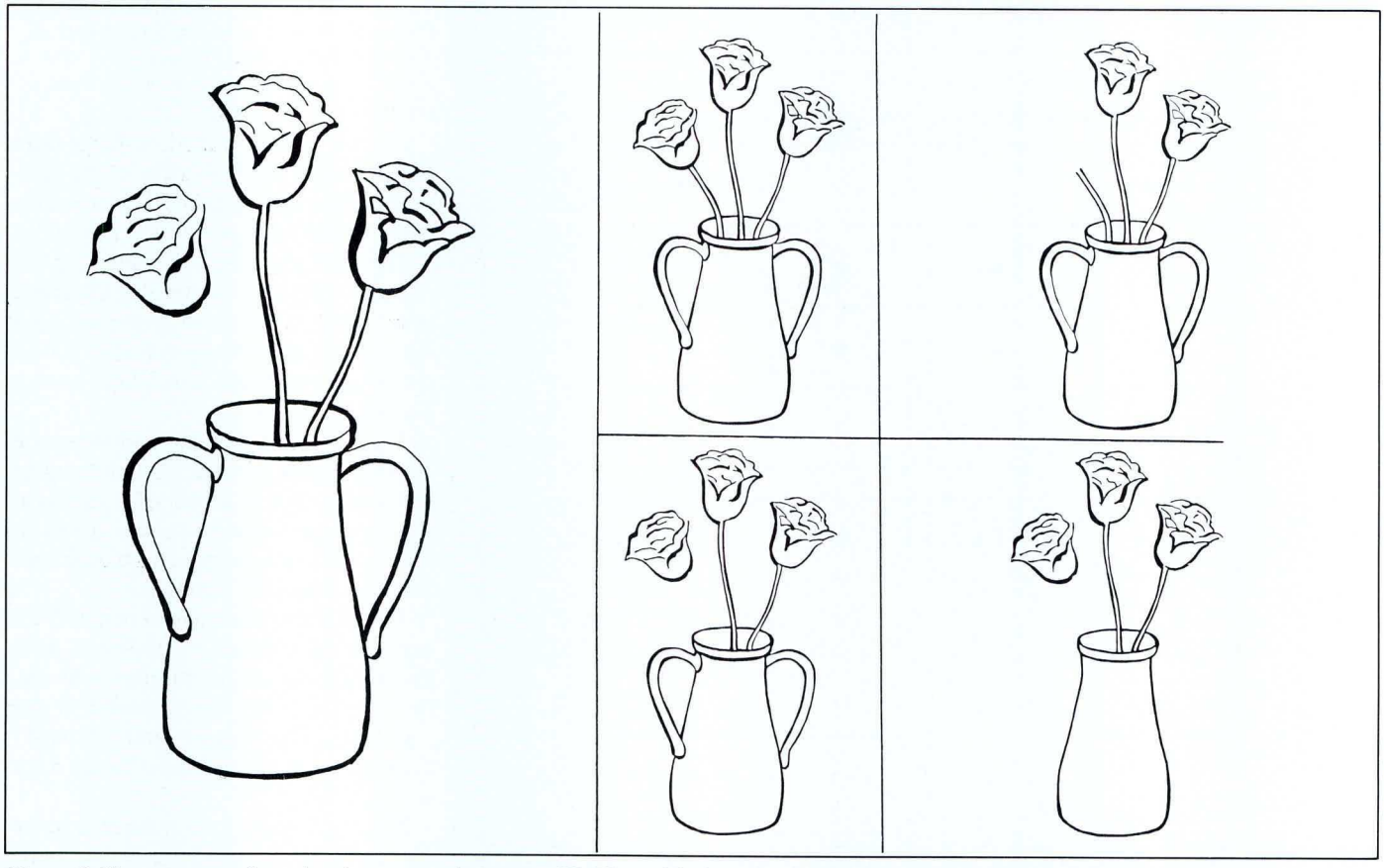


Figure 6. Flower pattern from the picture completion test (WAIS) modified to allow a multiple-choice response for the target match level.

In the letter recognition the observer is requested to identify a target letter, for example the letter "i" in Fig. 9 and "y" in Fig. 10. The word tasks require the observer to find every word in the sentence within the bottom paragraph of meaningless words (Fig. 11).

We confirmed the results obtained from previous studies stating that the Frostig Figure Ground is a good predictor of reading performance and related tasks.

Preliminary data in the form of Spearman Rho correlations of 25 patients who had completed most of these tests, demonstrate weak correlations except for the conditions of Frostig Figure Ground and all the tests in levels 7 and 8 which produced correlation coefficients between +0.56 and +0.80. In other words, we confirmed the results obtained from previous studies stating that the Frostig Figure Ground is a good predictor of reading performance and related tasks. The production of testing materials is not complete and final conclusions on the validity of each measure and how they relate is premature.

It is hoped that a systematized approach to testing and training visual functions of low vision individuals will bring about dividends in the future.

3. Discussion

Testing low vision patients with evaluative tools such as the ones just described can provide insights for future training designs on the basis of the different approaches taken by the observers. An example of this can be given by comparing the performance of two patients whom we will identify as X and Y. X and Y are both males of approximately the same age with 6/120 (20/400) in the better eye. X had a good Frostig result and Y had a bad result. The approach taken by X could be identified as "thinking his way through". When tracing a star he assumed correctly that there were so many even points and thus could trace more appropriately. It was clear that Y could not adjust to the Frostig task. When they were tested on the letter and word recognition tasks, patient Y could not do them at all. The results of patient X are demonstrated in Figs. 12, 13, 14 and 15.

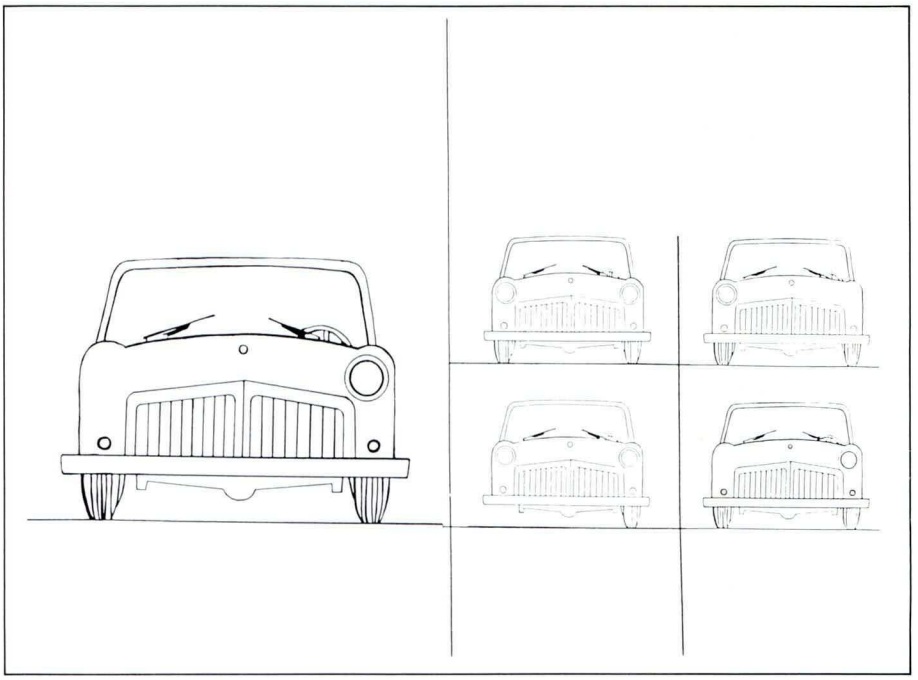


Figure 7. Car model from the picture completion test (WAIS) modified to allow a multiple-choice response for the target match level.

A demonstration of his strategy for identifying the "y"s was shown to us by the patient and can be seen in Fig. 14. He would look for the "tail end" of the "y" which was very different from the "g". In the word recognition task it is clear from Fig. 14 and 15 that patient X was tracing from one consonant to the other such as a "d" and a "t", to determine the correct word. For example, when searching the word "doesn't" in the phrase, a horizontal line was drawn between the "d" and "t" of "don't" and "doesn't" which, by the difference in length, helped recognition of the appropriate word. X also was able to read the standard text in 9 minutes and 31 seconds.

What this tells us is that 1) an individual who theoretically should not have been able to read was able to do so with highly strategic maneuvers, and 2) training observers to be more attentive to pattern details of words may enhance their performance. Ideally, after systematic training this could become second nature and not necessitate conscious attention on the part of the reader.

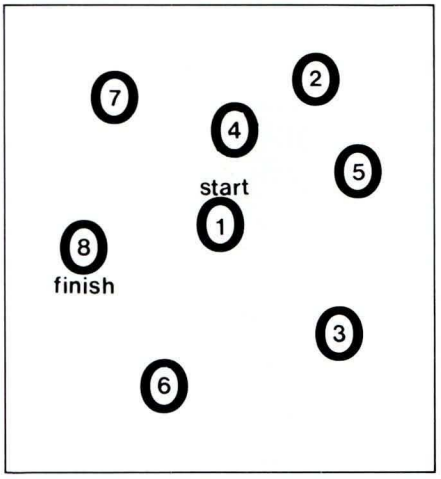


Figure 8. Sample of tracing number task for the figure-ground level. The observer must trace from one number to another. The actual test contains 25 numbers.

An attempt was made to describe the ongoing activities of a long term joint project between two low vision service centers. It is hoped that a systematized approach to testing and training visual functions of low vision individuals will bring about dividends in the future. This would enable related professionals to understand the dynamics of low vision and to speak "the same language" and thus improve services in this area.

4. References

1. E.J. Gibson: Improvement of perceptual judgements as a function of controlled

Patient Name or Code: _____ Date: _____

Low Vision Clinic (check 1):

[ ] Palo Alto [ ] Berkeley [ ] Houston [ ] New York [ ] Montreal

Find the "i's":

lllllll llllll lilll llll llllil llll i llll llill llll llil
llill llllll lll lllllll lill llliil lll llllill lll llllll
lll ill llllil llll lilll llll llllll lill llll llli llll
lilllll llill llllll llllil llll llli llllll llll illll lll

Number of "i's" found: _____

Time to complete: _____

Comments:

Figure 9. Example of letter search task. Observer must identify the "i"s embedded within the "l"s.

Patient Name or Code: _____ Date: _____

Low Vision Clinic (check 1):

[ ] Palo Alto [ ] Berkeley [ ] Houston [ ] New York [ ] Montreal

Find the "y's":

ggggygg gggg ggy gggg ggygg ggyggg
gyggg ggy gggggg gyggg gggygg gggg
ggggg gygg gyggggg ggggy gyg ggggg
gggg gggggy gygg gggygg gggg gyggg

Number of "y's" found: _____

Time to complete: _____

Comments:

0.2in

Figure 10. Letter search task where the observer must identify the "y"s embedded within the "g"s.

Get some extra milk, eggs, and fish when you shop today.

Got Get Go gone some soon extra exert melt milk malt eyes eggs east and end fish fine what where when you year shop ship today toast

Min ___ Sec ___

Jack, who always cries, and his friend, who doesn't, were lost.

Jack Joke Jake who why how away always after cry cries crisis and this her his kind friend find who don't doesn't where were last lost

Min ___ Sec ___

Figure 11. Example of word search task. The observer must identify the words in the nonsense paragraph below which make up the target sentence.

Patient Name or Code: _____ Date: _____

Low Vision Clinic (check 1):

[ ] Palo Alto [ ] Berkeley [ ] Houston [ ] New York [ ] Montreal

Find the "i's":

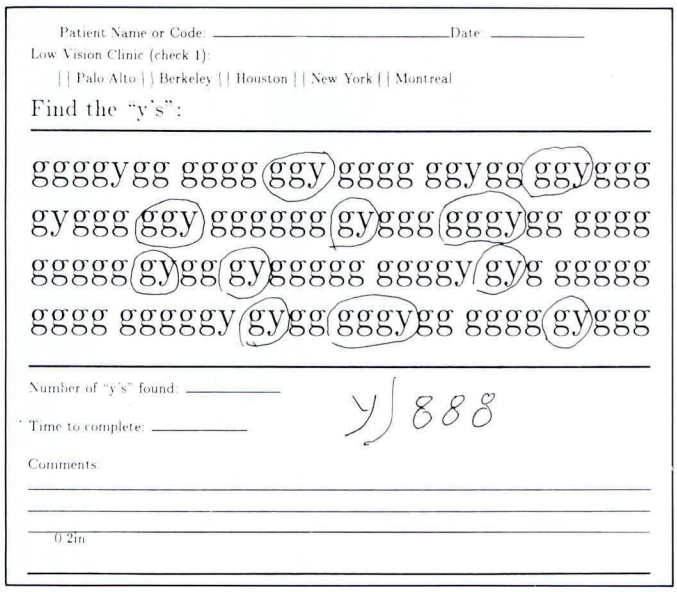
llllll llllil illl llll llllil llllil illll llill llll llil
llill llllll lll lllllll lill llliil lll llllill lll llllll
lll ill llllil llll lilll llll llllll lill llll llli llll
lilllll llill llllll llllil llll llli llllll llll illll lll

Number of "i's" found: _____

Time to complete: _____

Comments:

Figure 12. Results of patient X in the "i" letter search task.


Patient Name or Code: _____ Date: _____

Low Vision Clinic (check 1):

[ ] Palo Alto [ ] Berkeley [ ] Houston [ ] New York [ ] Montreal

Find the "y's":

ggggygg gggg ggy gggg ggygg ggyggg
gyggg ggy gggggg gyggg gggygg gggg
ggggg gygg gyggggg ggggy gyg ggggg
gggg gggggy gygg gggygg gggg gyggg

Number of "y's" found: _____

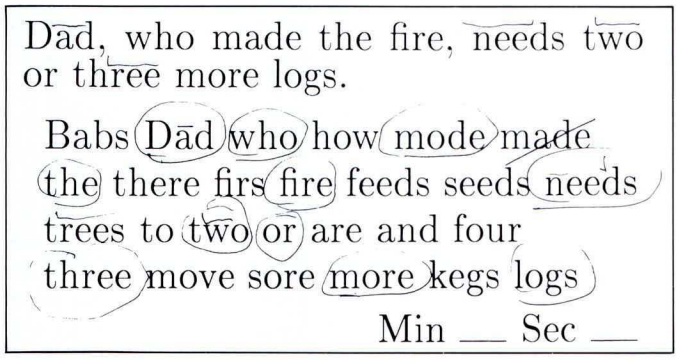
Time to complete: _____

Comments:

0 2in

y 888

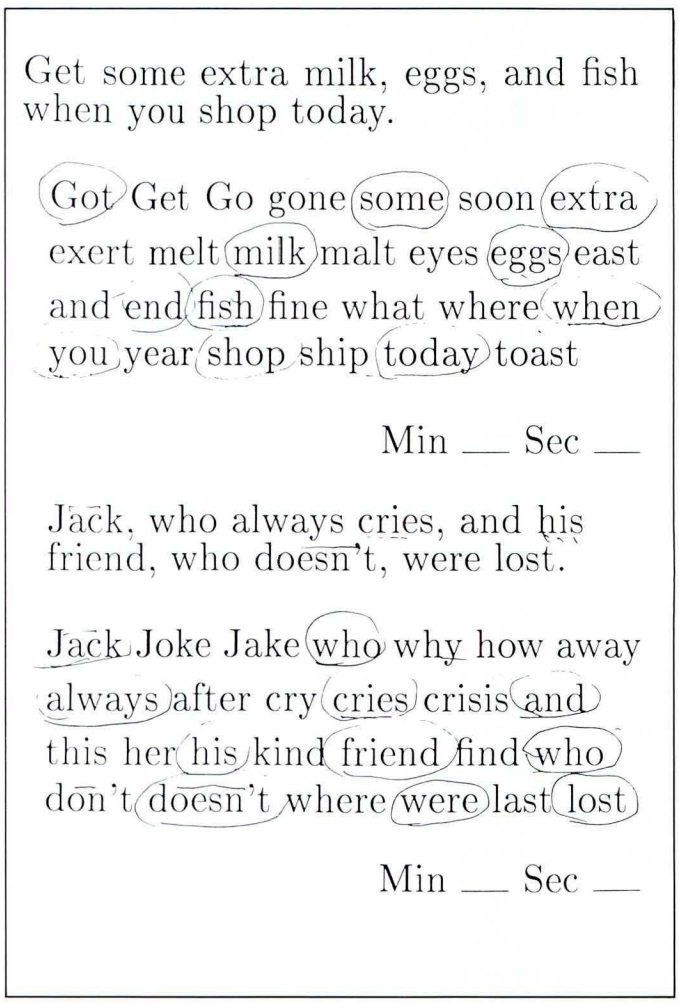
Figure 13. Results of patient X in the "y" letter search task.


Dad, who made the fire, needs two or three more logs.

Babs Dad who how mode made
the there firs fire feeds seeds needs
trees to two or are and four
three move sore more kegs logs

Min ___ Sec ___

Figure 15. b) Results of patient X in the word search task.


Get some extra milk, eggs, and fish when you shop today.

Got Get Go gone some soon extra
exert melt milk malt eyes eggs east
and end fish fine what where when
you year shop ship today toast

Min ___ Sec ___

Jack, who always cries, and his friend, who doesn't, were lost.

Jack Joke Jake who why how away
always after cry cries crisis and
this her his kind friend find who
don't doesn't where were last lost

Min ___ Sec ___

Figure 14. a) Results of patient X in the word search task.

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An Overview on the Use of a Low Magnification Telescope in Low Vision

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1. Introduction

A Galilean telescope in its simplest form is a two element system consisting of a positive lens as an objective and a negative lens as an eyepiece. The system is restricted to lower magnifications and smaller fields of view in comparison with a Keplerian telescope. The image through the system, however, is always erect permitting its use for distance viewing for partially sighted patients. Other optical factors besides magnification and field of view that need to be considered include exit pupil size, focus adjustability, vertex distance, and image quality in terms of color and brightness. Such non optical factors as weight, portability, ease of use, appearance and cost are also influencing variables[1]. In this overview on the clinical use of low power telescopes in the examination room, only a few properties will be examined. The use of a low power full-field telescope in subjective and objective refractions will be discussed. Magnification through a telescope will also be elaborated upon.

1.1 Low Power Telescopes

Bier[2] states there are two basic types of Galilean telescopes used in low vision. They are available either in fixed focus form for insertion in ordinary spectacle frames or in variable focus form available commercially. These full field telescopes are relatively inexpensive and are commonly prescribed as distance aids for low vision patients. Although no prescription may be incorporated into the eyepiece of these 2.5X or 2.8X low power telescopes, the refractive error of the patient can be compensated, in the form of equivalent spheres, by altering the telescope from an afocal to a focal system. This is achieved by altering the distance between the eyepiece and the objective. According to Emsley[3] this method was first proposed by von Graefe in 1863. When these telescopes are used by emmetropes, the amount of accommodation required through the telescope can be obtained by increasing the lens separation. Uncorrected ametropes can also use these devices by increasing or decreasing the distance between the eyepiece and the objective lenses depending upon the error of refraction. There are, however, some limitations. The separation between the objective and the eyepiece is limited in length and the field of view is generally restricted to 15 degrees or less. The proximity of the object as viewed by the patient will alter the image vergence at the ocular to require a large amount of accommodation[4]. On the other hand, instrument myopia or instrument accommodation through the telescope may induce accommodation which partially counteracts the demand for accommodation through a telescope.

2. Magnification of Low Power Focal Telescopes

Afocal telescopes are used focally by emmetropic users looking at objects other than at infinity or ametropic users without any correction. The question is whether or not the actual magnification of the telescope will be changed significantly from the nominal magnification.

If the position of the object is relatively fixed in relationship to the focusable low power telescope, an appropriate definition of magnification would be the relative size of the retinal image after the telescope is introduced to the eye without the telescope (Figs. 1 and 2). The value of that ratio depends on whether or not the user changes the relative position of his eye and the object when he uses the telescope. There are two extreme cases. In the first the user merely places the telescope into the space between himself and the object of regard, adjusting the telescope length until the object is in focus. In this case the distance from the

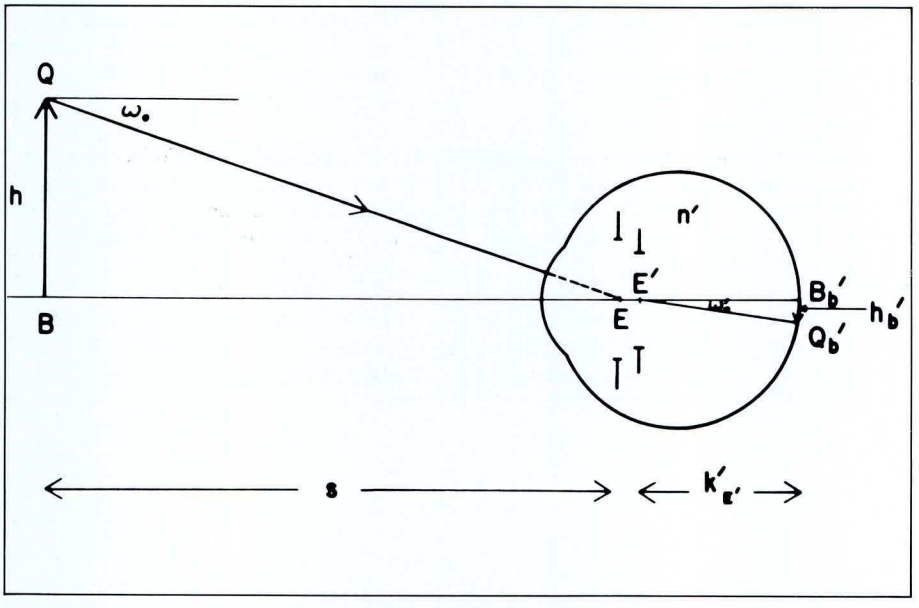

Figure 1. Geometry of retinal image formation by an unaided eye (from Long and Woo[5]).

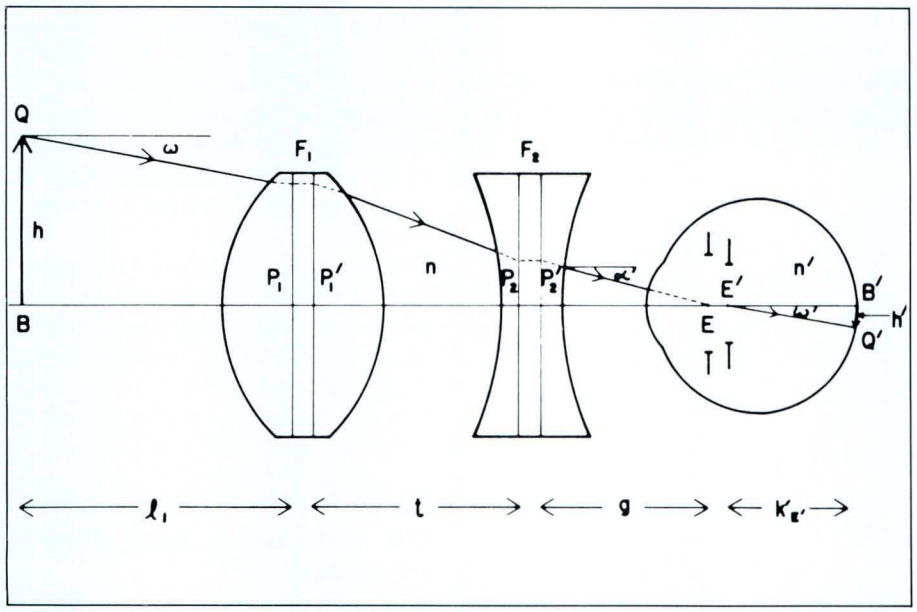

Figure 2. Geometry of retinal image formation by an eye-telescope system (from Long and Woo[5]).

eye to the object is the same with and without the telescope. Spectacle magnification in this case will be designated M_1 [5].

In the second case the user places the objective lens of the telescope in his spectacle plane and focuses while holding the position of the objective lens constant, moving his head back and forth as the position of the eyepiece is adjusted. Magnification will be designated M_2. For practical interest $M_1 > M_2$.

In practice a user may move both ocular and objective while focusing a telescope so that his actual retinal magnification will lie between M_1 and M_2. These values should be interpreted as the limiting value of retinal magnification. In most cases of interest, the numerical value of the two kinds of magnification do not differ very much from each other.

Long and Woo[5] derived a general expression for spectacle magnification. It is used to determine the magnification of focal telescopes for correcting ametropia and/or for viewing objects at finite distances. The results of careful calculations of retinal image magnification show that changes in telescope magnification large enough to alter acuity by a line on a LogMAR chart occur only when the viewing distance is less than 60 cm or when a Galilean telescope used at distance is adjusted to compensate for a very large ametropia. In practice, the expression reveals a clinically negligible difference between spectacle and nominal magnification.[5]

$$M_s = s/[\,1 - \bar{t}\,F_1)\,(1\ gF_g'\ v)\ 1_1 - \bar{t} - (1 - \bar{t}\,F_2)g]$$

3. Refraction

3.1 Subjective Refraction with the Use of a Low Power Telescope

In a low vision assessment, the use of a low power telescope will often enable the practitioner to evaluate the refractive status of a patient. Refraction in equivalent spheres can be determined by asking the patient to move the knurled knob (Fig. 3) slowly either clockwise or counter clockwise until the visual acuity chart is in best focus at 6 m. The practitioner can of

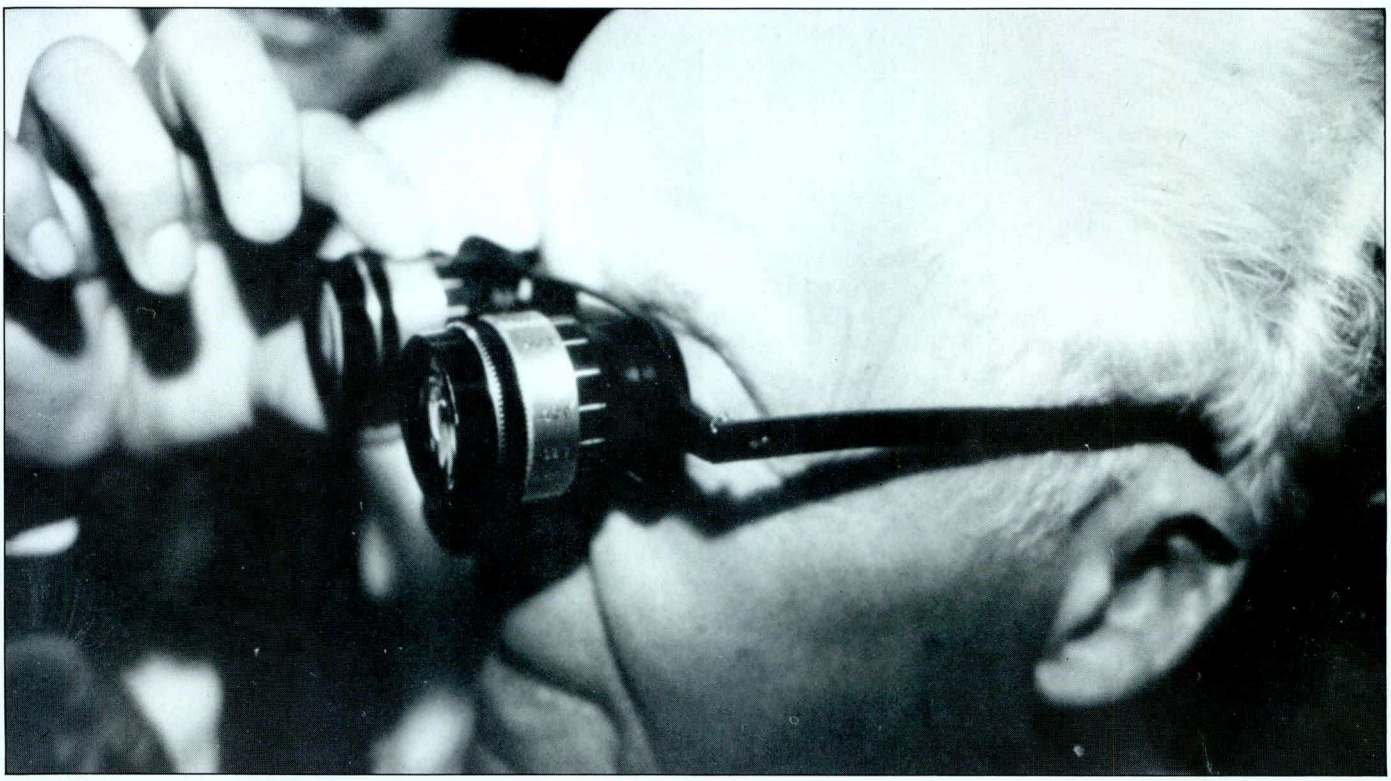

Figure 3. Use of a calibrated telescope in subjective refraction

course choose to turn the knob instead. Provided the patient does not accommodate at a distance considerably closer than the location of the visual acuity chart, the indication is that the patient is hyperopic when the knob is turned clockwise. Turning the knurled knob clockwise is equivalent to lengthening the distance between the eyepiece and the objective. When the knob is turned counterclockwise thus shortening the separation between the eyepiece and the objective, the patient is shown to be myopic.

The amount of ametropia can be quantified by noting the setting relative to the zero position. On most of these devices, there is a zero position marked in red. On either side of this red mark are inscribed white marks at equal intervals. Table 1 gives measurements of back vertex powers of a typical 2.5X monocular achromatic telescope taken from a *Sportscope* when it is placed in the lensometer and adjusted to different positions away from the zero position. The minus sign indicates shortening of the separation and that the vergence leaving the eyepiece is divergent: the plus sign indicates lengthening the separation and that the vergence leaving the eyepiece is convergent. Table 1 shows that although positions of white marks are separated linearly at equal intervals, they are not linearly related dioptrically.

Repeated measurements on a number of 2.5X monocular achromatic telescopes of the same type yield similar findings. Occasionally, there is a difference of +/− 0.25 D which can be attributed to a misalignment of the individual white mark from the zero position when the reading is taken through the lensometer.

Another consideration is that the demand on accommodation through the telescope is substantially greater than indicated by the object distance. The demand is due to the image vergence at the ocular when an object is imaged through the telescope. An approximate formula used to calculate the vergence is $L_2^1 = M^2L_1^4$, where M is the magnification of the telescope, L_1 is the object vergence at the plane of the objective, and L_2^1 is the image vergence at the plane of the eyepiece.

For low magnification telescopes of 1.7X and 2.5X, the respective discrepancy is 0.50 D and 1.00 D when the distance is 6 m. A 4X telescope on the other hand requires an accommodation of

Table 1

Calibrated back vertex powers of a 2.5X telescope at specific intervals.

Counter-clockwise marks	BVP in diopters	Clockwise marks	BVP in diopters
-1	-0.75	+1	+0.75
-2	-1.50	+2	+1.25
-3	-2.00	+3	+1.75
-4	-2.50	+4	+2.50
-5	-3.00	+5	+3.00
-6	-3.50	+6	+3.50
-7	-3.75	+7	+4.25
-8	-4.25	+8	+5.25
-9	-4.50	+9	+6.25
-10	-5.00	+10	+7.25

approximately 2.75 D for the same object distance. Thus a compensating lens should be incorporated in the calibration of a 4X telescope if it is to be used for subjective refraction.

Occasionally, however, it is impossible to determine refractive errors of some low vision patients using conventional refractive techniques including radical retinoscopy. It is in these cases that the technique becomes invaluable in estimating the refractive error subjectively.

The use of a calibrated telescope in determining the refractive error of low vision patients clinically has been reported by Woo[6]. The technique, however, is far from being precise as pointed out by Bailey[1]. It does not, for example, provide accurate astigmatic corrections. Although instrument accommodation would generally counter the effect of image vergence through a telescope, the net result is determined by the accommodative state of the patient, thus contributing to the inaccuracy of subjective refraction through a telescopic device. Information on the amplitude of accommodation of low vision patients is essential to obtain a more accurate refraction.

In order to obtain a more accurate reading, the examiner could "fog" the patient by lengthening the distance between the objective and the eyepiece of the telescope after the subjective refraction has been established either by the patient or the examiner. This procedure is similar to the fogging technique employed by some automated refraction systems and by conventional subjective refraction.

Occasionally, however, it is impossible to determine refractive errors of some low vision patients using conventional refractive techniques including radical retinoscopy. It is in these cases that the technique becomes invaluable in estimating the refractive error subjectively.

3.2 Objective Refraction with the Use of a Low Power Telescope

Retinoscopy is an objective technique used to measure refractive errors. In retinoscopy there are two systems in operation[7]. The illumination system begins with the light source of the instrument and ends in the patient's retina and the observation system begins on the patient's fundus as a light patch and ends in the examiner's eye. The retinoscopic finding determines the amount and type of refractive error by bringing the far point of the patient's eye coincident with the plane of the retinoscope. When this occurs, the examiner has reached the "neutral" point or the "flashing" point in retinoscopy. With the use of a low power telescope, the same principle holds. The required emerging vergence from the objective can be obtained by having the illuminated retinal patch focused at the examiner's entrance pupil. A schematic diagram illustrates this principle in Fig. 4. As an example, a typical 2.5X telescope would have the following values:

$F_1 = +15.00$ D (objective)
$F_2 = -37.50$ D (eyepiece)

separation distance of F_1 and F_2 = 4 cm
working distance = 60 cm

Given the above values the required emerging vergence from the objective would be +1.67 D in order to have the illuminated retinal patch focused at the observer's entrance pupil when arriving at the neutral point in retinoscopy. The calculated neutralizing lens using the simplified vergence formula [4] $L_2^1 = M^2L_1$ is equal to +10.44 D for an emmetrope. Thus by calculation it is predicted a neutralizing lens of approximately +10.50 D is required for an

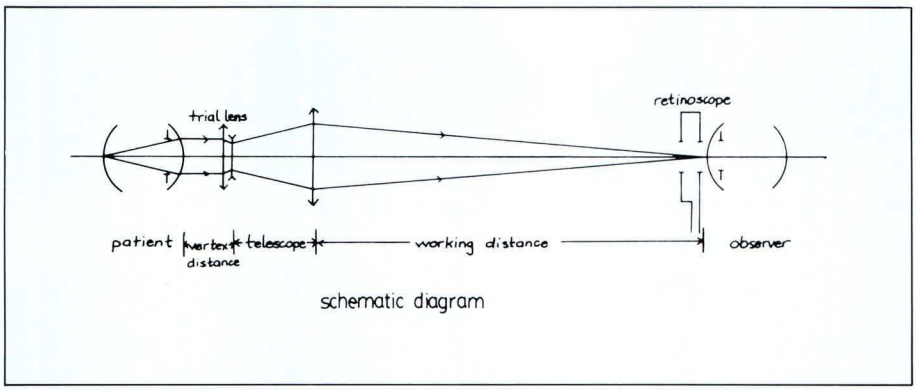

Figure 4. Schematic representation of telescopic retinoscopy.

emmetrope. The technique is similar to loose lens retinoscopy whereby lenses are inserted behind the eyepiece at the spectacle plane at regular intervals until the "with" movement of the reflex is neutralized. Insertion and removal of lenses in this manner are cumbersome and the vertex distance is not always maintained. Alternative methods such as increasing the separation between the objective and eyepiece by a specific amount and/or placing low power reading caps in front of the telescope can reduce the amount of positive lenspower required at the spectacle plane immediately adjacent to the eyepiece.

For practical purposes actual magnification of a lower power focal telescope and its nominal magnification may be viewed as being identical.

Thirty normal subjects were subjected to telescopic retinoscopy. Preliminary data indicate correspondence between the experimental results and the predicted values. Discrepancies however do occur. These can be attributed to sources of error usually attributed to retinoscopy including: 1. inexact working distance 2. scoping off the patient's visual axis 3. failure to obtain a reversal 4. failure to locate the principal meridians 5. failure to recognise scissors motion and 6. failure of the patient to fixate the distance target[8]. It is our observation that there appears to be a zone of neutrality once the "neutral" point is reached contributing perhaps to much of the discrepancy in most cases. To verify this, we are planning to refract two groups of subjects with and without cycloplegia. These results would then tell us whether accommodation could be another influencing factor in telescopic retinoscopy. In addition to conventional sources of error in retinoscopy, there are other factors to be considered in telescopic refraction. These include vertex distance, the tilt of the telescope, aberrations of the telescope, Modulation Transfer Function (MTF) of the telescope, alignment of the exit pupil of the telescope with the pupil of the eye and the brightness of the reflex. Clinically there is little or no advantage obtained by refracting low vision patients with a telescope. The employment of such a technique will not provide additional information in refraction. Observation of media opacities in some low vision patients could occasionally be made easier because of the larger reflex seen by the examiner.

4. Summary

For practical purposes actual magnification of a lower power focal telescope and its nominal magnification may be viewed as being identical. The use of a low power telescope in refraction has been described. This technique for subjective refraction can be useful in estimating the refractive error of some low vision patients. The use of the same device in objective refraction provides little clinical advantage.

Acknowledgements

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Rights of Low Vision Children and Their Parents

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1. Introduction

This paper will deal with the rights — medical, educational and rehabilitative — of a very special population of children. Children that are "at risk" because of their recognized visual impairment, as well as being "at risk" because some of their basic needs are not being met.

> Pratt[2] suggested that there are four times as many partially sighted children as there are legally blind. If this is in fact true, there may be as many as 12,000 low vision children in Canada.

Statistics for 1984 indicate that there are over 3,000 legally blind children under age 19 in Canada[1]. Pratt[2] suggested that there are four times as many partially sighted children as there are legally blind. If this is in fact true, there may be as many as 12,000 low vision children in Canada.

Are these children being served in a manner that recognizes the fact that they are first *children with vision* or are they being placed in programs for the visually impaired and being *taught to be "blind"*? Are low vision children part of the "forgotten population"?

Genensky[3], himself a partially sighted individual, stated emphatically:

> There is nothing wrong with being totally blind, and there is nothing wrong in providing the totally blind with services appropriate for their blindness. It is, however, grossly unfair to regard the partially sighted... as being blind and to offer them services that are appropriate only for the totally or functionally blind. What the partially sighted need most of all is to be classified differently from the functionally blind. Until this difference is recognized by our government and society, the partially sighted will continue to be neglected.

2. Medical Rights

The most basic right of the low vision child is that of *accurate diagnosis* of the problem. The diagnostic procedures may range from basic vision screening to more complex diagnostic work-ups. This basic right is most evident if the child is thought of as being "visually at risk"[4]. For all children, neonatal and infant screening programs are of prime importance in detecting a vision loss. There should be mandatory vision screening prior to school entrance.

In 1985, Pennock and Shapiro examined the vision screening programs in public schools in British Columbia. This study was a follow-up investigation of a similar study conducted in 1980[5]. The authors found that the majority of the schools still relied on far-point assessment by means of an eye-chart. They concluded:

> It is as probable today as it was five years ago that many children with visual anomalies (other than myopia) are not identified in school screening programmes. Thus many children attempt to learn with some discomfort and/or difficulty in classrooms of this province.

The findings of Pennock and Shapiro[6] are probably representative of Canada as a whole. One exception is in the Province of New Brunswick, where all Grade One children are provided a "modified clinical examination" by optometrists traveling to schools in a mobile vision van. The program found, during the 1984-1985 school year, that 7.8% of the children had visual problems requiring immediate care, and that 14.0% of the children would need to be seen within six to nine months[7].

Vision assessment for the multihandicapped child is often a neglected area. Cress *et al.*[8] discussed the need for policies regarding vision screening for this population. They stated that "most states do not include persons with severe handicaps in vision screening programs, even when such screening is mandatory for the nonhandicapped". Regardless of the individual's handicap, every person has a right to comprehensive professional eye examinations[8].

The multihandicapped are difficult to assess, and many ophthalmologists and optometrists have been frustrated by the fact that these children do not respond to the standard testing procedures[9]. However, within the past several years,

> No child should be considered "untestable", regardless of age or the multiplicity of the problem.

a plethora of articles and books have delineated methods that are applicable for assessing the vision of these special needs children[9-18].

No child should be considered "untestable", regardless of age or the multiplicity of the problem. Many children are diagnosed as being "cortically blind", even though they have not undergone an electrophysiological measure, such as the visually evoked response (VER)[10]. Many children have been placed in educational settings "accompanied by inadequate reports giving some indication of visual classification and an unintelligible description of the specific impairment"[17]. It is the right of the parent (and teacher) to know the extent of the vision loss. With this information, realistic goals for the child can be set.

Once a diagnosis of the problem has been made, the obvious need for the child is *treatment*. If the vision problem can be ameliorated (e.g. corrective lenses, low vision aids, surgery, etc.) then the

child should be treated by the appropriate individual. If the child cannot be assisted medically, the child should be referred to the appropriate agency.

Too often the attitude of the eye specialist is "nothing can be done". The doctor makes the diagnosis — "your child is blind" — and the child and the parents have to go home and "live with it". I cannot stress enough the importance of further follow-up by those that have training in the fields of rehabilitation and/or education. Referrals should be made as early as possible. Too often the referral comes at the point the child is ready to enter school, at the age of 5 or 6. This is too late. Early intervention is critical, as it plays a significant role in ameliorating the effects of the loss and preventing the occurrence of additional problems (e.g. motor problems, cognitive deficits).

Children being educated in programs designed specifically for the visually impaired are not always provided with the medical intervention they require. Hofstetter[19] examined the visual needs of 60 visually handicapped students in the Indianapolis public school system and at the Indiana School for the Blind — children diagnosed as having a significant visual loss. The students were "known to have at least some light perception and no other grossly disabling handicaps serious enough to prevent the attaining of reliable responses to visual tests". Hofstetter found that 45% of the students could have been helped significantly by special visual aids and rehabilitative guidance. Another 20-40% would probably have gained from such assistance. Only 15% were judged not to have needed assistance by means of optical aids.

Even more alarming were his findings related to routine vision care. Over 40% of the children who were wearing glasses did not have the correct prescription. The refractive error magnitudes exceeded the criteria for referral in conventional school screenings. He stated, "the specially classified group appears to be receiving no better, or even less, vision care than the rank and file school population".

In his concluding remarks, Hofstetter stated "in a very real sense we may be teaching them (i.e. those recognized as being visually impaired) how to be blind rather than how to utilize such residuals of vision as may be at their disposal". Visually impaired children have the right to receive the "specialized visual attention that is available and capable of enhancing not only their quality of life but also their opportunities to be self-sufficient and self-supporting"[19].

In my work with visually impaired children, I have found that *treatment* — basic treatment — is often not offered to all children in Canada, particularly if they have more than one problem. Many multihandicapped children are denied treatment, (e.g. surgery, corrective lenses, etc.) because of the severity of their handicaps. Ophthalmologists and optometrists must use the same treatment criteria for patients with and without handicaps[8].

In my work with visually impaired children, I have found that *treatment* — basic treatment — is often not offered to all children in Canada, particularly if they have more than one problem.

Many low vision children, both in residential and day schools, could benefit from *referral* to a low vision clinic. However, some clinics will not accept children. If there is not a clinic available locally, geographical distance must not preclude referrals. Ophthalmologists must refer children to clinics run by optometrists, and vice versa. The needs of the child must come first. Too often the parents are not made aware that visual aids may dramatically improve the visual status of their child. If they are told "nothing can be done", they do not know to question the verdict. Eye practitioners must act as advocates for this unique population.

Before a child is seen at the Low Vision Clinic, input from the child's teachers and the child's parents is crucial. Particularly critical is input from the teacher of the visually impaired working with the child, for he/she is knowledgeable about the child's visual abilities and the child's visual needs.

In an "ideal" situation, the examining doctor, or his assistant, would conduct an "on-site" visit to the home, the school or the work place prior to the assessment[20]. In a more "realistic" situation, the information should be gained through a Clinic Referral Form. Pre-examination information is critical to the successful prescription of a device and its longtime usage.

For those children that are seen by a Low Vision Clinic, adequate *follow up* must be available. The referring doctor needs a follow up report, but even more important, the parents and the child's teachers need to know the results of the assessment, and if an aid has been prescribed, how the aid should be used[21]. Children are just as likely to suffer from the "top drawer" syndrome[22] if adequate follow up is not provided.

Doctors must convey the assessment information, by means of written reports, to the child's teachers and not expect the information to arrive "through some osmotic process" from the parent to the educator[23]. Since educational decisions will be made on the basis of the information gained, the evaluation results are "too important to trust to chance"[23]. All children seen by a low vision clinic must be followed carefully. As their visual needs change with maturity and the visual demands change over time, a visit to a low vision clinic should not be a "one-shot deal".

Kelleher, in 1979, wrote the following:

> It has been well documented... that there is a tremendous lack of comprehensive low vision services throughout the nation. Teachers, counsellors, social workers, and other non-eyecare professionals have begun dispensing low vision aids to visually impaired persons out of frustration at the difficulty of obtaining appropriate low vision services for their clients and students.[24]

His comments, unfortunately, remain accurate in the mid 1980s. There is an urgent need for more low vision clinics across Canada. There is an urgent need for pediatric low vision specialists to serve these students.

Parents and children have the right to *medical counselling* regarding the condition underlying the vision problem. Many parents and children that I work with do not know the etiology of the eye problem. I have had many parents say to me that their child has had eye surgery — but cannot tell me what the surgery was. Doctors must spend time talking to the parents and to the children — in language that they can understand. Often a simple diagram will help. Parents need to know more than that their child is blind and glasses will not help.

Parents need to know the cause of the eye problem and to know if treatment can

alleviate the problem. They need to know what services are available for their son or daughter, who the service providers are, and how to access the services. They need to be made aware of services not only directly related to the loss of vision, but also those, such as occupational and physical therapy, speech and language training, and audiological assessment, that may be needed by their child. Parents and children need to learn about environmental modifications that may be beneficial and about equipment (both optical and non-optical) that may be appropriate. They also need to know about eligibility criteria for financial assistance (e.g. the ''blind'' pension, income tax reductions).

> There is an urgent need for more low vision clinics across Canada. There is an urgent need for pediatric low vision specialists to serve these students.

To be able to provide this information to the parents, ophthalmologists and optometrists must work to become more informed. If eye practitioners are not able to do anything more for the child, their involvement must not end there. They are obligated to refer the children to those persons or agencies that are able to provide further assistance. Eye professionals too often have the attitude ''we are interested in vision but have little interest in blindness'' — after all, blindness represents failure and no one likes failure[25].

Brilliant[26] stated that the attitude and the words ''nothing more can be done'' must be ''struck from low vision vocabulary''. Freeman[27] suggested that there are two ways that the eye professional can approach the low vision child:

> First is the image of the ''omnipotent practitioner''. From high atop the professional mountain, the doctor will lay down the edict as to whether or not the child will see... The other attitude, the one which puts most children at ease, is that the doctor is a helper whose knowledge will aid the child's achievement in the sighted world.

In all provinces there are provincial and/or local educational and rehabilitative services for visually impaired children. The majority of these services extend from birth to age 21. The programs not only assist in the basic education of the child (i.e. the three Rs) they also provide students with training in a wide variety of compensatory skills — vision stimulation, orientation and mobility, daily living skills, vocational training, to name a few. Ontario, Quebec and the Atlantic Provinces have residential programs for the visually impaired. Some residential schools also have home-based programs for preschool children, school-age and multihandicapped children. In all provinces, the Canadian National Institute for the Blind has regional offices. Many of these offices employ Children and Youth Counsellors and for older children, many of the offices have Employment Counsellors.

Another area of counselling that is often lacking is that of *genetic counselling*. I have students on my caseload that have never been told that their eye problem was genetic in origin. Pagon[28] suggested that ''each family with a genetic eye disorder needs to be evaluated to determine the specific diagnosis and its mode of inheritance. All individuals at risk in a given family should be examined and counseled''. The low vision child has the right to be educated regarding the cause of the vision problem, and how the condition may be passed on to his/her offspring.

Those working with visually impaired individuals, in either the educational setting or a rehabilitative setting, may be in a unique position to provide some assistance. Cross stated:

> Personnel employed by agencies and associations for the blind often spend much time with patients and have extensive contact with relatives. Consequently, his emotional rapport may exceed that of the doctor and his patient, and, since counselling and guidance are already part of this relationship, workers among the blind have considerable opportunity *and* responsibility to ensure that all who can benefit from genetic counselling are advised of its availability.[29]

3. Educational/Rehabilitative Rights

All low vision children have the right to an *appropriate education*. In Canada, there is no federal equivalent to the American ''Education for all Handicapped Children Act'' (Public Law 94-142) that ensures educational services to children regardless of the handicap. Some provinces (e.g. New Brunswick), but not all, have legislation dealing specifically with the education of the blind child. Ontario's Bill 82, the ''Education Amendment Act'', provides every exceptional pupil in the province, including those that are visually impaired, with access to educational programs. Regardless of where the child lives, the low vision child is entitled to have an education based on sound education philosophy. These programs must be of the highest quality.

> All low vision children have the right to an *appropriate education*.

Hill[30] examined the quality of programming to visually impaired students attending public day school programs in Canada. She found that on the whole, educational services in Canada were of high quality. In some parts of Canada, educational services to the preschool and/or multihandicapped visually impaired children were weak. There is, however, always room for improvement. Teachers of the visually impaired must continue to strive for excellence.

A *wide continuum of services* must be available for low vision children, designed to meet their unique needs. The various program alternatives, suggested by Bryant[31] range from self-contained classrooms/programs (i.e., residential schools; local day schools) to consultative programs (i.e., teacher-counsellor/consultant support to regular classroom teachers).

The services must be provided by *well qualified teachers,* with specialized training in working with low vision students. These teachers ''need a knowledge base, skills, sensitivity and appreciation of the unique learning styles and needs of visually handicapped students''[32].

The low vision student is different from the totally blind student, and, consequently a *unique curriculum* is necessary. Programs designed to meet the needs of the totally blind may not be suitable for the partially sighted (e.g., orientation and mobility programs). The program must meet the educational, social, psychological and emotional needs of the low vision students so that they will be prepared to ''make their own

choices as to how and where they will live, work and recreate''[32].

In Canada, teachers can obtain preservice training (diploma level) in working with the visually impaired at the University of British Columbia. The University of Western Ontario offers a 3-summer Additional Qualifications program, for teachers in Ontario that are employed to teach the visually impaired. In a study of 104 teachers of the visually impaired working in Canada completed in 1984, it was found that only 46% had specific training in working with the visually impaired at the diploma or degree level[30]. There is an urgent need to expand the preservice and inservice training options for teachers of the visually impaired in Canada.

Barraga[33] suggested that teacher training programs must ''adapt and change the content... to fit the roles performed and the population served''. Teachers of the visually impaired are working with more and more students that have significant amounts of residual vision. Consequently, teachers must have specific training to work with low vision students. She stated:

> How much attention are we devoting in teacher preparation courses to the 80 or 85 percent of the school-age population that has usable vision? Certainly not 80 to 85 percent of the curriculum. Teachers complain that 60 to 75 percent of the curriculum relates only to blind learners[33].

The increasing emphasis on the use of residual vision (i.e. ''vision training'' or ''vision stimulation''), with both ''normal'' low vision children and multihandicapped visually impaired students, must be addressed by teacher training programs.

I am aware of only one training program that deals exclusively with services to low vision individuals — the Pennsylvania College of Optometry's Master of Science Degree Program in Vision Rehabilitation. This is a one year program and is designed ''to prepare professionals from a wide variety of disciplines (e.g. Optometry, Special Education, Orientation and Mobility, Rehabilitation Teaching, Rehabilitation Counselling and related fields) to employ a team approach in working with low vision individuals''[34]. There is no such program in Canada.

Low vision children have the right to be provided with all the *necessary equipment* that they need to complete their schooling and to train them for future employment, along with the right to receive *training* in the proper use of such equipment. The term ''equipment'' not only refers to optical aids, but also to a wide variety of non-optical aids.

Many children need aids and appliances for both school and home — both should be made available. The financial status of the child's parents should not be a consideration. If the parents are unable to pay for the necessary equipment, and it is not supplied by the educational system, other sources of financial support must be tapped (e.g., service clubs, foundations, insurance companies, etc.). Too often, there are significant delays in obtaining the necessary equipment, due to lack of funding.

> There is an urgent need to expand the preservice and inservice training options for teachers of the visually impaired in Canada.

The low vision child and the child's parents have a right to *educational, psychological and vocational counselling* by persons that are trained specifically to provide the necessary assistance. The teacher of the visually impaired is one provider of counseling, however, often the teacher works in conjunction with many other professionals (e.g., guidance counsellors). Teachers of the visually impaired should be cognizant of their own limitations in the area of counselling, and refer their students for further assistance, if appropriate (e.g., psychiatric counselling, vocational counselling, etc.).

In the area of *educational counselling*, the teacher of the visually impaired should be knowledgeable about the educational programs available to the student, in the child's home community. She/he must help the student choose courses that are appropriate for future career goals, must be able to discuss with the student and the student's teachers any modifications and/or adaptations that will be necessary, and must be aware of resources that may assist the student (e.g., reader service, books on tape).

One of the greatest handicaps of being visually impaired is society's lowered expectations of the individual. The teacher of the visually impaired must provide counselling to students, other teachers, parents, etc., that is realistic and appropriate. Visually impaired students are expected to compete alongside of their sighted peers — visually impaired students should not be getting A's because they are different — they should be getting A's (or B's or C's) because they deserve them.

In the area of *psychological counselling* the teacher of the visually impaired plays a significant role, in her work with both the student and the student's parents. A great deal has been written about the psychological impact of a visual impairment[35-38]. The adjustment of a person to being partially sighted is considered by some to be greater than the adjustment to being totally blind. They are people ''in limbo'', neither sighted nor blind, the ''marginal man''[39] often desperately trying to appear ''normal''. Tuttle stated, ''unfortunately, low vision provides the individual with the opportunity to hide his disability, to play ''as if'' he were fully sighted''[38].

The teacher of the low vision student can be a ''sounding board'' for the child and the child's family (e.g., siblings). The teacher can be instrumental in bringing together visually impaired students so that they can discuss the adjustment problems inherent with low vision. The low vision student, particularly the adolescent student, needs to define and delineate the personal issues intrinsic to being a young adult with low vision. Along with his teacher, Roessing[40] suggested that the student should explore such issues as: how he differs from peers because of his low vision, if at all; his feelings about the visual impairment and/or physical handicap; if being different equals being inferior or superior to others; how sighted peers perceive him; the issue of driving a car; the attitudes and opinions of his peers with low vision; the opinions expressed by successful blind members of the community about the trials and pleasures of being a low vision person; dating, marriage, family, children; and finally, the work ethic and visual loss.

The teacher of the visually impaired may also be a provider of *vocational counselling* to the low vision student. Guidance counsellors, employment counsellors and rehabilitation counsellors also play a vital role. Career education is an ''essential part of every student's education'' [39]. Spungin stated:

I find that many visually handicapped

youngsters do not have an accurate picture of themselves in relation to their peers. Students tend to think either that they can do absolutely anything in a particular field, or that they can do absolutely nothing. Many students seem to be laboring with a serious lack of information regarding their own specific strengths and limitations.[39]

It is the role of the vision teacher or rehabilitation counsellor to help the student understand the effects of the vision loss in terms of future vocational plans. Does the child's vision loss affect whether or not the job can be done, with modifications, without modifications, or not at all? The days of the "stereotypic" jobs for the visually impaired (such as chair caning, mop making and piano tuning) hopefully are over. Many different opportunities exist in the 1980s. Technology for the visually impaired has opened a lot of doors[41,42]. The low vision student has a right to be made vocationally productive. The decision regarding a specific occupation must be based on "the capacity of the individual to function efficiently and effectively rather than upon any measured acuity or labeled categorization"[43].

The employment prospects for the handicapped unfortunately are bleak, particularly in this time of high unemployment. The partially sighted individual, given proper training, which results in obtaining the necessary qualifications has the right to *employment*. Along with the right to employment are ancillary rights to adequate *housing* and means of *transportation*.

Kirchner and Peterson[44] examined employment in the blind and visually impaired in the United States. They found that there was widespread unemployment. Approximately 75% of the general adult population is employed, whereas, less than one third of the blind and visually impaired were working. In another study by Kirchner and Peterson[45] it was found that of those blind and visually impaired persons that were employed, many were underemployed (i.e. working fewer hours than desired or employed in jobs that are not commensurate in status, income or challenge with their training skills and desires).

There have been no comparable studies in Canada that I am aware of. However, it is not unreasonable to expect to find similar statistics. As advocates for the visually impaired, it is our responsibility to promote the hiring of visually impaired individuals, if they are qualified for the job.

4. Summary

In summary, it is apparent that low vision children and their parents have many rights, however, many of their basic rights are not being met by those of us that are working with them. They have health care rights, that must be met by the health professions (i.e., ophthalmologists, optometrists, low vision technicians, etc.). They have *educational rights*, that must be met by the education profession (i.e. educators, administrators, counsellors) and they have *rehabilitative rights*, that must be met by rehabilitation agencies (i.e. rehabilitation counsellors, employment counsellors).

The partially sighted individual, given proper training, which results in obtaining the necessary qualifications has the right to *employment*.

There are many professionals who deal with low vision children. Each of us must determine our unique role, and strive to provide the best service available within our mandate. We must be the advocates for those with low vision. They are a unique group. They have unique needs. Our goal should be to make the low vision individual function at his/her highest possible level. However, none of us can "do it alone". We must work together in an interdisciplinary fashion. We must not let low vision children become part of the "forgotten population".

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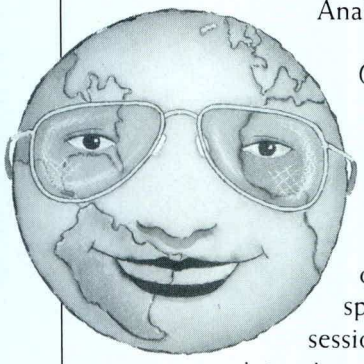

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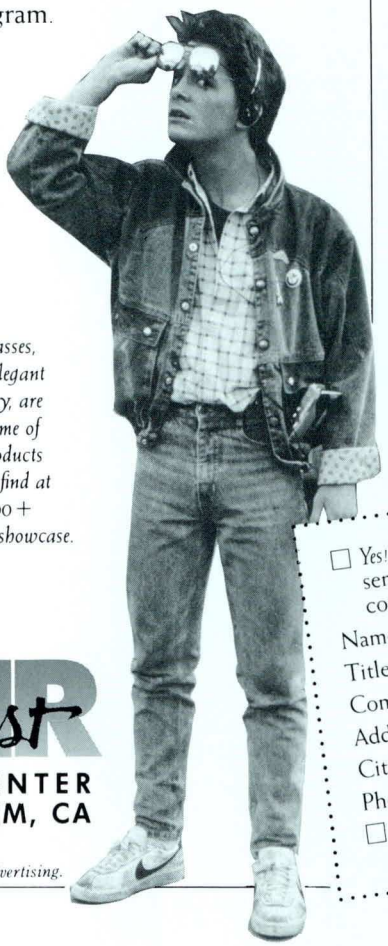

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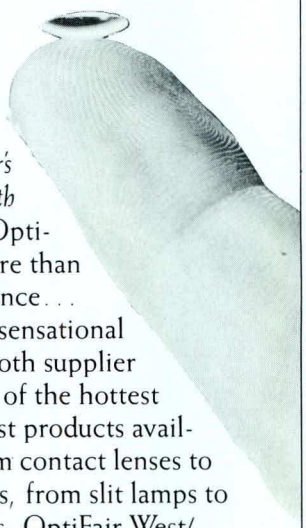

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Supplément to/à The Canadian Journal of Optometry • la Revue Canadienne d'Optométrie, Vol. 49, n.2, June/juin 1987

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Announcing the 1987 CAO Biennial Congress Photography Contest

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1 "Land, Sea and Air": Scenic landscapes, seascapes, flowers, clouds, etc.

2 "The Face is Familiar...": Portraits or photos in which the human body and its actions play the major role.

3 "To boldly go...": Let your imagination soar. Multiple exposures, macrophotography, abstracts, darkroom tricks, etc.

Rules

1 Prints only. Sizes 5 × 7, 8 × 10, 11 × 14; mounted, but not framed.

2 Photos must have been taken by the entrant between June 1, 1986 and June 1, 1987. Name, address and category entered must be printed clearly on the back of the entry.

3 Technical data *may* be included but is *not* required.

4 A maximum of two pictures in each category (total six photos) may be submitted by each entrant.

5 Entrants are responsible for the recovery of their own photos at the *conclusion* of the Congress. Photos not claimed will be returned by CAO with postage/packaging invoiced to the entrant.

6 By submitting photos, all entrants automatically grant to CAO the rights to publish any or all winning entries in *The Canadian Journal of Optometry* and, further, represent that the photo(s) have/has never been previously published and that publication in the *CJO* is not a violation of any existing copyright.

7 Prizes for the winners will be announced later.

8 All photos will be judged by a special contest committee in advance of the Congress and a selection of entries displayed on site in Saint John.

9 *Deadline for Entry:* All entries must be *received* no later than midnight, July 31, 1987 and are to be sent to: Dr. Arnold Brown, Optometrist, 14 King Square South, Saint John, NB. E2L 1E5.

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1 Photographies seulement. Dimensions 5 × 7, 8 × 10 ou 11 × 14; les photos doivent être montées, mais non pas encadrées.

2 Les photos doivent avoir été prises par le participant entre le 1er juin 1986 et le 1er juin 1987. Le nom et l'adresse de la personne et la catégorie doivent être en lettres moulées au verso de chaque photographie.

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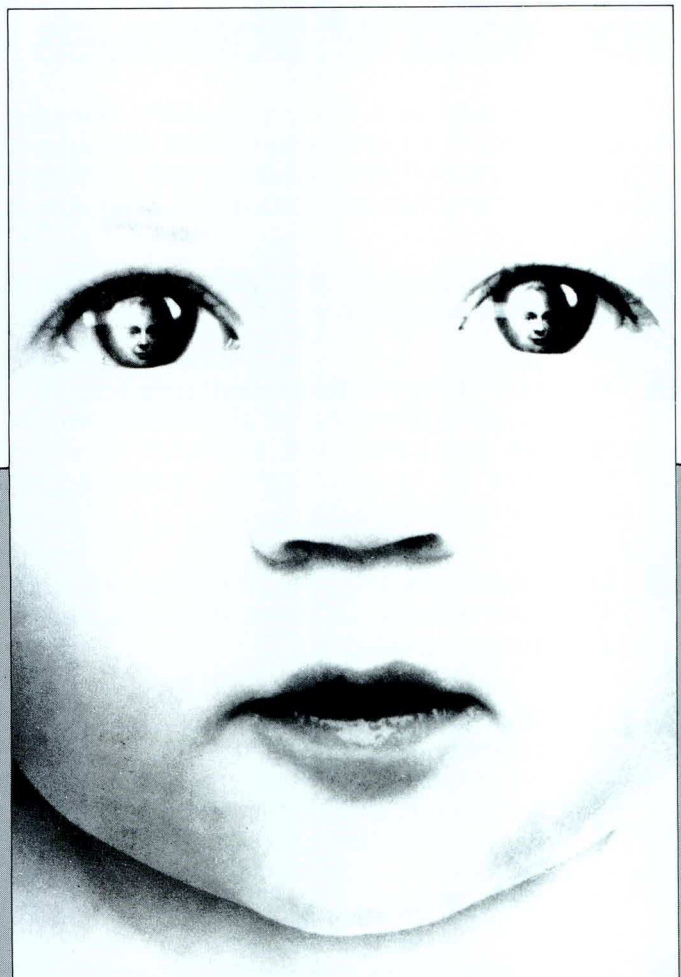

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Donnez donc la vie en héritage à ceux qui vous suivront en ce bas-monde. Ce sera, pour vous, une belle façon de vous rendre immortel.

SOCIÉTÉ CANADIENNE DU CANCER | CANADIAN CANCER SOCIETY

Si votre notaire ou vous-même voulez en connaître davantage sur la Société et sur ce que nous faisons, téléphonez ou écrivez à la Société canadienne du cancer.

Cette annonce est publiée à titre de service public.

Today, Harry and I did something we've wanted to do for a long time.

Throughout our lives together, Harry and I have known people...had friends...whose lives have been touched by cancer. We always offered our help, but somehow it was never enough. I mean, what else could we really do?

Well, Harry and I discussed it carefully and we decided to leave something in our wills for the Canadian Cancer Society.

Because someday our children might live in a world without cancer...And now Harry and I feel that we've really helped.

If you or your lawyer want to know more about the Society and what we do, telephone or write the Canadian Cancer Society.

CANADIAN CANCER SOCIETY | SOCIETE CANADIENNE DU CANCER

This space contributed as a public service.

Special Information and Policies

Your name badge is your passport. Please ensure that you wear it at all times for admission to all business, education, social, tour and exhibit functions.

1. **Continuing Education** attendance will be validated at each lecture.

2. **Simultaneous translation** service will be offered at each lecture and the General Business Meeting. All tours and service at the Congress Registration desk will be offered in either English **or** French.

3. Special **Class Reunion** arrangements are being made by Dr. Thomas McCue. Please check at the Congress Registration Desk.

4. A **Recommended Dress Guide** is provided on the individual Program Guides elsewhere in this booklet. Please remember you are on the seacoast and, while daytime temperatures are usually warm, evenings can get chilly. A sweater is a recommended accessory for all evening outings.

5. If you require a **tuxedo**, you must make your own arrangements prior to your arrival in Saint John. There are no short-notice rental facilities in the City.

6. For those guests and delegates staying at the Holiday Inn or Keddy's, a **shuttle service** will be provided to and from the Trade and Convention Centre.

7. The **Congress Registration Desk** will also be the Congress Information Centre, City of Saint John Information Centre, lost and found and **President's Banquet Table Reservation** location.

Please bring this program with you to the Congress.

Renseignements spéciaux et politiques

Votre porte-nom sera votre passeport. Assurez-vous de le porter en tout temps afin d'être admissible aux assemblées ainsi qu'aux activités éducatives et sociales, aux tournées et expositions.

1. L'admission sera contrôlée à chaque conférence en **Éducation permanente**.

2. Un service de **traduction simultanée** sera offert pour chaque conférence ainsi que pour l'assemblée générale. Les tournées et le service offerts au comptoir d'inscription au Congrès seront en anglais **ou** en français.

3. Le Dr Thomas McCue organise actuellement la tenue d'une **conventum**. Informez-vous au comptoir d'inscription au Congrès.

4. Un **guide vestimentaire** est publié dans les guides de programmes individuels, ailleurs dans cette brochure. Rappelez-vous que vous serez au bord de la mer et que la température y est habituellement chaude le jour, et froide le soir. Le chandail constitue un accessoire recommandé pour toutes vos sorties, le soir.

5. Si vous avez besoin d'un **smoking**, vous devrez prendre les dispositions nécessaires avant votre arrivée à Saint-Jean, car il n'y a pas dans cette ville de maisons spécialisées dans la location à court terme.

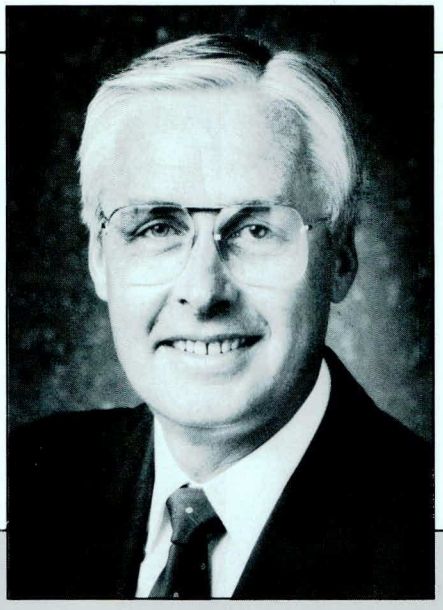
6. Les invités et délégués qui seront logés au Holiday Inn ou au Keddy's bénéficieront d'un **service de navette** qui fera la liaison entre ces hôtels et le Centre du commerce et des congrès.

7. Le **comptoir d'inscription au Congrès** réunira aussi le Centre d'information du Congrès, le Centre d'accueil de la ville de Saint-Jean, les objets perdus et le bureau de **réservation d'une table au banquet du président**.

Veuillez apporter ce programme au Congrès.

Message from the Minister

of National Health and Welfare



Message du ministre

de la Santé nationale et du Bien-être social

It is again my pleasure to extend greetings on behalf of the Government of Canada to the delegates attending the 20th Biennial Congress of the Canadian Association of Optometrists.

The Congress provides a valuable opportunity for continuing education and development, keeping abreast of current technology and equipment, exchanging ideas with one's peers from across our country, renewing old acquaintances and making new friends.

The Canadian Association of Optometrists and its many members are to be congratulated for their continuing fine work in the field of optometry in Canada. Such educational opportunities as the present Congress will help ensure that this high standard will continue, to the benefit of all Canadians.

Yours sincerely,

Jake Epp
Minister, National Health and Welfare

Il me fait plaisir, au nom du gouvernement du Canada, d'offrir mes voeux à tous les congressistes de ce 20e Congrès biennal de l'Association canadienne des optométristes.

Ce congrès est l'occasion idéale d'ajouter à vos connaissances en participant aux séances d'éducation permanente et de vous renseigner sur les derniers progrès de la technologie et de l'équipement d'optométrie.

Ce sera aussi l'occasion de discuter et d'échanger des idées avec vos collègues venant des diverses régions de notre pays, de renouer les liens avec d'anciens amis et d'en faire de nouveaux.

Je félicite tous les membres de l'Association canadienne des optométristes de leur excellence soutenue en matière d'optométrie au Canada. Les séances éducationnelles de ce congrès assureront certes que ce haut standard soit maintenu et ce, au bénéfice de tous les Canadiens.

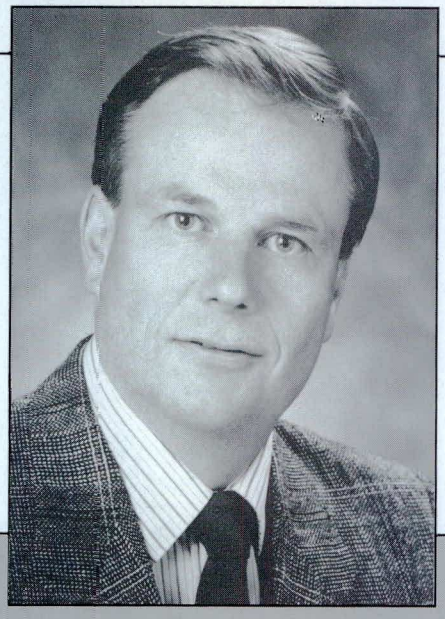
Veuillez agréer l'expression de mes sentiments les meilleurs.

Le ministre de la Santé nationale et du Bien-être social

Jake Epp

Greetings from the President

of the Canadian Association of Optometrists



Mot du Président

de l'Association canadienne des optométristes

Call it "the Greatest Little City in the East."

Call it Canada's first officially incorporated City.

Call it the Site of the world famous Reversing Falls.

Call it whatever you want, for four days in August, 1987, Saint John, New Brunswick will be "home" to the Canadian Association of Optometrists and our 20th Biennial Congress.

When Calli and I were invited to sit in on one of the early planning meetings of the 1987 Congress Local Arrangements Committee, we both became assured of one thing — the enthusiasm shown by Barb Iftody and her team will translate into a warmly hospitable event for everyone who attends.

On behalf of the Executive and Council of the Canadian Association of Optometrists, I welcome you to our 20th Biennial Congress. They aren't calling it a "Merry-Tyme Mingle" for nothing. You won't be able to avoid mingling, and the merry "tyme" will just flow from the program. Relax and enjoy yourselves.

As for the Brisbin family — I just checked. Our lobster bibs are through the rinse cycle and have just gone into the dryer. So we're ready.

See you on Fundy's shore!

Scott D. Brisbin, O.D.
President
Canadian Association of Optometrists

Que sa réputation soit celle d'être "la plus grandiose des petites villes de l'Est" ou la première ville civilement constituée au Canada ou le site d'un phénomène qui l'a fait connaître dans le monde entier (le Mascaret), pendant quatre jours, en août 1987, Saint-Jean du Nouveau-Brunswick accueillera l'Association canadienne des optométristes, à l'occasion de son vingtième Congrès biennal.

Quand Calli et moi avons été invités à assister à l'une des premières réunions de planification du Comité d'organisation locale du Congrès de 1987, nous avons acquis une certitude : l'enthousiasme de Barbara Iftody et de son équipe ne peut que produire un congrès agréable et acceuillant pour tous.

Au nom de l'exécutif et de l'Association canadienne des optométristes, je vous souhaite la bienvenue au 20e Congrès biennal. En anglais, les jeux de mots sont faciles, avec "Maritime", d'où l'expression "Merry-Tyme Mingle", qui joue sur la prononciation de *Maritime* et les concepts de plaisir et de fraternisation. En effet, vous ne pourrez que fraterniser avec vos collègues, et le programme nous promet bien du bon temps. Détendez-vous et amusez-vous.

En ce qui a trait à la famille Brisbin, je viens tout juste de vérifier. Nos serviettes à homards sont dans le sèche-linge. Nous sommes fins prêts.

À bientôt!
Le président de l'Association canadienne des optométristes
Dr Scott D. Brisbin

Welcome

to Canada's Loyalist City

It is indeed a pleasure for me as the First Lady Mayor of the First Incorporated City in Canada to extend a warm welcome to all delegates of the Biennial Congress of the Canadian Association of Optometrists.

During your visit you will experience the fine hospitality of our citizens and I know you will have many pleasant memories of your stay in our Loyalist City.

Saint John has seen dramatic growth in recent years; undoubtedly the most impressive evidence of this is our transformed core area featuring a new waterfront development, two hotels, two shopping complexes, new and exciting dining and recreational facilities — all connected by a series of pedways. Discover a perfect blend of modern facilities including Market Square, Brunswick Square and the Canada Games Aquatic Centre, as well as fine historic sites such as the City Market, the New Brunswick Museum and many others.

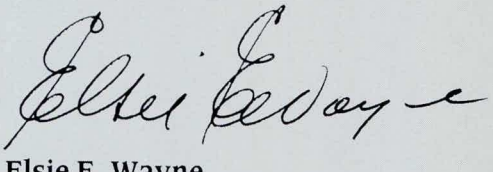
On May 23rd Saint John played host to the Canada/ United States Olympic Qualifying Soccer Game. It was the first time that Canada and the United States have met in Olympic qualifying play. From July 12 to 24, Saint John was one of four Canadian hosts for the 2nd FIFA U-16 (Fédération internationale de football Association) World Tournament, which featured 16 of the top soccer countries in the world.

Also, Saint John will play host to the World Chess Festival, the first to be staged in North America. This is a global event of immense prestige and reward for Canada, the Province of New Brunswick and our City. The dates for this event are January 23-February 21, 1988, and in addition to chess, the Festival will feature such activities as plays, art displays and musical performances.

On June 6th of this year the City of Saint John hosted a pre-season CFL Game at the Canada Games Stadium between the Montreal Alouettes and the Hamilton Tiger Cats. This match marked the second Canadian Football League game played outside a major Canadian metropolitan area. The first was in Saint John in June of 1986.

There will be two festivals held in Saint John in August; the Acadian Festival, August 15th-17th and Festival By The Sea, August 9th-22nd. I encourage you to return to Saint John again soon and partake in the many exciting upcoming events. There's so much to do and see. You will soon know why Saint John, New Brunswick is known as "The Greatest Little City in the East".

Sincerely,



Elsie E. Wayne
Mayor

Bienvenue

au Berceau des Loyalistes

C'est avec un réel plaisir, en tant que première femme maire de la première ville civilement constituée du Canada, que je souhaite la plus cordiale des bienvenues aux délégués du Congrès biennal de l'Association canadienne des optométristes.

Au cours de votre séjour, vous saurez certainement apprécier l'hospitalité incomparable de mes concitoyens et accumuler nombre de souvenirs agréables de votre séjour en notre ville loyaliste.

Saint-Jean a connu une croissance incroyable ces dernières années; la preuve la plus évidente de ce phénomène est la transformation de notre centre-ville, qui compte désormais un aménagement en bord de mer, deux hôtels, deux centres commerciaux, de nouvelles et intéressantes installations de restauration et de divertissement, toutes reliées par une série de voies piétonnières. Vous découvrirez un heureux mélange de modernisme, par exemple la Place du Marché, la Place Brunswick et le Centre des sports en piscine des Jeux du Canada, ainsi que de prestigieux lieux historiques comme le Marché de la ville, le Musée de Nouveau-Brunswick, et tant d'autres.

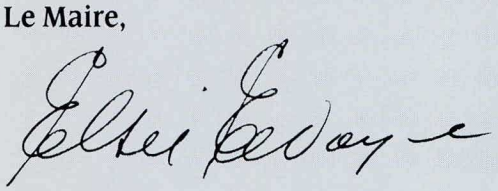
Le 23 mai, Saint-Jean a été l'hôtesse du Tournoi de soccer de qualification olympique Canada-États-Unis. C'était la première fois que le Canada et les États-Unis se mesuraient dans un tournoi de qualification olympique. Du 12 au 24 juillet, Saint-Jean était parmi les quatre villes-hôtesses canadiennes du 2e tournoi mondial U-16 de la FIFA (Fédération internationale de Football Association) réunissant les meilleures équipes nationales de soccer au monde.

En outre, Saint-Jean recevra le Festival mondial des échecs, le premier à se tenir en Amérique du Nord. C'est un événement mondial immensément prestigieux pour le Canada, le Nouveau-Brunswick et notre ville. Ce festival aura lieu du 23 janvier au 21 février 1988 et, en plus des échecs, on y prévoit toutes sortes d'attractions, notamment du théâtre, des expositions artistiques et des concerts.

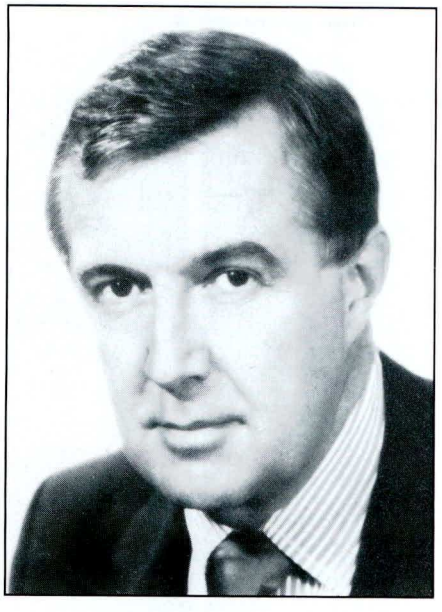
En août, Saint-Jean sera le théâtre de deux festivals : le Festival acadien du 15 au 17 août, et le Festival de la Mer, du 9 au 22 août. Je vous invite à revenir bientôt à Saint-Jean et à prendre part aux nombreux événements intéressants qui se préparent. Il y a beaucoup à faire et à voir. Vous saurez bientôt pourquoi on appelle Saint-Jean du Nouveau-Brunswick "la plus grandiose des petites villes de l'Est".

Veuillez agréer, Mesdames et Messieurs, l'expression de mes sentiments les meilleurs.

Le Maire,



Elsie E. Wayne



I am pleased to extend a warm welcome to those who are in Saint John to attend the 20th Biennial Congress of the Canadian Association of Optometrists.

Your association has been most active in promoting the importance of good eyesight. We have become aware of the important role optometrists play in the preservation of that valuable gift.

Many of you have travelled a great distance to be here for this worthwhile gathering of professionals. I hope your deliberations are productive and that your stay in New Brunswick is a pleasant one.

Richard Hatfield

Richard Hatfield

Je suis heureux de souhaiter la plus chaleureuse bienvenue à Saint John, à tous ceux et celles qui participent au 20e congrès biennal de l'Association canadienne des optométristes.

Votre association s'est toujours efforcée de sensibiliser les gens à l'importance d'une bonne vue. Nous en sommes venus à prendre conscience du rôle prépondérant que jouent les optométristes dans la conservation de ce don précieux.

Beaucoup d'entre vous sont venus de très loin pour prendre part à cet important rassemblement de professionnel(le)s. J'espère que vos discussions seront fructueuses et que votre séjour au Nouveau-Brunswick sera des plus agréables.

Richard Hatfield

Richard Hatfield

Greetings from Canada's "Picture Province"!

Bienvenue au pittoresque Nouveau-Brunswick

Dear Colleagues,

As another Maritime summer arrives, this season we will have a special reason for celebration as the New Brunswick Association of Optometrists hosts CAO's Biennial Congress for the first time.

Ruth and I, on behalf of all our members and their families, are looking forward to being your hosts and getting to know as many of you as we can at this year's "Merry-Tyme Mingle" in Saint John, NB. It will be CAO's 20th Biennial Congress, and one which we hope will be the biggest and best ever!

This Congress Souvenir Program will serve as your guide to the full Congress Agenda. Our Local Arrangements Committee has put together an outstanding array of activities and special events, something certain to please everyone in the family.

Plan now for some fun and relaxation "Way Down East" this summer!

Sincerely yours,
Les Clements, O.D.
President
New Brunswick Association of Optometrists

Estimé(e) collègue,

L'été qui vient, dans les Maritimes, s'annonce comme une saison bien spéciale, car c'est la première fois que l'Association des optométristes du Nouveau-Brunswick accueille le Congrès biennal de l'ACO.

Ruth et moi-même, au nom de tous nos membres et de leurs familles, nous réjouissons d'avance de vous accueillir et de faire connaissance avec le plus grand nombre possible d'entre vous à cette "fraternisation maritime", à Saint-Jean du Nouveau-Brunswick. Ce sera le 20e Congrès biennal de l'ACO et, nous l'espérons, le meilleur à tous égards!

Le présent programme-souvenir vous servira de guide pendant tout le Congrès. Le Comité d'organisation locale a dressé un programme extraordinaire d'activités et d'événements spéciaux, de quoi plaire à tous les membres de la famille.

Planifiez dès maintenant vos vacances d'été, venez vous détendre et vous amuser "à la façon de l'Est"!

Veuillez agréer, Estimé(e) collègue, l'expression de mes sentiments les meilleurs.

Le Président de l'Association des optométristes du Nouveau-Brunswick
Dr Les Clements

Local Arrangements Committee

Comité d'organisation locale

Welcome to Saint John and the 1987 CAO "Merry-Tyme Mingle"!

From Tuesday's beginning to Friday's end, we have planned a program of very special events both for your enrichment and your pleasure. Combine this with an opportunity to mingle with colleagues and their families from across Canada and we feel you have an excellent time ahead of you!

On behalf of the Local Arrangements Committee, I hope you enjoy the program to the fullest, that you make new friends along the way and renew acquaintances from years past.

Our goals shall be accomplished if this 20th Biennial Congress becomes a special highlight in your personal album of memories.

Enjoy!
Dr. Barbara Iftody
Chairperson

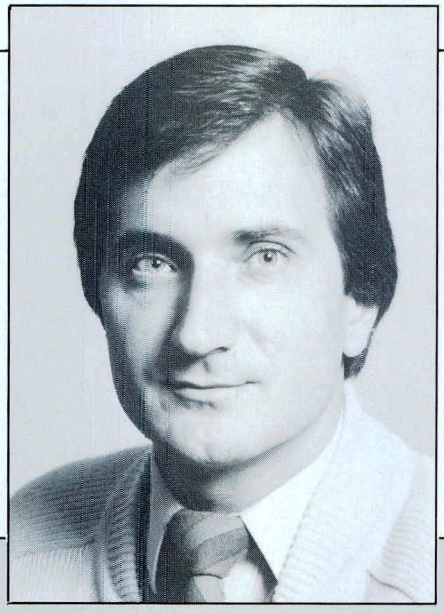
Bienvenue à Saint-Jean et au congrès 1987 de l'ACO, où "on s'amuse"!

Du début à la fin, soit du mardi au vendredi, nous avons préparé un programme tout à fait spécial qui saura vous procurer à la fois enrichissement et divertissement. En plus de cela, vous aurez l'occasion de fraterniser avec des collègues de tous les coins du pays et avec leurs familles. Nous sommes sûrs que vous passerez d'excellents moments!

Au nom du Comité d'organisation locale, j'espère que vous tirerez le maximum du programme et que vous vous ferez de nouveaux amis et reprendrez contact avec ceux des années passées.

Si ce 20^{e} Congrès biennal occupe une place de choix dans vos souvenirs personnels, notre but sera atteint.

Amusez-vous bien!
La présidente
D^{r} Barbara Iftody



John V. Lovasik, B.Sc., M.Sc., O.D., Ph.D., F.A.A.O.

Dr. Lovasik is a graduate of McGill University in Montréal (B.Sc.) and of the University of Waterloo (O.D., M.Sc., Ph.D.).

He has been the recipient of several academic awards and distinctions and is currently an Associate Professor at the School of Optometry, University of Waterloo.

Dr. Lovasik is very active in the area of research in the fields of pediatrics and electrophysiology.

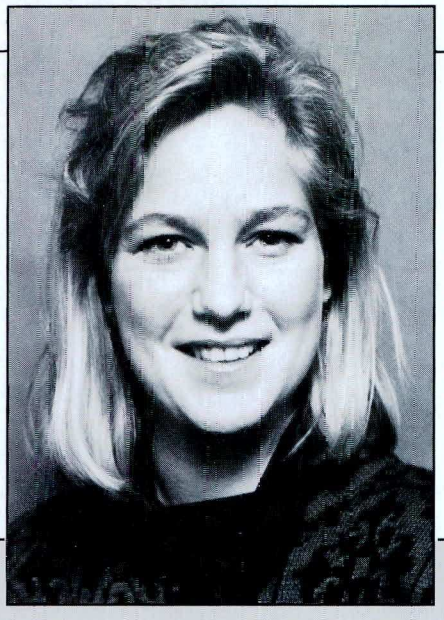
His lecture, which combines the two, is entitled, "Norms and Electrodiagnostic Techniques".

Le Dr Lovasik est diplômé de l'Université McGill de Montréal (baccalauréat en sciences) et de l'Université de Waterloo (diplôme d'optométrie, maîtrise en sciences et doctorat).

Il a reçu plusieurs prix universitaires et distinctions et est actuellement professeur associé à l'École d'optométrie de l'Université de Waterloo.

M. Lovasik est très impliqué dans le domaine de la recherche, notamment en pédiatrie et en électrophysiologie.

Son exposé, qui joue sur ces deux thèmes, s'intitule "Normes et techniques d'électrodiagnostic".



Carole Melançon, O.D.

Dr. Melançon received her O.D. degree from l'École d'Optométrie, Université de Montréal in 1979.

She has worked in a group practice and has acted as a consultant to schools and industry. Dr. Melançon has completed several research projects and has published several scientific articles on Video Display Terminals (VDTs) and their effects on vision.

Dr. Melançon's lecture is entitled, "VDTs, An Update".

Le Dr Melançon a reçu son diplôme d'optométrie de l'École d'optométrie de l'Université de Montréal en 1979.

Elle a exercé en cabinet communautaire et comme conseillère dans les industries et dans les écoles. Elle a terminé plusieurs projets de recherche et a publié plusieurs articles scientifiques sur les terminaux à écran d'affichage et leurs effets sur la vision.

La conférence du Dr Melançon s'intitule "Mise à jour sur les terminaux à écran".

Jerome Sherman, B.Sc., O.D.

Dr. Sherman attended Brooklyn College and graduated from the Pennsylvania College of Optometry in 1970.

He has received appointments to the Optometric Center of New York, the Southern California College of Optometry, Mount Sinai School of Medicine, City University of New York, the Editorial Review Board of the **Journal of the American Optometric Association** and the Editorial Review Board of **Review of Optometry**.

Dr. Sherman is currently a Professor and Director of Professional Services at the University Optometric Center, State University of New York.

His lecture, "Retina, retina, retina", is on fundus pathology.

Le Dr Sherman a fréquenté le Collège de Brooklyn et a obtenu en 1970 son diplôme d'optométrie du College of Optometry de Pennsylvanie.

Il a travaillé pour l'Optometric Center de New York, le Southern California College of Optometry, la faculté de médecine de l'Hôpital Mount Sinai, la City University de New York, ainsi que les comités de rédaction du **Journal of the American Optometric Association** et du **Review of Optometry**.

Le Dr Sherman est professeur et directeur des services professionnels du Centre universitaire d'optométrie de l'Université de l'État de New York.

Son exposé, qui est intitulé "La rétine, toujours la rétine", porte sur la pathologie du fond de l'oeil.

for Optometrists

DATE/TIME	EVENT	LOCATION* (Dress Recommendation)

* **Note:** "TCC" refers to the Saint John Trade and Convention Centre, located directly across the street from the Hilton Hotel and adjoining, via an indoor walkway, both the Hilton and Delta Brunswick Hotels.

TUESDAY — AUGUST 4

1:00 p.m.	**Registration Desk** opens	Coatcheck Foyer — TCC
7:00-10:00 p.m.	**Congress Opening Ceremonies** — Start your Merry-Tyme Mingle. Meet your old friends, make new ones. Cocktails, loads of hors d'oeuvres, mixers and surprises!	Loyalist Room — TCC (Good Casual)
9:00 p.m.-12:00 mdnt.	**Hospitality Suite**	Hilton Hotel Room 317/18

WEDNESDAY — AUGUST 5

9:00 a.m.-12:00 nn.	**Education 1** **Dr. Jerome Sherman** **"Retina, retina, retina"**	Loyalist Room — TCC
12:00 nn.-2:00 p.m.	**Welcome Luncheon** Co-sponsored by the Province of New Brunswick, featuring an address by the Minister of Health and Community Services, the Hon. Nancy Clark Teed	Marco Polo Room — TCC
2:00-5:00 p.m.	**Education 2** **Dr. John Lovasik** **"Pediatrics: Norms and Electrodiagnostic Techniques"**	Loyalist Room — TCC
6:00 p.m.-1:00 a.m.	**Lobster Feast and Fun Night** Come on down for some real Maritime treats — seafood and New Brunswick entertainers!	Thistle St. Andrews Curling Club. Buses begin leaving Hilton Hotel Lobby entrance at 5:45 p.m. (Casual)
11:00 p.m.-1:00 a.m.	**Hospitality Suite** open	Hilton Hotel Rm 317/18

THURSDAY — AUGUST 6

8:00-9:00 a.m.	**Sponsored Continental Breakfast**	Foyer outside Montagu Rooms — TCC
9:00 a.m.-12:00 nn.	**Education 3** **Dr. Carole Melançon** **"VDT Update"**	Loyalist Room — TCC

12:00 nn.-2:00 p.m.	**Exhibit Hall Buffet Luncheon** Look into what's new, and what's been made better	Marco Polo Room — TCC
2:00-5:00 p.m.	**CAO Section Meetings**	
	(i) Aviation Vision	Montagu Room 2 — TCC
	(ii) Children's Vision	Montagu Room 3 — TCC
	(iii) Contact Lenses	Loyalist Room — TCC
	(iv) Low Vision	Kennebecasis 1 — Hilton
	(v) Sports Vision	Kennebacasis 2 — Hilton
	(vi) Voluntary Services	King's County Room — Hilton
2:00-6:00 p.m.	**Exhibit Hall** open	
6:00-8:00 p.m.	**Exhibit Hall Cocktails and Hors d'oeuvres.** Begin your evening out with a visit to the displays.	Marco Polo Room — TCC (Good Casual)
8:00 p.m.-????	**Class Reunions** — Join your classmates, reminisce and find out what's new! Check at registration area for more information	
10:00 p.m.-2:00 a.m.	**Hospitality Suite** open	Hilton Hotel Rm 317/18

FRIDAY — AUGUST 7

9:00 a.m.-12:00 nn.	**CAO General Business Meeting**	Loyalist Room — TCC
9:00 a.m.-12:00 nn.	**Exhibit Hall** open	Marco Polo Room — TCC
12:00 nn.-2:00 p.m.	**COETF "Light Lunch Launch" and Raffle Draw** will see some lucky Congress attendee win a luxury hotel barge tour of France's Champagne region	Montagu/Loyalist Rooms and Foyer — TCC
(Afternoon)	**Free Afternoon.** Enjoy touring, shopping, etc. in the Loyalist City of Saint John. More information and suggestions at the Registration Desk	
6:30-7:30 p.m.	**CAO President's Cocktail Reception**	Montagu Rooms and Foyer — TCC
7:30-10:30 p.m.	**CAO President's Banquet and Awards**	Marco Polo Room — TCC (Semi-formal or Formal)
10:30 p.m.-1:00 a.m.	**Dance and Social.** In the Marco Polo Room, dance to New Brunswick's foremost orchestra, The Thomists or, across the hall in the Montagu Rooms, to a different beat.	

for Spouses/Guests

This program has been planned to entertain and enlighten you — in true Maritime spirit. But, most of all, it is a program for all to enjoy.

The colourful Opening Ceremonies on the evening of Tuesday, August 4 will set the stage for the following three memorable days of tours, sports events, information sessions, shopping, dining, food, food and more food and, of course, New Brunswick's famous hospitality.

Highlights include walking or bus tours of your host City of Saint John, a day trip to the beautiful seaside town of St. Andrews, golf, a "battery charging" session at the Saint John Aquatic Centre and a fun and informative session with a genuine local character — Pete Luckett, CBC's Green Grocer.

Evenings will be special times with a Maritime Fun Night and Lobster Feast, class reunions across the City and the elegant closing Banquet and Ball.

A Maritime Merry-Tyme — all we need now is you!

DATE/TIME	EVENT	LOCATION* (Dress Recommendation)

* **Note:** "TCC" refers to the Saint John Trade and Convention Centre, located directly across the street from the Hilton Hotel and adjoining, via an indoor walkway, both the Hilton and Delta Brunswick Hotels.

TUESDAY — AUGUST 4

1:00 p.m.	**Registration Desk** opens	Coatcheck Lobby — TCC
7:00-10:00 p.m.	**Congress Opening Ceremonies** — a Welcome Party to start your Maritime Merry-Time (cocktails, hors d'oeuvres, entertainment)	Loyalist Room — TCC (Good Casual)
9:00 p.m.-12:00 mdnt.	**Hospitality Suite***	Hilton Hotel Room 317/18

* **Note:** The Hospitality Suite will also be open and hosted by New Brunswick delegates from 9:00 p.m. to 5:00 p.m. Wednesday through Friday. All registered Spouses and Guests are welcome to drop in and visit.

WEDNESDAY — AUGUST 5

9:00-11:00 a.m.	Join us in our **Hospitality Suite**. Plenty of coffee and local information available.	Hilton Hotel Room 317/18
12:00 nn.-2:00 p.m.	**Welcome Luncheon** with optometrists	Marco Polo Room — TCC (Good Casual)
2:30-4:30 p.m.	**City Tours** (i) **Walking Tour** of downtown Heritage and shopping area or (ii) City of Saint John **Bus Tour**	Assemble in lobby of Hilton Hotel at 2:20 p.m.
6:00 p.m.-1:00 a.m.	**Lobster Feast and Fun Night** — an evening with a real Maritime flavour — lobster and lots of entertainment	Thistle St. Andrews Curling Club. Buses begin leaving Hilton Hotel lobby entrance at 5:45 p.m.
11:00 p.m.-1:00 a.m.	**Hospitality Suite** open	Hilton Hotel Rm 317/18

PROGRAMME

THURSDAY — AUGUST 6

8:00-8:45 a.m.	**Continental Breakfast**	Hilton Hotel Lobby
9:00 a.m.-5:00 p.m.	**Day Trip to St. Andrews by the Sea.** Bus tour to scenic St. Andrews, historic block house, Huntsman Marine Aquarium and free time to browse through quaint waterfront shops to find that perfect gift or souvenir. **Lunch** at the picturesque Algonquin Hotel with time to relax and enjoy your surroundings.	Assemble in the Hilton Hotel Lobby at 8:45 a.m. (Comfortable Casual)
6:00-8:00 p.m.	**Exhibit Hall Cocktails and Hors d'oeuvres.**	Marco Polo Room — TCC (Good Casual)
8:00 p.m.-????	**Class Reunions** — Check at Registration area	
10:00 p.m.-2:00 a.m.	**Hospitality Suite** open	Hilton Hotel Rm 317/18

FRIDAY — AUGUST 7

(Morning)	**Golfing.** Times must be arranged at Registration Desk on arrival.	Rockwood Park Golf Club
9:00-10:00 a.m.	**Aerobics, Aquacise or Weight Training Classes.** Something for every non-golfer, with trained instructors and supervisors.	Saint John Aquatic Centre
10:30 a.m.-12:00 nn.	**Pete's Frootique.** An informative session on personality Pete Luckett. Don't miss this one!	Ballroom — Delta Brunswick
12:00 nn.-2:00 p.m.	**COETF "Light Lunch Launch" and Raffle Draw** will see some lucky Congress attendee win a luxury hotel barge tour of France's Champagne region	Montagu/Loyalist Rooms and Foyer — TCC
(Afternoon)	**Free Afternoon.** An opportunity to shop or tour local sites with your spouse. Need some ideas? — Check the **Hospitality Suite** (Hilton Hotel Room 317-318) or the **Registration Desk**	
6:30-7:30 p.m.	**CAO President's Cocktail Reception**	Montagu Rooms and Foyer — TCC
7:30-10:30 p.m.	**CAO President's Banquet and Awards**	Marco Polo Room — TCC (Semi-formal or Formal)
10:30 p.m.-1:00 a.m.	**Dance and Social.** An elegant ending and farewell to your memorable "Merry-Tyme Mingle".	

PROGRAMME

for Junior Delegates*

DATE/TIME	GROUP	EVENT	LOCATION* (Dress Recommendation)

* **Note:** "Group" references are for the following Age Groups:
I 0-5 yrs; II 6-11 yrs; III 12 yrs and up.

WEDNESDAY — AUGUST 5 to FRIDAY — AUGUST 7

8:30 a.m.-5:00 p.m.	I	**Preschool Daycare.** Storytime, crafts, lunches and snacks	Belleisle Rooms 1 and 2 Hilton Hotel

TUESDAY — AUGUST 4

7:00-10:00 p.m.	II, III	**Welcome Party** Entertainment includes comic/impressionist Fred Little	Kennebecasis Rooms 1 and 2 Hilton Hotel

WEDNESDAY — AUGUST 5

9:30 a.m. (Overnight) -5:00 p.m. Thursday	III	**Overnight Visit to Scenic St. Andrews** hosted by Sunbury Shores Arts and Nature Centre	Buses depart Hilton Hotel Lobby at 9:30 a.m.
12:00 nn.-5:00 p.m.	II	**Lunch** at McDonald's, then **Tour our local Dairy** for dessert!	Buses depart Hilton Hotel Lobby at 12:00 noon
6:30 p.m. (Overnight) -7:00 a.m. Thursday	II	**Sleepover**. Movies, games **Please bring sleeping bag.**	Belleisle Rooms 1 and 2 Hilton Hotel

THURSDAY — AUGUST 6

8:00-9:00 a.m.	I, II	**Continental Breakfast** with Spouses, Guests	Hilton Hotel Lobby
9:00 a.m.-5:00 p.m.	II	**Day Trip to St. Andrews by the Sea.** Travel to St. Andrews with Spouses/ Guests, then take part in separate day program hosted by Sunbury Shores Arts and Nature Centre	Buses depart Hilton Hotel Lobby at 9:00 a.m.
(Evening)	ALL	**Free Time.** A list of babysitters is available at the Registration Desk.	

FRIDAY — AUGUST 7

9:00 a.m.-5:00 p.m.	II, III	**A Day of Fun at Rockwood Park.** Waterslides, animal farm, lakes, zoo, lunch provided. **Bring money for snack bar and slide.**	Buses depart Hilton Hotel Lobby at 9:00 a.m.

6:00-9:30 p.m.	II	**Farewell Party.** Dinner, dance and games at the Delta Brunswick Hotel	Depart (walking) from Hilton Hotel Lobby at 6:00 p.m.
6:00-10:30 p.m.	III	**Farewell Party.** Pizza feast at Mother's Restaurant followed by a dance at the Delta Brunswick Hotel	Buses depart Hilton Hotel Lobby at 6:00 p.m.

P R O G R A M M E

pour optométristes

DATE/HEURE	ACTIVITÉ	LIEU* (Tenue vestimentaire recommandée)

* **Remarque :** Le sigle "PCC" désigne le Palais des congrès et du commerce de Saint-Jean, qui fait face directement à l'Hôtel Hilton et qui est relié, par une passerelle intérieure, aux Hôtels Hilton et Delta Brunswick.

LE MARDI 4 AOUT

13 h	Ouverture du **kiosque** d'inscription.	Hall des vestiaires — PCC
19 h à 22 h	**Cérémonies d'ouverture du Congrès** — C'est le temps de commencer à fraterniser, de revoir de vieux amis et de s'en faire des nouveaux. Des cocktails, de tonnes de hors-d'oeuvres, etc...et des surprises!	Salle Loyalist — PCC (Tenue de détente soignée)
21 h à 0 h	**Appartement d'accueil**	Chambres 317-318 de l'Hôtel Hilton

LE MERCREDI 5 AOUT

9 h à 12 h	**Éducation 1** **Dr Jerome Sherman** **"La rétine, toujours la rétine"**	Salle Loyalist — PCC
12 h à 14 h	**Déjeuner de bienvenue** Sous le coparrainage de la province du Nouveau-Brunswick; allocution du ministre de la Santé et des Services à la collectivité, Mme Nancy Clark Teed	Salle Marco Polo — PCC
14 h à 17 h	**Éducation 2** **Dr John Lovasik** **"Pédiatrie : normes et techniques d'électrodiagnostique"**	Salle Loyalist — PCC

PROGRAMME

18 h à 1 h	**Banquet de homards et soirée de divertissement** Quelques grandes spécialités des Maritimes — fruits de mer et artistes du Nouveau-Brunswick!	Club de curling Thistle St. Andrews. Les autocars partent du hall de l'Hôtel Hilton à 17 h 45. (Tenue de détente)
13 h à 1 h	**Appartement d'accueil** ouvert	Chambres 317-318 de l'Hôtel Hilton

LE JEUDI 6 AOUT

8 h à 9 h	**Petit-déjeuner continental parrainé**	Foyer à l'extérieur des salles Montagu — PCC
9 h à 12 h	**Éducation 3** **Dr Carole Melançon** **"Mise à jour sur les terminaux à écran"**	Salle Loyalist — PCC
12 h à 14 h	**Déjeuner-buffet dans la salle des exposants** Tout ce qui est nouveau, ou amélioré!	Salle Marco Polo — PCC
14 h à 17 h	**Réunion des sections de l'ACO**	
	(i) Vision et aviation	Salle Montagu 2 — PCC
	(ii) La vision des enfants	Salle Montagu 3 — PCC
	(iii) Lentilles cornéennes	Salle Loyalist — PCC
	(iv) Basse vision	Kennebecasis 1 — Hilton
	(v) Vision sportive	Kennebacasis 2 — Hilton
	(vi) Services bénévoles	Salle King's County — Hilton
14 h à 18 h	**Salle des exposants** ouverte	
18 h à 20 h	**Rafraîchissements et hors-d'oeuvres dans la salle des exposants** Commencez votre sortie de la soirée par une visite des kiosques d'exposition.	Salle Marco Polo — PCC (Tenue de détente adéquate)
20 h à ????	**Réunions de classe** — Avec vos confrères de classe, rappelez-vous le bon temps et découvrez les nouveautés! Renseignements supplémentaires au kiosque d'inscription	
22 h à 2 h	**Appartement d'accueil** ouvert	Chambres 317-318 de l'Hôtel Hilton

LE VENDREDI 7 AOUT

9 h à 12 h	**Assemblée générale de l'ACO**	Salle Loyalist — PCC
9 h à 12 h	**Salle des exposants** ouvert	Salle Marco Polo — PCC
12 h à 14 h	**Déjeuner et tirage du FFOCE :** Un congressiste chanceux gagnera un voyage dans la province française de la Champagne à bord d'une luxueuse péniche-hôtel.	Salles Montagu et Loyalist et Foyer — PCC

(Après-midi)	**Après-midi libre.** Faites du tourisme, du magasinage, etc. dans Saint-Jean, la Loyaliste. Renseignements supplémentaires et suggestions à l'Inscription	
18 h30 à 19 h 30	**Réception et cocktail du président de l'ACO**	Salles Montagu et Foyer — PCC
19 h 30 à 22 h 30	**Banquet et prix du président de l'ACO**	Salle Marco Polo — PCC (Tenue habillée ou de gala)
22 h 30 à 1 h	**Danse et soirée sociale.** Dans la salle Marco Polo, danse au son de la musique de l'orchestre le plus réputé du Nouveau-Brunswick, The Thomists ou, dans les salles Montagu, à l'opposé, pour ceux qui préfèrent uin autre rythme.	

P R O G R A M M E

des conjoint(e)s/invité(e)s

Nous avons préparé ce programme à votre intention, dans un but de divertissement et d'enrichissement, dans l'esprit des Maritimes, mais surtout, afin que tous et toutes aient du bon temps.

Les cérémonies d'ouverture hautes en couleurs, dans la soirée du jeudi 4 août, marqueront le rythme et l'allure des trois jours qui suivront : circuits touristiques, activités sportives, séances d'information, magasinage, banquets, tant et tant d'autres occasions de bien manger et, évidemment, l'hospitalité incomparable du Nouveau-Brunswick.

Parmi les points saillants, mentionnons : promenades ou excursions par autocars dans la ville-hôtesse, Saint-Jean; excursion d'une journée au magnifique bord de mer de St. Andrews, golf, séance de "récupération d'énergie" au Centre nautique de Saint-Jean, ainsi qu'une rencontre agréable et enrichissante avec une personnalité pittoresque de l'endroit, à savoir Pete Luckett, le maraîcheur du réseau anglais de Radio-Canada. Les soirées seront bien remplies : soirée de divertissement des Maritimes, banquet de homards, réunions de classe ou conventums partout dans la ville, sans oublier l'apparat du banquet et du bal de clôture.

On s'amusera, c'est sûr...Ne ratez pas cette occasion!

DATE/HEURE	ACTIVITÉ	LIEU* (Tenue vestimentaire recommandée)

* **Remarque :** Le sigle "PCC" désigne le Palais des congrès et du commerce de Saint-Jean, qui fait face directement aux Hôtels Hilton et Delta Brunswick.

LE MARDI 4 AOUT

13 h	Ouverture du **kiosque** d'inscription	Hall des vestiaires — PCC
19 h à 22 h	**Cérémonies d'ouverture du Congrès** — Soirée de lancement. On s'amuse dans les Maritimes. (Cocktails, hors-d'oeuvres, divertissements)	Salle Loyalist — PCC (Tenue de détente adéquate)
21 h à 0 h	**Appartement d'accueil***	Chambres 317-318 de l'Hôtel Hilton

* **Remarque :** L'appartement d'accueil sera ouvert de 9 h à 17 h du mercredi jusqu'au vendredi. Des délégués du Nouveau-Brunswick vous y accueilleront. Les conjoint(e)s et invité(e)s inscrits y sont les bienvenus.

P R O G R A M M E

LE MERCREDI 5 AOUT

9 h à 11 h	Rendez-vous à l'**Appartement d'accueil**. Café à volonté et renseignements de première main.	Chambres 317-318 de l'Hôtel Hilton
12 h à 14 h	**Déjeuner de bienvenue** avec les optométristes	Salle Marco Polo — PCC (Tenue de détente adéquate)
14 h 30 à 16 h 30	**Visite de la ville** (i) **Promenade** dans le centre commercial et historique de la ville ou (ii) Visite de Saint-Jean par **autocar**	Rendez-vous dans le hall de l'Hôtel Hilton à 14 h 20
18 h à 1 h	**Banquet de homards et soirée de divertissement** Une vraie soirée des Maritimes — du homard et tout plein de divertissements	Club de curling Thistle St. Andrews. Les autocars partent de l'entrée centrale de l'Hôtel Hilton à 17 h 45.
23 h à 1 h	**Appartement d'acceuil** ouvert	Chambres 317-318 de l'Hôtel Hilton

LE JEUDI 6 AOUT

8 h à 8 h 45	**Petit-déjeuner continental**	Hall de l'Hôtel Hilton
9 h à 5 h	**Excursion d'une journée jusqu'à St. Andrews by the Sea** Excursion par autocar jusqu'au pittoresque village de St. Andrews : Blockhous historique, l'Aquarium Huntsman et assez de temps libre pour flirter dans les merveilleuses boutiques du front de mer, afin de trouver le souvenir ou le cadeau parfait. **Déjeuner** au pittoresque Hôtel Algonquin et temps libre pour se détendre et admirer les environs.	Rendez-vous à 8 h 45 dans le hall de l'Hôtel Hilton (Tenue de détente confortable)
18 h à 20 h	**Cocktails et hors-d'oeuvres dans la Salle des exposants**	Salle Marco Polo — PCC (Tenue de détente adéquate)
20 h-????	**Conventums** — S'informer à l'Inscription	
22 h à 2 h	**Appartement d'acceuil** ouvert	Chambres 317-318 de l'Hôtel Hilton

LE VENDREDI 7 AOUT

(Matin)	**Golf.** Précisez l'heure au comptoir d'Inscription, dès votre arrivée.	Golf Rockwood Park

PROGRAMME

9 h à 10 h	**Périodes d'exercices aérobiques en piscine ou de musculation** De tout pour ceux qui n'aiment pas le golf, avec des instructeurs et des surveillants professionnels.	Centre de sports aquatiques de Saint-Jean
10 h 30 à 12 h	**Pete, le fruitier** Séance intéressante sur les dernières nouveautés en matière de préparation des produits frais, avec Pete Luckett, personnalité du réseau anglais de Radio-Canada. À ne pas rater!	Salle de bal de l'Hôtel Delta Brunswick
12 h à 14 h	**Déjeuner et tirage du FFOCE :** Un congressiste chanceux gagnera une excursion dans la région française de Champagne, à bord d'une luxueuse péniche-hôtel	Salles Montagu et Loyalist et Foyer — PCC
(Après-midi)	**Après-midi libre** L'occasion de magasiner ou de visiter la région avec votre conjoint. Des idées? À **l'appartement d'accueil**, chambres 317-318 (de l'Hôtel Hilton) ou à **l'Inscription**, on a toutes sortes de suggestions pour vous.	
18 h 30 à 19 h 30	**Cocktail et réception du président de l'ACO**	Salles Montagu et Foyer — PCC
19 h 30 à 22 h 30	**Banquet et prix du président de l'ACO**	Salle Marco Polo — PCC (Tenue habillée ou de gala)
22 h 30 à 1 h	**Danse et soirée sociale** Pour clôturer le tout dans l'élégance et recueillir encore quelques bons souvenirs des Maritimes.	

PROGRAMME

des jeunes*

DATE/HEURE	GROUPE	ACTIVITÉ	LIEU

* **Remarque :** Les groupes d'âge sont les suivants :
I 0 à 5 ans; II 6 à 11 ans; III 12 ans et plus.

DU MERCREDI 5 AOUT AU VENDREDI 7 AOUT

8 h 30 à 17 h	I	**Garderie préscolaire** Histoires, bricolage, repas et collation	Salles Belleisle 1 et 2 Hôtel Hilton

LE MARDI 4 AOUT

19 h à 22 h	II, III	**Partie de bienvenue** Le comique-impressionniste Fred Little sera de la partie	Salles Kennebecasis 1 et 2 de l'Hôtel Hilton

P R O G R A M M E

LE MERCREDI 5 AOUT

9 h 30 (deux jours) à 17 h le jeudi	III	**Excursion de deux jours jusqu'au pittoresque village de St. Andrews,** accueil par le Centre d'Arts et de Nature Sunbury Shores	Les autocars partent de l'entrée centrale de l'Hôtel Hilton à 9 h 30
12 h à 17 h	II	**Déjeuner** chez McDonald et, comme dessert, **visite de la laiterie locale!**	Les autocars partent de l'entrée centrale de l'Hôtel Hilton à midi (12 h)
18 h 30 (coucher compris) à 7 h le jeudi	II	**Soirée-camping** : films, jeux. **Ne pas oublier les sacs de couchage.**	Salles Belleisle 1 et 2 de l'Hôtel Hilton

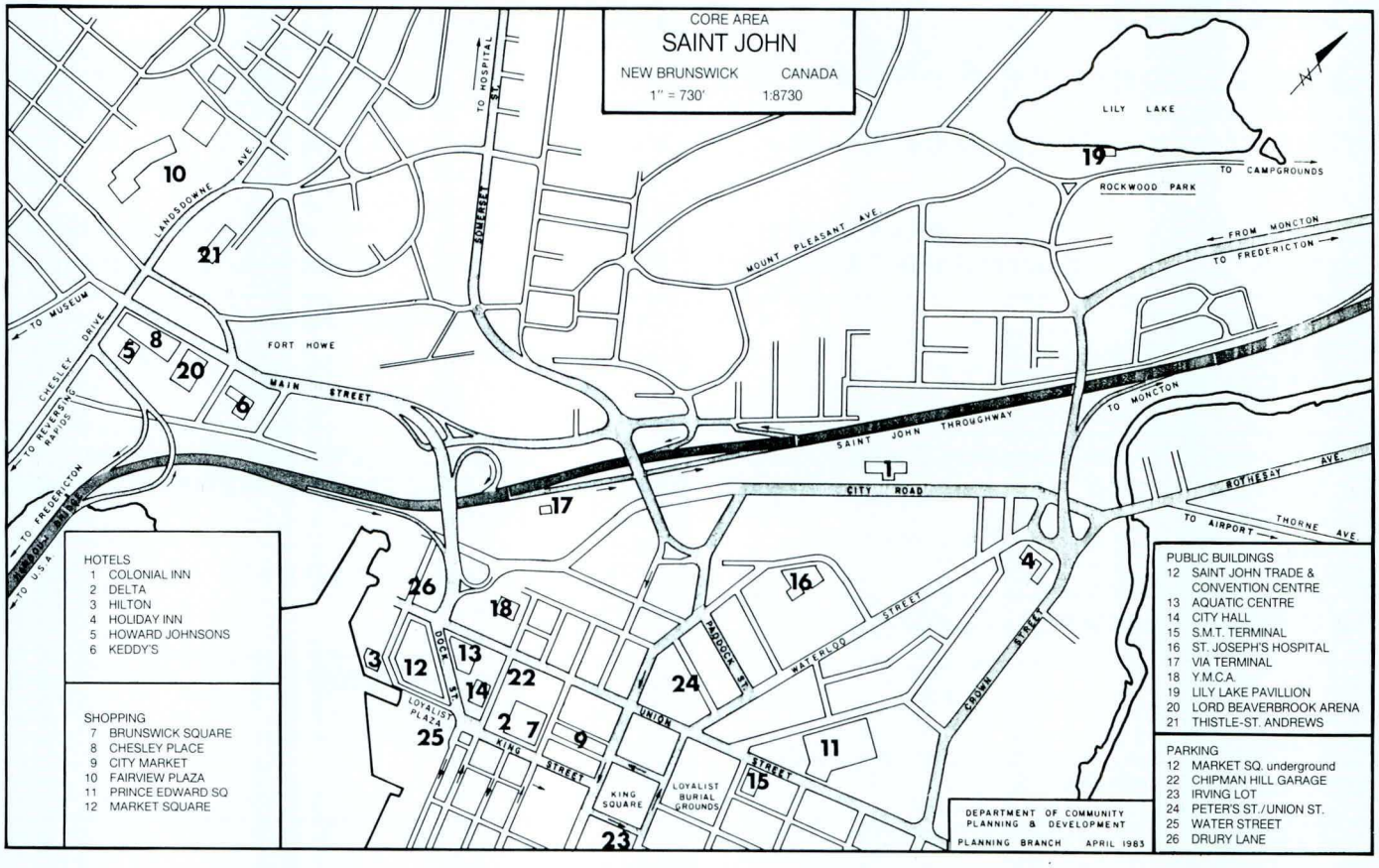
LE JEUDI 6 AOUT

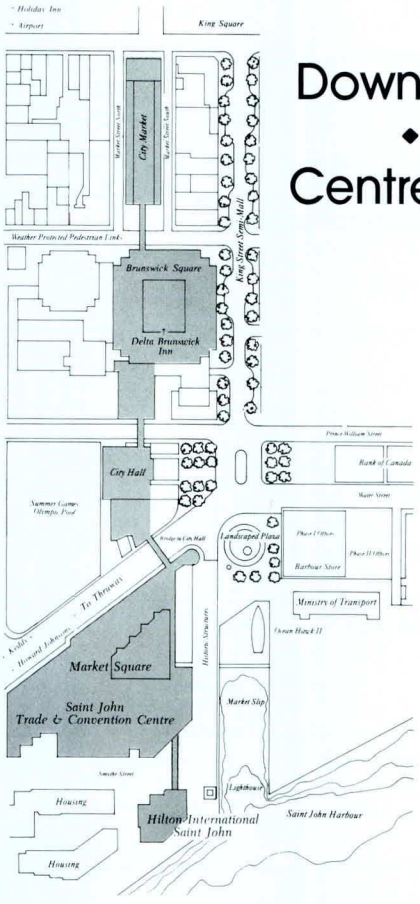
8 h à 9 h	I, II	**Petit-déjeuner continental** avec les conjoints et les invités	Hall de l'Hôtel Hilton
9 h à 17 h	II	**Excursion d'une journée à St. Andrews by the Sea** : voyage jusqu'à St. Andrews avec les conjoints et les invités et ensuite, programme distinct pour la journée, avec l'équipe du Centre d'Arts et de nature Sunbury Shores.	Les autocars partent de l'entrée centrale de l'Hôtel Hilton à 9 h
(Soirée)	TOUS	**Temps Libre.** Liste de gardiennes d'enfants à l'Information.	

LE VENDREDI 7 AOUT

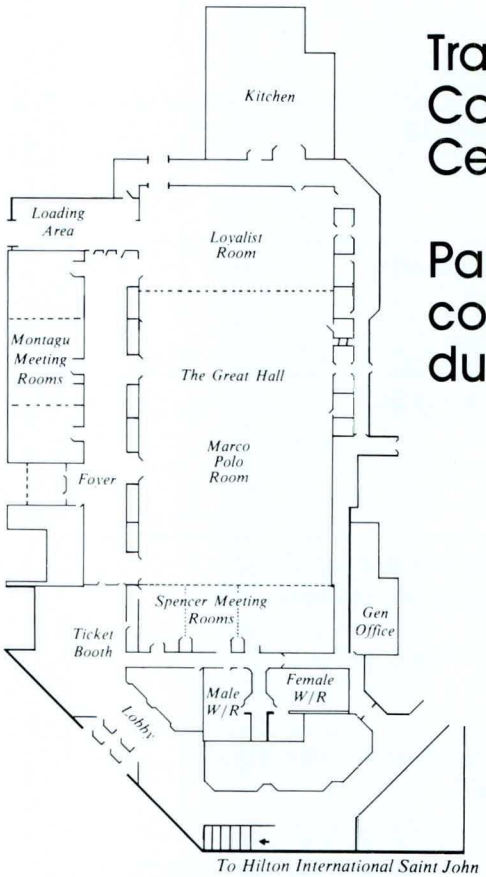
9 h à 17 h	II, III	**Journée de plaisir au Parc Rockwood** Glissoires, ferme, lacs, jardin zoologique, repas compris. **Apporter un peu d'argent pour la collation et les glissoires.**	Les autocars partent de l'entrée principale de l'Hôtel Hilton à 9 h
18 h à 21 h 30	II	**Partie d'adieu** Repas, danse et jeux à l'Hôtel Delta Brunswick	Départ (à pied) du hall de l'Hôtel Hilton à 18 h
18 h à 22 h 30	III	**Partie d'adieu** Pizza à volonté, au restaurant Mother's, et soirée de danse à l'Hôtel Delta Brunswick	Les autocars partent de l'entrée principale de l'Hôtel Hilton à 18 h

Maps • Cartes





Downtown
◆
Centre-ville



Trade and Convention Centre
◆
Palais des congrès et du commerce

Exhibitors

Following is an alphabetical list of Exhibitors and booth locations confirmed at press time. A supplementary list will be provided at the Congress Registration Desk.

Exhibitor Exposant	Booth Number(s) Numéro du(des) kiosque(s)
Alcon Canada Inc 6500 Kitimat Road Mississauga, Ontario L5N 2B8	3-3
Allergan Inc/Allergan Humphrey Canada 2255 Sheppard Avenue East Suite 414W Willowdale, Ontario L3T 5E4	2-5 2-6
AM Ophthalmic Instruments (Canada) Inc 1535 Meyerside Drive Unit No. 18 Mississauga, Ontario L5T 1M9	7-1 7-2 7-3
AOCO Limited/Limitée 80 Centurion Drive Markham, Ontario L3R 5Y5	4-4
Barnes-Hind Inc 6535 Mill Creek Drive Mississauga, Ontario L5N 2M2	4-2
Bausch and Lomb Canada 480 Denison Street Markham, Ontario L3R 1B9	2-9 2-10
Les Laboratoires Blanchard 1522 King ouest Sherbrooke, Québec J1J 2C3	3-8
Cameo Optical/Cartier Optical 600 Peel Street Suite 411 Montréal, Québec H3C 3A5	7-4 7-5
Canadian Association of Optometrists/ Association canadienne des optométristes Suite 301 1785 promenade Alta Vista Drive Ottawa, Ontario K1G 3Y6	5-1
Canadian National Institute for the Blind 1931 Bayview Avenue Toronto, Ontario M4G 4C8	5-3

Exposants

Suite une liste alphabétique des exposants et de l'emplacement des kiosques confirmés au moment de la mise sous presse. Une liste supplémentaire sera disponible au bureau d'inscription du Congrès.

Exhibitor Exposant	Booth Number(s) Numéro du(des) kiosque(s)
Canadian Optical Supply Co Ltd 8360 Mayrand Montréal, Québec H4P 2C9	1-3
Canadian Optometric Education Trust Fund/ Les fonds de fiducie des optométristes canadiens pour l'éducation Suite 301 1785 promenade Alta Vista Drive Ottawa, Ontario K1G 3Y6	5-2
Centennial Optical Limited/ Olympia Optical 16 Eugene Street Toronto, Ontario M6B 3Z4	3-1 3-2
Ciba Vision Care Inc 2150 Torquay Mews Mississauga, Ontario L5N 2M6	4-7
Coopervision 100 McPherson Street Markham, Ontario L3R 3V6	5-4
Eastern Optical Laboratories Ltd 101 Ilsley Avenue Dartmouth, Nova Scotia B3B 1S8	2-8
Essilor Canada 295 Deslauriers St-Laurent, Québec H4N 1W2	2-3
Hydron Canada Limited 1091 Brevik Place Mississauga, Ontario L4W 3R7	1-5
Imperial Optical Canada 21 Dundas Square Toronto, Ontario M5B 1B7	3-11 4-9 4-10 4-11
KDS Optical Company Ltd 140 Islington Avenue Toronto, Ontario M8V 3B6	3-5

P R O G R A M M E

Laboratoires optique de Hull 5-9, 5-10
12 Buteau Street
Richelieu Industrial Park
Hull, Québec
J8Z 1X4

Lifestyle Eyewear 5-11
21 Dundas Square
Toronto, Ontario
M5B 1B7

Luxottica Canada Inc 1-6, 1-7
947 Verbena Road
Mississauga, Ontario
L5T 1T5

Medi-Dent Services 4-8
5050 S. Service Road
Burlington, Ontario
L7R 4C8

Menrad Canada Inc. 2-4
4995 Timberlea Blvd
Unit 8
Mississauga, Ontario
L4W 2S2

New Brunswick Association of Optometrists 6-1
Mobile Vision Screening Services
461 King Street, Suite 1
Fredericton, New Brunswick
E3B 1E5

Nordic International Inc 3-9
No. 504, 5250 Ferrier Street
Montréal, Québec
H4P 1L4

North American Coating Labs Ltd 4-6
747 Erskine Avenue
Peterborough, Ontario
K9J 7Y6

Ocean Optical Ltd 2-2
PO Box 1150, 5 Orange Lane
Moncton, New Brunswick
E1C 8P6

Opal Optical Ltd 2-7
93 Armstrong Avenue
No. 8, PO Box 10
Georgetown, Ontario
L7G 4S1

Optocoat ML 6-12, 6-13
2388 Dunwin Drive
Mississauga, Ontario
L5L 1T1

Optyl Eyewear Fashion International 3-4
6185 Tomken Road, Unit 8
Mississauga, Ontario
L5T 1X6

Optique Perfect Inc 7-7
1265, avenue Ducharme
Outremont, Québec
H2V 1E6

Pinehurst Woodworking 1-1
32 Regan Road
Brampton, Ontario
L7A 1A7

Plastic Contact Lens Company (Canada) Ltd 3-10
21 Dundas Square
Suite 815
Toronto, Ontario
M5B 1B7

Polymer Technology 2-11
29 Milford Crescent
Bramalea, Ontario
L6S 3E3

Regional Optical Limited 5-8
PO Box 627
Stephenville, Newfoundland
A2N 3B5

Reichert Ophthalmic Instruments 4-3
2220 Midland Avenue
Unit No. 60
Scarborough, Ontario
M1P 3E6

Rodenstock (Amber Optical) 7-8
186 Dupont Street
Toronto, Ontario
M5R 3J4

Plastique Ronor 3-7
90, ouest Beaubien
Suite 601
Montréal, Québec
H2S 1V6

Les Services optométriques (AOQ) Inc 1-8
465, rue St-Jean
bureau 1001
Montréal, Québec
H2Y 2R6

Shilling Optical Case 7-6
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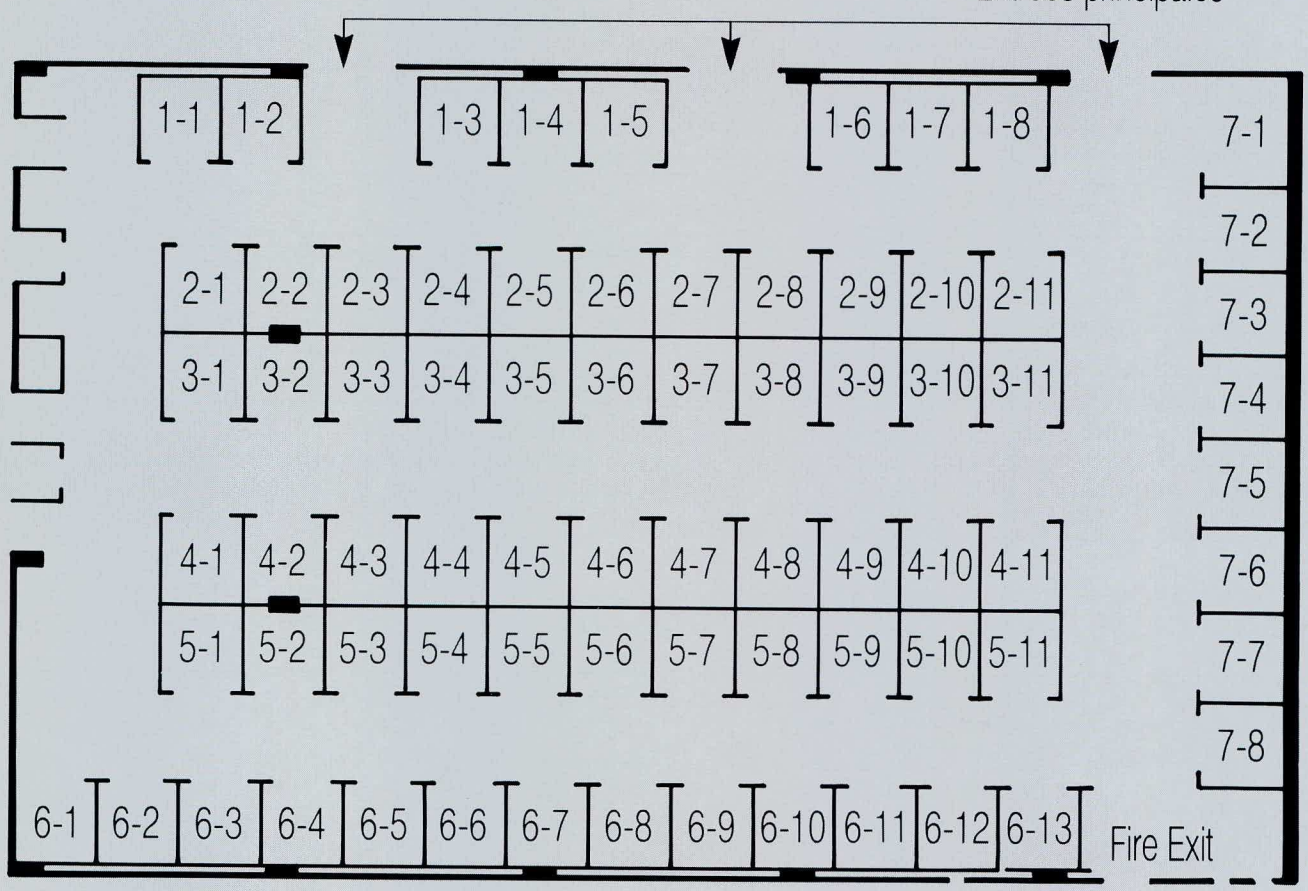

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Sight Enhancement Services — A Safety Net or a Spider's Web?

E.J. Herie *
G. Grace * *

*LL.D.
*(above and **) Canadian National Institute for the Blind (CNIB) Toronto*

1. Sight Enhancement Services

This paper will review the development of the "human services" aspect of sight enhancement, and the integral role of human services in an effective and comprehensive sight enhancement system.

First, what exactly is meant by human services? Briefly, it is the organized capacity of people to care for one another through organizations or social institutions — how we as a society offer love, compassion and help to members of our society and the world at large. With regard to sight enhancement, human services are those rehabilitation, counselling, educational and leisure services that allow individuals the freedom to attain their potential and to participate fully in society. Important as these human services are, they cannot be offered in isolation from the diagnostic and remedial assistance provided by vision health practitioners and specialists.

The use of the term "blind" refers to persons without any vision at all, while at the same time, there is a close association between blind persons and those whose vision is extremely poor, or is failing rapidly.

Early reference to care and compassion for blind persons is found in the book of Leviticus: "Thou shalt not ... put a stumblingblock before the blind." In the 14th century attempts were made to allow blind persons to read, but five centuries were to pass before Louis Braille's embossed system was to remove the barrier of illiteracy.

From this point Western societies were to witness the evolution of organized human services for the blind and visually impaired. Braille's system was truly the key to organized human services for the blind as they exist today. This evolution began with the development of schools for the blind. The first school for the blind in Canada was established in 1861, but over half a century passed before the CNIB as a service organization received its charter in March of 1918. CNIB proved to be a unique approach to human and rehabilitative services given that it is a national service organization. Contrasted to other developed countries, CNIB represents a most interesting approach, and one that is envied by other organizations involved in human services in this country and elsewhere.

The Canadian National Institute for the Blind — the CNIB — is a complex rehabilitation organization providing a wide range of human services. While the CNIB has only recently become involved on an expanded scale with the new Sight Enhancement Program for visually impaired individuals, its goal has always been to help blind, visually impaired and blind multi-sensory-deprived individuals find ways to lead productive and satisfying lives. The concern has always been with the whole person, and not just his or her lack of vision.

As the needs and expectations of the blind and visually impaired population changed, and as society has become more interested in the rights of disabled individuals, this concern has taken a number of forms. The CNIB began by providing rehabilitation services and training and worked to educate the public while lobbying the government at all levels. This approach paid off through legislation, including disability pensions, public health measures, Income Tax Act exemptions, and White Cane Acts. The CNIB not only employed blind and visually impaired persons, but built residences and service centers. In 1968 the CNIB established a national vocational guidance and training centre, a decision that in retrospect was at variance with today's trend to community-based services and programs.

Today the CNIB has only a few residences for elderly blind persons remaining, as public and private sectors in Canada have assumed responsibility for providing services in local communities.

From its inception the CNIB has promoted consumer participation in decision-making. Today the public has become sensitized to the problems of the disabled, and organizations of the disabled have achieved a stronger influence in decision-making, planning and implementation of services directed at them, and in numerous initiatives to secure general and specific human rights.

This trend will continue, along with decentralization of service, and partnerships between government, service organizations, and consumer groups in this field. The consumer — the individual consumer — is going to have an increasing say, not only in what service is provided, but in how, where and when it is provided. To keep in touch with and respond to the needs of this fast-changing market, service providers are going to have to step up their sensitivity to and understanding of the environment with increased penetration and analysis of the "consumer" impact. Planned co-ordination of human and sight enhancement services will become even more important if service providers hope to deliver responsive, efficient and useful service to our constituency.

Some of these trends are worrisome given the risk of fragmentation and duplication and CNIB has become one of the players in an ever-expanding network of professional organizations. But CNIB, because of its concern with human services and with its firm goal of helping individuals with impaired vision achieve their full potential, must ensure that individuals are receiving the service they need, and that the complex network

helps rather than hinders their attempts to take their place in society.

Before addressing the issue of the sight enhancement system or network in Canada, a brief description of CNIB's expanded sight enhancement policy and program is required.

In 1985 CNIB served 46,000 individuals of whom approximately 10 per cent (or 4,636) were new registrants. Figure 1 depicts the dramatic increase in the number of registrants from 1969 to 1985 — more than 68 per cent. This registered group is comprised of individuals who fall within the 6/60 (20/200) or less category, often referred to as "legally blind". In fact, 90 per cent do have a degree of residual vision.

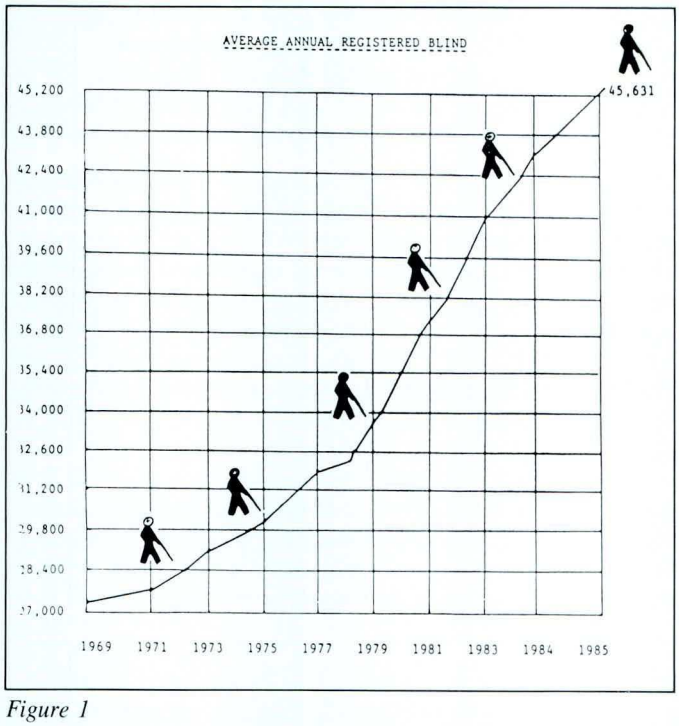

Figure 1

Globally, the number of blind persons is expected to increase from 42 million in 1978 to 100 million by the year 2000. The prevalence of blindness in Canada and other developed countries is approximately 222 cases per hundred thousand people, compared to as many as 5,000 per hundred thousand in developing countries. The prevalence of blindness for developed countries supports our projection of a total of 55,000 people eligible for registration with CNIB. However, if the scope of what is considered severe visual impairment is broadened from 6/60 (20/200) or 10 per cent vision or less to 6/21 (20/70) or less, the number of potential registrants for CNIB services increases by 195,000. Altogether, there may be 250,000 people in Canada who might benefit from Sight Enhancement Services, although by no stretch of the imagination would all these people require assistance, nor would CNIB have the capacity to serve them.

It is for this group, those whose visual impairment is not severe enough to be considered blindness as the term is usually defined, but whose sight is poor enough to create practical or functional problems, emotional stress and family difficulties, for whom CNIB has recently developed a new sight enhancement policy and launched a new program, Sight Enhancement Enterprise (SEE).

Through SEE, every person wishing to optimize his or her remaining sight can be trained in the best use of this residual vision and will have access to the most advanced technological products. Our first priority is and will continue to be those with no vision or extremely poor vision, the deaf-blind and the multi-handicapped. It is this group which the CNIB will serve first and always.

Anyone with a vision problem can approach any of the 50 offices of CNIB across Canada for counselling, rehabilitation services, or referral to other community services. The program will be a co-operative effort involving health practitioners and education and social service personnel from the private and public sectors.

In short, SEE is about rehabilitation. It is designed to reduce the impact of disabling and handicapping conditions, with the objectives of enabling the disabled and the handicapped to achieve social integration and full participation. The importance of such rehabilitation is well documented: visual impairment, along with other disabilities, causes society to incur high costs, both social and economic. Rehabilitation and support programs can significantly reduce these costs, and better still, prevention can avoid them altogether. The bottom line of course, goes back to human services and the organized capacity of people to care for one another and help each other to lead satisfying lives.

Every one of the 50 CNIB offices will have a range of technical aids on display, and 14 major display centers across the country are now being developed. Individuals with vision problems will have the opportunity to try new technical aids, to borrow them and to receive training.

Two aspects of the SEE program are of special note. First, every one of the 50 CNIB offices will have a range of technical aids on display, and 14 major display centers across the country are now being developed. Individuals with vision problems will have the opportunity to try new technical aids, to borrow them and to receive training.

The second aspect is service to seniors. Today, nearly 60 per cent of the people registered with the CNIB are over 65 years of age, compared to about 45 per cent only 10 years ago. Since 1971, when CNIB registered 1,100 new persons over 65, the number of new registrants over 65 each year has climbed 300 per cent to 3,300. That 3,300 represents 72 per cent of the new registrants in 1985. It underlines the fact that the population of older people, here and in the rest of the world, is growing at a tremendous rate, and is going to have considerable impact on health systems, including sight enhancement.

Loss of vision usually occurs slowly, over time, and may not be noticed by the individual, his family or his friends. However, loss of vision can have a devastating effect on an individual. Low vision aids have on occasion had impressive results with older people who had been mislabeled "confused" or "depressed" when the real problem was that they could no longer see well.

Sight enhancement services for the elderly are particularly important because they can mean the difference between independence and institutionalization. The price we have paid for industrialization in the developing world is the erosion of

the nuclear family. This is in stark contrast to stronger family ties in the developing world. In Western society we are more dependent on the safety net. Loss of vision often forces an individual to give up his or her home and ultimately to lose independence. And since independence is one of the best measures of quality of life, the role of sight enhancement services in maintaining independence is crucial.

The Sight Enhancement Enterprise Program, and CNIB itself, are today just one part of the complex network of low vision services in Canada portrayed in Fig. 2. At the centre, of course, is the consumer, the person with poor or failing vision. Next is the resource system — optometry, ophthalmology, medical doctors, public health nurses, hospitals, university clinics, vocational rehabilitation services, assistive devices, research groups, consumer groups, volunteers and other services and organizations such as the CNIB. Next is the information system, which attempts to connect consumers with the services available. This includes the media, association newsletters, government publications, libraries, consumer organizations, and so on.

It is a good system, it is a thorough system, and in Canada there are a minimum of 45,000 points of entry to obtain rehabilitative, medical and the entire range of sight enhancement services. For North America as a whole, the evidence suggests approximately half a million points of entry. There exists enough entry points to the system to ensure access for everyone in Canada or North America who needs assistance. But the question is, does it? Does the system ensure access to appropriate service? Unfortunately, the answer is no, not always. It doesn't take much discussion with the consumers, with the users of the system, the people who are supposed to benefit, to discover problems with this very complex system. In other words, the safety net could be described as functioning more like the spider's web where you are caught in the system rather than helped by it.

Too commonly, one of the first problems cited is lack of money. It is difficult to calculate just how much money is allotted for services for the visually impaired in Canada, but if we knew, the amount would be staggering. More money is not always the solution; rather, better planning and co-ordination of comprehensive services can achieve surprising results.

Another problem, and perhaps a more basic problem, concerns co-ordination. In many cases, people are receiving conflicting information from a variety of sources. It is not unusual for parents of a child with visual impairment to receive advice from 15 different sources and to be left confused and without clear direction. In other cases, people are not receiving enough information, or what they are receiving is fragmented. Or they get fed up with bureaucracy, with being shunted from one place to another. The result is often that they are trapped at a particular part of the network, labeled as blind or not blind, and not really receiving the most beneficial assistance — and CNIB must accept its share of criticism in this regard. For these reasons it is imperative that all of us work together to co-ordinate our efforts.

> Our response must reflect our belief and resolve that the impossible can be achieved through co-operation, planning and co-ordination.

To return to that all-important human services aspect, it is not unusual for consumers to complain that specialists in low vision are authoritarian and unimaginative in their counselling. Consumers say that low vision experts do not tell them the things they really want to know. And perhaps worst of all, many low-

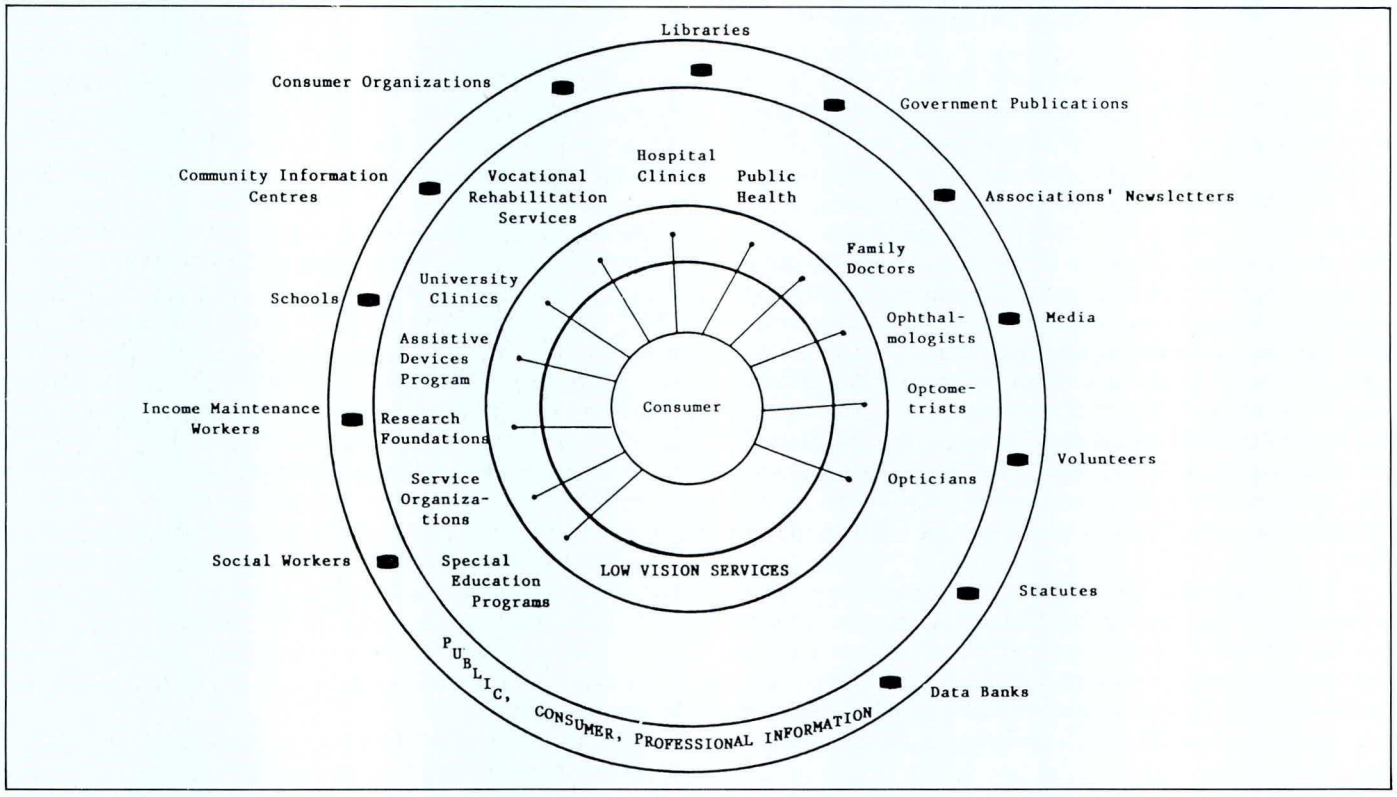

Figure 2. Low Vision Services Network

visioned people believe the experts have focused their work so narrowly on the eyes themselves, that they overlook the person in whom the eyes reside.

The answer to many of these problems is planned co-ordination of funds and services. In the absence of co-ordinated services, this incredible system functions not as the safety net it was meant to be, but as a spider's web, restraining and confusing, and preventing the individual from receiving equitable and beneficial service. With the necessary co-ordination, basically adequate resources in the developed world, and the potential for the establishment of adequate resources in the developing countries, we can provide the kind of safety net truly required.

While we have sight, we sometimes lack vision, the vision that will give us what we seek — an effective, efficient and caring sight enhancement system accessible to all.

Each discipline has a clear picture of what needs to be done and how it should be done. The problem arises when these disciplines become so narrowly focused on their own specific areas that they are unable to work together with others to present a clear direction to the consumer. Without the ability to see beyond their own specialties and conditions, valuable resources are wasted and effectiveness and ability to truly help people with low vision to achieve their full potential is reduced. While we have sight, we sometimes lack vision, the vision that will give us what we seek — an effective, efficient and caring sight enhancement system accessible to all.

A final word of caution — organizations of and for the blind and visually impaired risk sliding under the umbrella of the generic disability group. There is, in this worrisome trend, an inherent danger that the problems that have been identified for this group will be compounded if we water down, or worse, lose the special knowledge and expertise that is required for successful intervention.

2. Summary and Conclusion

This review of current and historical trends has been presented as a guide for future planning and activities. Enough is known of the future in respect of demographic, economic and technological trends to project service requirements well into the 21st century. It is clear that we must make our existing resources work more efficiently and more quickly to serve more people. We must allocate both human and financial support to make the principle of equity a reality throughout the world. In this regard, we cannot overlook the dramatic and excellent work currently underway to prevent blindness or severe visual impairment, since as much as 80 per cent of blindness is said to be preventable. Where prevention of blindness is not possible, remedial programs must be either developed or strengthened.

Relevant research and statistical data will help us all in that essential process of planning and co-ordination. As this information is studied and analyzed to determine its relevance to the respective disciplines and organizations, it should be done with a sense of excitement and renewal. This is truly a unique opportunity to challenge and be challenged. Our response must reflect our belief and resolve that the impossible can be achieved through co-operation, planning and co-ordination. We can reduce or eliminate barriers to service, whether they be social, economic or organizational. Too long have we accepted systems established to serve humans, systems that, over time, have become inflexible and insensitive, and that in their worst applications create orphans rather than beneficiaries.

Much has been written about the incredible sight of the eagle. The vision of a clam is a frightening parody of that keen eyesight. The information reviewed in this paper suggests that, in respect of sight enhancement systems, we have a sky full of eagles with the clearest sight in their respective areas. The challenge before us is to harness those eagles and to focus their vision towards the future where the world can be relatively free of blindness and severe visual impairment. Astronauts, from their vantage point in space, have described with awe the incredible beauty of our earth. Our view of that world must be shared through a common vision of what can be achieved through our collective contribution as individuals with a common purpose.

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Detection of Visual Field Defect Using Topographic Evoked Potential in Children

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1. Introduction

The interpretation of visual evoked potentials (VEP) suffers from a lack of objectivity due to several causes. First there is as yet no good biological model explaining the relation between the physiological activities occurring in the brain and the voltage variations measured during the VEP. This means that no mathematical standard for a "normal" reading has been set, nor a normal range of variation against which to test a VEP under investigation. There are certain features whose presence or absence are considered relevant to the analysis, like peak morphology and latency features, but these are difficult to code mathematically and it is not clear at all what their statistical distributional properties are, both in the healthy population and in specific types of illnesses.

> In this study we have therefore tried to concentrate on methods which may be justified on a theoretical basis, accepted on an empirical one, and could be treated in a manner as objectively as possible.

Other features which may seem more amenable to mathematical coding, like the latency and amplitude of the main occipital positive peak, need a subjective element for their identification and, moreover, have proved to have variable discrimination power in the study of patients with visual field defects[1]. Increasing the number of scalp electrodes has provided additional information of the relationship of electrical activity between different brain regions, and has been found useful[2].

In this study we have therefore tried to concentrate on methods which may be justified on a theoretical basis, accepted on an empirical one, and could be treated in a manner as objectively as possible. The basis of comparison was both the clinical localization of the defect and the visual interpretation of the VEPM. It is hoped that a statistical procedure could be developed which does not require any subjective judgement.

2. Materials and Methods

The patient population consisted of 12 children (age 1 to 10 years, median 3 years). All were examined with particular emphasis on their neurological and visual systems, including visual field examination at the bedside. All 12 patients had unilateral homonymous hemianopia on clinical examination. The etiology of the field defects varied among the patients. For three of the patients we had multiple VEPMs performed at various points during the clinical recovery. These data were only used to further test the techniques analyzed.

> The problem that seemed most tractable for our study is that of symmetry, namely, whether the two sides of the brain react in a similar way to the incoming symmetric stimuli.

The control group consisted of 23 normal subjects (age 6 to 18 years, median 10.8 years) with no history of neurological disturbance or visual defect.

The subjects were not sedated and during testing laid supine in a darkened room. The strobe unit was placed 10 inches in a direct line of sight from the patient's closed eyes. Continuous effort was made to ensure alertness. Collodion electrodes were used, with impedence less than 3K Ohm. Twenty simultaneous channels (International 10–20 system, including 0_z) were available to acquire data for 512 ms after each flash stimulus. The input was led to a 21 channel electroencephalogram (Nihon Kohden Corporation model 4221, Irvine, California) and its output digitized at 500 Hz by a dedicated microcomputer (Biologic Systems Corporation model Brain Atlas, Northbrook, Illinois). Two hundred stimuli were averaged with automatic artifact rejection to form a single average evoked potential. Visual interpretation was done with prior knowledge of any identification or clinical information. The VEPM data was transferred into an ASCII file and analyzed with the methods

described below by using the Systat statistical package (Systat Inc., Evanston, Illinois).

The problem that seemed most tractable for our study is that of symmetry, namely, whether the two sides of the brain react in a similar way to the incoming symmetric stimuli. Several statistics were constructed.

2.1 Correlation Coefficients:

The Pearson correlation coefficient was computed for the data from the 8 homologous electrode pairs: F_{p1}-F_{p2}, F_3-F_4, F_7-F_8, C_3-C_4, T_3-T_4, P_3-P_4, T_5-T_6, and O_1-O_2. The control group was used to construct onesided 95% normal confidence intervals. Values below the lower limit of such interval were considered abnormal.

2.2 Multiple Correlation:

Multiple correlation coefficients were computed for each of the lateral occipital channels with respect to the adjacent channels (O_1 with respect to T_5, P_3, P_Z and O_z; O_2 with respect to P_Z, P_4, T_6 and O_7). A two sided 95% confidence interval was constructed using the normal subjects and then the values obtained for the patients were tested against such interval. If a strong local source was present near O_1, say, a high spatial gradient would exist, giving a lower correlation. Conversely, a higher correlation value would result from a low spatial gradient as a result of volume conduction from distant generators.

2.3 Mahalanobis Distance:

Each EP series of 256 points was divided into 8 time bins of 64 ms, with a single average voltage computed per bin. This produced response vectors from which the mean value and the covariance matrixes were estimated, separately for the patient and control groups. The Mahalanobis distance[3] of each response from both groups was then computed and the VEP classified to belong in the group with the smaller distance. In order to respect the independence and the meaningfulness of the data we used only the left channel (O_1) for the control subjects and the abnormal side for the patients.

2.4 Cross-correlation Analysis:

This type of analysis was limited to the O_1-O_2 pair. The correlations between O_1 and O_2, in this order, were computed at lags varying from −20 to +20 (i.e. −40 to +40 ms) and the following set of statistics was constructed for each VEP:

— the lag at which maximum correlation occurred;
— the value of the correlation at lag 0;
— the ratios of the correlation at lag 0 to those at lag −20 and +20 independently (skewness ratios).

These were all taken as non parametric statistics, as no assumptions were made about their distribution. The two ratios presented an additional problem, namely that for some EP's the correlation at one of the three lags considered was negative. In order to maintain interpretability we assigned to these ratios a value of 0 whenever the correlation at lag 0 was negative and a value of 100 whenever the correlation at lag 0 was positive but was negative at the corresponding extreme.

3. Results

Visual interpretation resulted in 11/12 (92%) VEPMs being classified as abnormal, while 1 was classified as normal.

3.1 Correlation Coefficients:

The set of correlation coefficients provided some indication of the nature of the VEP investigated. Of the 23 control subjects 13 had all correlations within the confidence limit, 7 had one abnormal value, 2 had two abnormal values and 1 had three. Of the 12 patients 1 had 1 abnormal value, 1 had them all abnormal and the remaining had between 3 and 7 abnormal values, mostly in the occipital region (see Table 1).

Table 1

Summary of statistics for correlation coefficients

				# of cases below limit	
Ch. pair	Mean	St. dev.	Lower limit	CONTROL	PATIENT
F_{p1}-F_{p2}	.975	.028	.928	2/23	5/12
F_3-F_4	.925	.088	.780	3/23	2/12
F_7-F_8	.776	.249	.366	1/23	5/12
T_3-T_4	.827	.148	.583	2/23	10/12
C_3-C_4	.923	.071	.806	1/23	6/12
P_3-P_4	.891	.100	.726	1/23	9/12
T_5-T_6	.812	.122	.611	2/23	10/12
O_1-O_2	.923	.082	.788	2/23	10/12

3.2 Multiple Correlation:

Multiple correlation produced disappointing results. The confidence interval obtained from the control group was too wide and close to unity to provide any discrimination value for the patient group (mean 0.987, S.D. 0.011, 95% interval 0.965 to 1). Of the 46 values for the control group 2 were classified as abnormal. Of the 24 values for the patient group only 5 were classified as abnormal and two of these referred to the side which, on clinical examination, had proved less abnormal.

3.3 Mahalanobis Distance:

The Mahalanobis distance method provided only one misclassification in the control group, but only 7 of the 12 patients were correctly classified as abnormal.

3.4 Cross Correlation:

Based on the values obtained from the control group we set the following *ad hoc* discrimination rule. A reading was considered abnormal if:

— the maximum correlation was at a lag lower than −5 or higher than +5 or,
— the correlation at 0 was lower than 0.6 or,
— one of the skewness ratios was lower than 1.5.

With this criterion all control subjects were classified as normal and all patients in the study group as abnormal except one (92%), the same accuracy as visual interpretation. The exception was caused by a type of abnormality not revealed by

TABLE 2

Mahalanobis distance.

Individual controls' distance from:			Individual patient's distance from:		
Control group	Patient group	Classif.	Control group	Patient group	Classif.
2.410	3.450	n	3.810	4.600	n
6.100	48.990	n	4.290	4.990	n
3.100	22.110	n	66.740	10.000	a
7.500	129.880	n	29.330	9.780	a
7.290	46.460	n	11.810	9.950	a
4.910	17.920	n	4.550	4.920	n
4.480	7.260	n	68.700	7.960	a
3.100	48.530	n	6.310	8.420	n
9.290	568.860	n	22.130	8.590	a
13.790	392.200	n	6.880	5.290	a
1.400	12.540	n	6.810	7.970	n
3.790	3.070	a	10.680	5.530	a
3.550	11.620	n			
7.590	45.470	n			
6.630	82.310	n			n = 5/12
19.870	142.760	n			
9.430	486.660	n			a = 7/12
8.700	47.060	n			
13.470	158.030	n			
15.380	172.970	n			
10.820	185.250	n			
10.920	47.130	n			
2.470	76.300	n			
		n = 22/23			
		a = 1/23			

n = individual is closer to the control group.
a = individual is closer to the patient group.

TABLE 3

Cross-correlation study

	Lag of max. correlation	Correlation at lag 0	Ratio with corr. at −20	Ratio with corr. at +20
CONTROL GROUP				
	0	0.958	2.047	2.777
	−1	0.975	1.509	1.908
	0	0.928	1.657	2.812
	0	0.976	1.852	2.509
	0	0.736	3.242	3.472
	0	0.916	5.234	1.722
	0	0.857	12.243	100.000
	0	0.874	28.194	16.491
	2	0.954	100.000	954.000
	0	0.949	100.000	100.000
	−1	0.929	1.621	2.617
	0	0.989	12.519	6.774
	0	0.972	2.467	1.873
	0	0.973	1.954	1.900
	−2	0.922	1.592	2.499
	−1	0.984	1.922	2.491
	0	0.939	1.912	1.940
	2	0.898	10.090	4.157
	0	0.961	1.806	2.164
	1	0.958	1.808	1.797
	−1	0.969	16.424	100.000
	0	0.971	1.994	2.111
	1	0.648	2.455	7.714
PATIENT GROUP				
	17 *	0.185 *	1.063 *	0.564 *
	0	0.296 *	10.963	100.000
	−20 *	0.387 *	0.531 *	1.155 *
	−10 *	0.500 *	1.018 *	100.000
	−1 *	0.928	1.291 *	1.925
	−2	0.862	1.626	1.523
	20 *	−0.248 *	0.000 *	0.000 *
	20 *	−0.190 *	0.000 *	0.000 *
	−20 *	−0.230 *	0.000 *	0.000 *
	−20 *	0.279 *	0.398 *	100.000
	−20 *	0.079 *	0.140 *	100.000
	−17 *	0.476 *	0.815 *	23.800

The asterisks indicate values beyond the set limits.

the procedure, namely the patterns of the two channels were well matched in phase, but quite different in amplitude.

4. Discussion

We were initially concerned about the age difference between the patient and control group. However we believed that the type of features under study (mainly correlations) would not be affected by age, unlike some latency values or morphological features. In fact an inspection of all the data revealed no systematic difference in the quantities analyzed between low and high age subjects.

4.1 Correlation Coefficient:

While correlation coefficients are the first choice for an analysis of this type and despite the fact that they did prove useful, some technical considerations would suggest intrinsic limitations.

First of all, for a normal subject one would expect the value of each such coefficient to be close to 1. In this case the distribution of the sample correlation, even under the usual assumptions of normality and independence of the data, tends to normality very slowly[4]. In fact it is not asymptotically normal if the true coefficient is exactly 1. This means that one may not correctly use normal confidence intervals to test individual readings. This theoretical fact was confirmed by our data: the histogram of the correlation coefficients for the control group was quite skewed and normal confidence intervals failed to create a convincing division between the two groups.

We were initially concerned about the age difference between the patient and control group.

It is perhaps worth mentioning that even if we had used a non-symptotic distribution theory for these coefficients, an "abnormal reading" would tell us very little about the nature of the abnormality, since this may be due to a phase shift, reversal, or unilateral low amplitude reading. Similarly, an abnormal result with large slow waves and missing peaks, which would present as a featureless reading of normal amplitude, may provide a high correlation coefficient, thus masking a striking abnormality together.

There is always the possibility of spurious findings on the basis of repeated or multiple statistical tests applied to the data[5]. This difficulty may be overcome by the use of a proper multiple comparison procedure[6].

4.2 Multiple Correlation:

The lack of usefulness of multiple correlation coefficients is likely caused by the great variability present in the data and by the variety of causes which may generate large values for this coefficient. This problem, which is already noticeable in the simple correlation case, became overwhelming when dealing with multiple correlations. No simple solution was found.

4.3 Mahalanobis Distance:

The method based on calculation of the Mahalanobis distance can be, in our opinion, quite effective. Several technical factors limited its use in the current study. First it requires estimation of the covariance matrix for both control and patient groups. Hence if we want to look at a fine time axis subdivision (i.e. bins of 8 ms or less) a large number of cases is needed in each group in order to obtain reasonable estimates. With the current number of cases we could only divide the total epoch into 64 ms bins and therefore some precision was lost. Short of obtaining a much larger number of VEP, one could limit attention to part of the VEP, say 80–200 ms. or chose as response variables some of the morphological features of the VEP, suitably quantified. This last option however would reintroduce the element of subjectivity that we are trying to eliminate.

Finally, it would be better to use one set of data to estimate mean vectors and covariance matrices and another to test the resulting procedure, but again this was not possible with the number of cases available.

4.4 Cross Correlation:

The analysis of cross-correlations proved very effective, despite the degree of arbitrariness that it required. It utilizes correlation coefficients in a non parametric, and so more acceptable way, and was developed based on the following considerations. In an ideal normal subject one would expect a fairly high positive correlation at lag 0, due to symmetry, and rapidly decreasing values as the two series are shifted with respect to one another, due to the richness of features of the EP. On the other hand if one side is delayed with respect to the other one would notice a maximum correlation at some lag different from 0, corresponding to the phase (latency) shift. Further, a unilaterally low amplitude result (e.g. unilateral cortical destruction) would generate low values at all lags, while a symmetric but featureless EP (which may indicate a bilateral disorder), would decrease quite slowly at either side of 0.

The choice of the value 100 for the case of negative correlation at one extreme should not cause any concern, again because we are treating these ratios non parametrically; a value of 30 is just as positive a finding as 60, not half as much.

The problem of the lack of sensitivity to amplitude asymmetries has to do with the calculation of cross-correlation. Local variations of slope (i.e. small peaks or troughs) are de-emphasized. We believe that these shortcomings may be corrected by the use of further statistics which emphasize local morphological features.

If the main occipital peak (DEF component)[7] is the dominant peak in the EP, a maximum correlation achieved at a large negative lag accompanied by a low but positive first ratio, may be a strong indication of a left side abnormality, based on a larger latency. This however requires subjective knowledge of the EP morphology.

> Our preliminary study suggests that a useful approach to the objective interpretation of a VEP is in terms of cross-correlations.

More generally, the use of all four variables considered may provide a better understanding of the nature of the asymmetry than the correlation coefficient alone.

The statistics we have considered were aimed at detecting asymmetries and none could clearly identify the abnormal side. However we believe that the Mahalanobis distance has the potential to do so, once the optimal division of the series is identified and a sufficient number of cases is available.

5. Conclusion

Our preliminary study suggests that a useful approach to the objective interpretation of a VEP is in terms of cross-correlations. In the small sample studied, this method gave the same accuracy as visual interpretation of the VEPM. The statistics we chose seemed to discriminate quite effectively between control and patient groups. Further work along these lines and a better understanding of the statistical properties of the variables involved seems worthwhile. In particular it will be crucial to validate that the set limits do in fact represent threshold values, and are not artifacts of our small set of data.

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Abnormal Arm Tone, Cigarette Smoking and Use of Blood Pressure Medication in a Sight Enhancement Clinic Population

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1. Introduction

There are three pigmented tissues originating from neural crest which frequently degenerate during aging in industrialized societies: the pigmented epithelium of the eye, the substancia nigra of the thalmus and the pigmented cells of the organ of Corti. Each of these tissues once developed does not regenerate following loss. They must last the insults of a lifetime for the elderly to see clearly, hear well, and have smooth coordination. Is degeneration of these tissues interrelated? Are they influenced by common risk factors?

Three diseases relate to degeneration of the pigmented tissue of the thalmus: Parkinson's disease, paratonia, and essential tremor.

Three diseases relate to degeneration of the igmented tissue of the thalmus: Parkinson's disease, paratonia, and essential tremor. The expected prevalence of these diseases is shown in Table 1[1,2,3]. Each of these diseases may result in tremors and/or abnormal arm tone. Although tremors and abnormalities of arm tone have individual characteristics[4], for statistical reasons, this study combines the patients with abnormal arm tone relating to diseases of the thalmus and contrasts them to those with normal arm tone. These diseases also have common factors. Prevalence of Parkinson's disease is found twenty-four times the expected among those with essential tremor[5]. Parkinson's disease shares with paratonia high incidence of the gabeller reflex and the nuchocephalic reflex[2].

Table 1

Expected prevalence of degenerative diseases of the thalmus

	AGE	
Parkinson's	65-74	639 / 100,000
	75 +	1148 / 100,000
Paratonia -	65-69	6%
	70-74	10%
	75-79	12%
	80 +	21%
Essential Tremor 1-10 in 100,000		

Age related maculopathy is found in 9.6% of white males and 6.9% of white females age 70 and over[6]. The Framingham study of patients who developed age related maculopathy showed association with weak hand grip many years previous to the development of disease[7]. This study questions whether there is increased prevalence of abnormal arm tone among patients with macular degeneration. Combined degeneration of the pigmented tissues of the thalmus and retina might account for the Framingham finding. Also questioned is if hearing loss is more frequent in either patients with age related maculopathy or abnormal arm tone. Abnormal hearing is predicted among 25-50% of those aged 65 and over[8]. Light coloured eyes have been associated with hearing loss[9] and age related maculopathy[10,11]. Other risk factors associated with age related maculopathy include: age, smoking habits[12], hypertension[13,14], family history of age related maculopathy[10], chemical exposure[10], history of lung disease[7]. Abnormality in lipids has been suggested in age related maculopathy[15]. The presence of corneal arcus was noted as it is associated with lipid abnormalities[16]. Exposure to light has been suggested as a factor in macular degeneration.

The interaction of the three diseases and diabetes is examined. The expected prevalence of diabetes is 9/100 in those aged 70 and over[17].

2. Materials and Methods

The low vision clinic at the University of Alberta is the only clinic doing visual rehabilitation in the Northern half of Alberta with a population of 1 million. Patients are referred by regional ophthalmologists. History was ascertained by one of two trained interviewers. Smoking history was recorded in pack years to ascertain lifetime exposure. A pack a day for one year equals one pack year. Passive smoking was not estimated as there is no way to quantify lifetime exposure. Patients were asked if they had ever been on hypertensive medication and if they had ever had lung disease or a diagnosis of diabetes. They were asked if they had a relative with blindness associated with macular

Table 2

Age by gender distribution of study population

AGE	MALE	FEMALE	TOTAL
65-69	7	16	23
70-74	22	43	65
75-79	25	62	87
80 +	56	92	148
	110	213	323

Table 3

Age by sex distribution of patients with age related maculopathy and visual loss from other causes

	ARM		OTHER	
	M	F	M	F
65-69	3	10	4	6
70-74	14	29	8	14
75-70	19	44	6	18
80 +	48	78	8	14
	84	161	26	52

degeneration, other or unknown causes. They were asked if they had ever worked with or been exposed to non specific chemicals and if they were aware of any hearing loss.

Patients aged 65 and over seen in the low vision clinic during a two year period were classified as to whether visual loss was due to age related maculopathy or other causes.

The presence or absence of any tremor was noted. While patients were requested to relax, each arm was passively moved to determine if arm tone was normal or abnormal. Normal arm tone was present if the arm moved easily with no rigidity, cog-wheel motion, intermediate opposition or catching. Two observers noted arm tone and eye colour. The cornea was examined with the +10.00 D ophthalmoscopic lens to determine if it was clear or otherwise. Corneal arcus was noted if a distinct white ring was present separated from the edge of the cornea by a clear zone. Confirmation of referred retinal diagnosis was done visually where possible. Those in whom retinal diagnosis was impossible due to more anterior pathology were noted and classified as non age related maculopathy. Data analysis was done using the statistical package for the social sciences.

3. Results

A total of 323 patients were enrolled. Age and gender distribution is shown in Table 2. Visual loss related to age related maculopathy and other causes is shown in Table 3. The most frequent causes of other visual loss were diabetic retinopathy (19), glaucoma (13), high myopia (7), cataract (4). Rarer causes of visual loss relating to trauma, genetic and metabolic diseases of the eye accounted for the other 33 cases.

Abnormal arm tone was present in 50 patients. Table 4 shows those with abnormal arm tone by age. Table 5 shows the expected percentage of paratonia by age[2] and the percentage of those with abnormal arm tone by age and smoking habit. Higher than expected percentages of those with abnormal arm tone was found for those smoking 35-124 pack years aged 70 and over. Table 6 shows the expected percentage of paratonia and the percentage of those with abnormal armtone by age and gender. Rates were double for males age 75-79. Table 7 shows the relationship between smoking habit and arm tone ($x^2 = 9.17$, $p<0.0102$). Table 8 shows that smoking habits were significantly associated with gender ($x^2 = 97.11$ $p<0.0005$). Those smoking 35-124 pack years were more likely to have lung disease ($x^2 = 8.75$, $p<0.02$) and for males more likely to have corneal arcus ($x^2 = 7.04$, $p<0.03$). The interactions of the three diseases associated with pigment tissues of the brain and risk factors is shown in Table 9. Women with abnormal arm tone were more likely to have good hearing than those with normal arm tone ($x^2 = 7.39$, $p<0.02$) and to have been treated with hypertensive medications ($x^2 = 4.01$, $p<0.05$). Abnormal arm tone related to the presence of tremor ($x^2 = 151.91$, $p<0.0005$). Tremor was so disabling that approximately ⅓ of those with abnormal arm tone were unable to hold telescopes. There were no other relationships between the three pigment tissue diseases. Having a light coloured iris was associated only for men with

Table 4

Patients with abnormal arm tone by gender and age

	Abnormal Arm Tone		
	M	F	Total
65-69	1	0	1
70-74	1	4	5
75-79	7	7	14
80 +	14	16	30
	23	27	50

Table 5

Expected % of paratonia *(Jenkyn) and % of abnormal armtone (AAT) by smoking habit

		STUDY POPULATION								
Expected		Never Smoked			– 35 Pack Years			+ = 35 Pack Years		
Age	%	AAT	Total	%	AAT	Total	%	AAT	Total	%
65-69	6%	1	11	9%	0	7	0%	0	4	0%
70-74	10%	1	27	4%	1	21	5%	3	15	20%
75-79	12%	6	44	14%	4	28	14%	4	13	31%
80 +	21%	18	87	21%	3	33	9%	9	26	35%
		26	169	15%	8	89	9%	16	58	28%

Table 6

Expected percentage of paratonia *(Jenkyn) and % of abnormal armtone (AAT) by gender

Expected		STUDY POPULATION MALE			FEMALE		
Age	%	AAT	Total	%	AAT	Total	%
65-69	6%	1	7	14%	0	16	0%
70-74	10%	1	22	6%	4	43	9%
75-79	12%	7	25	28%	7	62	11%
80+	21%	14	56	25%	16	92	17%
		23	110	21%	27	213	13%

Table 7

Relationship between smoking habit and armtone (Chi square test $p<0.0102$; 7 pipe smokers with normal armtone not included)

	Normal Armtone	Abnormal Armtone
Non-Smokers	143	26
1-34 pack-years	81	8
± 35 pack-years	42	16
Total	266	50

macular degeneration ($x^2 = 16.74$, $p<0.0005$). It was not associated with use of blood pressure medication. The age related maculopathy group had the following characteristics: 76% used medication for high blood pressure, 57% had hearing loss, 29% had a relative with visual loss due to maculopathy or unknown cases, 8% admitted chemical exposure, 15% had a diagnosis of diabetes, 26% had corneal arcus. Age related maculopathy ($x^2 = 15.55$, $p<0.002$) and tremor (women only – $x^2 = 10.15$, $p<0.02$) were both associated with older age. Sixteen patients had all three degenerative conditions.

4. Discussion and Conclusions

Aging degeneration of the three pigment tissues of the brain occurs independently for each tissue. In this study risk factors are not commonly shared. Some risk factors associated in the literature with macular degeneration were also associated with abnormal arm tone including smoking and hypertension. In the Baltimore study[10], patients with diabetes were eliminated due to common shared risk factors such as hypertension and diabetic retinopathy[14]. Our control group was visually impaired. Many had diabetes. Risk factors may be common for several diseases such as exposure to chemicals and optic atrophy.

> Although we cannot halt the passing of time or alter our genetic heritage, perhaps incidence of tremor and abnormal arm tone among the aged can be reduced by smoking less than 35 pack years.

Although we cannot halt the passing of time or alter our genetic heritage, perhaps incidence of tremor and abnormal arm tone among the aged can be reduced by smoking less than 35 pack years. Smoking 35 pack years or more was significantly a male custom during the life span of those now 65 and over. The outcome of the changed smoking habits following 1940 where women were encouraged to smoke may lead to excessive numbers of the elderly with abnormality of arm tone.

The etiology of Parkinson's disease and related diseases[18] is varied including virus triggering, autoimmune process, carbon monoxide poisoning[1], street drug use[19], psychiatric drug use[1] and minor stroke relating to hypertension, but not cigarette smoking[20]. Smoking heavy amounts increases carbon monoxide[21] and lead blood levels[22]. Systemic lead poisoning of rabbit retinal pigment epithelium has been shown[23]. There may be a similar reaction in the substancia nigra and in the pigmented epithelium of the eye to chronic chemical poisoning. Damage from a multitude of chemicals in cigarette smoke may account for our findings. The use of hypertensive medication was associated with women having abnormal arm tone. Whether the damage to the thalmus relates to the vascular insults of hypertension itself or chemical poisoning from one of the commonly used drugs must be determined.

> Warning: the one who falls in love with the man in the cigarette ad must love well, for in old age she may be his hands and if he is blue eyed, his vision.

Pathologic studies of the choroid of age related maculopathy have not shown consistent findings of atherosclerosis in all eyes[24]. Perhaps macular degeneration and degeneration of the thalmus are the end result of several different mechanisms of damage. Separating patients into groups according to those influenced by genetics, atherosclerosis, hypoxia and chemical poisoning may be helpful in understanding these diseases.

Rehabilitation of the visually impaired with profound tremor is severely limited as aids are difficult to hold. Tremor has a high social cost including early retirement and embarrassment[25]. The use of a stand magnifier occasionally facilitates reading. Telescopes and microscopes may be mounted on spectacles for these patients. Prevention of abnormality of arm tone should be encouraged.

Warning: excessive cigarette smoking may lead to abnormal arm tone which is associated with tremor in old age.

Warning: the one who falls in love with the man in the cigarette ad must love well, for in old age she may be his hands and if he is blue eyed, his vision.

Table 8
Relationship between gender and smoking habit (Not shown — 7 male pipe smokers; Chi-Square = 97.11 P < 0.0005)

	Never Smoked	1 - 34 pack years	35 - 124 pack years	
Female	152	47	14	
Male	17	42	44	
Total	169	89	58	316

Table 9
Summary of risk facts and degenerative disease and P value using Chi-Square test

	Age	Male gender	Eye Colour	Pack Years	Blood Pressure	Family History	Chemicals	Work	Diabetes	Arcus	Registered blind	Lung
Age related maculopathy	0.0002	NS	0.0002 M	NS	NS	0.06 NS	NS	NS	0.*0005	NS	NS	NS
Abnormal armtone	0.06 NS	0.06 NS	NS	.02	0.05 F	NS	NS	NS	NS	NS	NS	NS
Tremor	0.02F	NS	NS	NS	0.04 F	NS	NS	NS	NS	NS	NS	NS
Hearing	NS	NS	NS	NS	0.04 M	NS	NS	NS	NS	NS	NS	NS

NS - not significant
* - negative association
M - association for male only
F - association for female only

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Quantifying the Magnitude of Visual Impairment with Multi-Flash Campimetry

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1. Introduction

Multi-flash campimetry is a computer implemented clinical psychophysical technique that uses the ability to detect flicker to distinguish between healthy observers and ophthalmological patients[1-3]. On each trial, a computer randomly selects a point from a 36 point display and begins to flicker it at 5 Hz. The duty cycle of this flickering point (the proportion of the flicker period that is lit), is decreased from 100% in 1.4% steps each cycle until the observer makes a manual response indicating that flicker has been detected.

The main benefit of two and three dimensional visual field maps is the ease with which they can be interpreted.

Based on the duty cycles that occurred at the time of the response, two and three dimensional maps can be created depicting the temporal resolving power of the visual system across 40 degrees of the visual field as shown in Fig. 4. For both types of visual field maps, an interpolation algorithm is used to estimate the temporal resolving power of areas of the retina that lie between tested points.

The main benefit of two and three dimensional visual field maps is the ease with which they can be interpreted. In the two dimensional display, a seven category grey scale is used with darker shadings indicating areas of poorer temporal resolution. Thus patients who have either a general decrease in temporal resolving power or patients who have highly localized areas of poor flicker detection capability, will both be readily distinguished from the field maps of healthy individuals. Similarly, by presenting such areas of poor temporal resolution as elevations corresponding to the severity of the resolution loss, the clinician can immediately visually distinguish these "mountains" from "valleys" of normal resolution.

While the ease with which both these types of presentations can be interpreted is clearly a major benefit, both two and three dimensional data representations have inherent drawbacks. Three dimensional representations, because of the problem of occlusion, may require a number of different viewing orientations to illustrate any collection of data in its entirety, while two dimensional grey scales rely on the ordinal categorization of data, preventing the portrayal of small but potentially meaningful differences in score values within a given category.

If numbers could be provided in conjunction with the maps, the clinician would be able to both visually discriminate between the visual fields of patients and healthy observers, as well as use quantitative methods to increase the power of this discrimination process.

The base unit which we have adopted to quantify the degree of visual impairment in patients tested using multi-flash campimetry was derived from a study investigating two different luminance presentations and their effect on temporal resolution. Until very recently the form of flicker employed in multi-flash campimetry was of a constant pulse variety in which a light pulse was turned on to a predetermined luminance level and then turned completely off. Unfortunately, reducing the duty cycle in this type of flicker also reduces the time-average luminance and subsequently the Talbot brightness of the point. Thus it could be argued that patients might base their responses on this reduction of the apparent brightness of the point rather than on the detection of flicker.

Such a confound can be easily avoided by holding the time-average luminance of the point constant. This is accomplished merely by increasing the intensity of the on-period in proportion to any reductions in its duration. Furthermore, evidence from early critical fusion frequency (CFF) literature concerning the effect of duty cycle reduction on these two types of luminance displays suggests another advantage of maintaining a constant time-average luminance. While constant pulse luminance displays reveal inverted U-shaped temporal resolution functions with the highest resolvable frequencies at a 50% duty cycle[4], time-average luminance displays afford monotonically

increasing temporal resolution curves as the duty cycle of the stimulus is reduced[5]. If these relationships were maintained in multi-flash campimetry, then holding the pulse luminance constant would result in flicker becoming easier to see from duty cycles between 100% and 50%, whereupon further reductions in this parameter would cause flicker detection to become more difficult. A preferable situation would involve the implementation of a time-average luminance display in multi-flash campimetry, whereby the systematic reduction of duty cycle would elicit a continuous increase in flicker sensitivity. The question of empirical interest, therefore, was whether the relationships found in CFF studies, where variable frequencies are used to assess flicker detection capability, could be extrapolated to multi-flash campimetry, in which duty cycle is reduced in order to assess temporal resolution at a fixed frequency of 5 Hz. In order to address this question a depth of modulation experiment was conducted to test subjects' sensitivity to both time-average and constant pulse luminance stimuli.

2. Method

The sensitivity of subjects to 7 different duty cycles (20, 30, 40, 50, 60, 70 and 80%) and two different luminance presentations (time-average and constant pulse luminance) was assessed using a depth of modulation technique. The stimulus display consisted of a line of six points spaced at retinal eccentricities of 0.625, 1.25, 2.5, 5, 10 and 20 degrees of visual angle. This line of points appeared on one of 8 meridians, either the temporal horizontal or rotated by 45, 90, 135, 180, 225, 270 or 315 degrees away from this meridian.

The type of flicker employed was either of a mean constant pulse luminance (MCPL) variety, where the average of the maximum and minimum luminance levels remained at 3.1 cd/m^2 regardless of duty cycle, or alternatively, these luminance levels were manipulated as a function of duty cycle such that the time-average luminance (TAL) was maintained at a steady state level of 3.1 cd/m^2.

The experiment utilized the following split plot design: eight meridii X six eccentricities X seven duty cycles X two luminance types. Subjects were blocked only by meridian; each subject was exposed to all other treatment combinations. On any given trial, subjects were told to focus on a central fixation cross and to indicate with a manual paddle press whether flicker was detected in any of the six presented points. Points were flickered using a randomly chosen combination of duty cycle, luminance type, and eccentricity. The minimum depth of modulation required to see flicker for this stimulus combination was determined using a randomized staircase procedure with a stopping criterion of four reversals.

Thirty-two subjects with corrected or uncorrected acuities between 6/4.5 (20/15) and 6/7.5 (20/25) in their best eye were used in the experiment. The ages of these subjects ranged from 20 to 39. All viewing was monocular with subjects wearing corrective lenses for far vision if so required.

3. Results and Discussion

Panels A and B of Fig. 1 illustrate the results of this sensitivity experiment. In order to detect flicker: a) subjects required greater depths of modulation for peripheral compared to foveal points, and b) within an eccentricity, inverted U-shaped functions were obtained for *both* time-average and constant-pulse displays. Panels A and B of Fig. 2 present the amplitudes of the fundamental Fourier frequency component for each of the threshold stimuli that comprise the data in Fig. 1. A further analysis of this data reveals a significant effect of eccentricity on the amplitude of the fundamental $F(5,120) = 61.21$ $p<0.01$ (omega squared = 22% of the variance accounted for). Also, a significant effect of duty cycle was found $F(6,144) = 56.69$ $p<0.01$ (omega squared = 4% of the variance accounted for).

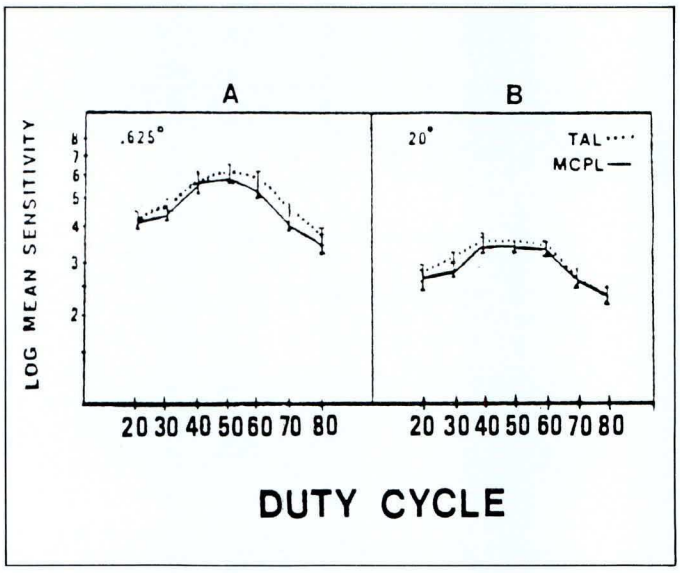


Figure 1. Log mean sensitivity (1/Threshold Contrast) over duty cycle for retinal eccentricities of 0.625 and 20 degrees.

The initially surprising discrepancy between the monotonically increasing TAL function obtained when CFF is plotted over duty cycle and the inverted U-shaped function acquired for the time-average luminance display in the sensitivity study may be explained in terms of the amplitude of the fundamental Fourier frequency component. Essentially, the idea is that manipulations in the characteristics of the flickering stimuli that lead to increases in this amplitude will in turn elicit increases in temporal resolving power. Evidence for this postulate comes from studies in which decreasing the duty cycle of a time-average luminance stimulus elicited monotonic increases in the amplitude of the fundamental and consequently, monotonic increases in temporal resolution as measured by CFF[5]. Further evidence comes from similar studies using constant pulse luminance displays where reductions in duty cycle caused increases in amplitude, and thus CFF, between 100% and 50% duty cycles, with further reductions in duty cycle evoking decrements in both the amplitude of the fundamental and CFF[4]. If one assumes that the amplitude of the fundamental would also underlie the detection of flicker in a sensitivity study, then in such a study, there should be a constant threshold amplitude above which subjects would be able to detect flicker.

To test this hypothesis, the amplitudes of the fundamental were calculated using the sensitivity data portrayed in Fig. 1. As can be ascertained by looking at the relatively flat functions depicting amplitude over duty cycle in Fig. 2, this prediction appears to be confined, for within a given retinal eccentricity, regardless of the duty cycle of the presented stimulus, the same amplitude of the fundamental seemed to be required in order for flicker to be detected. Statistically, however, there was a

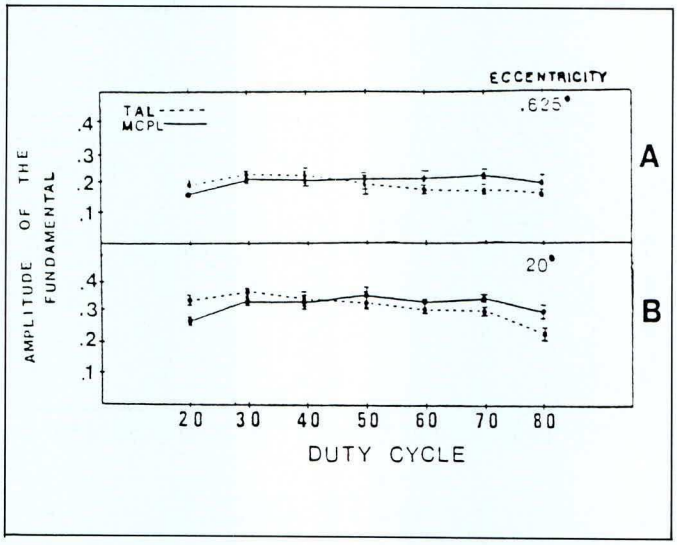


Figure 2. Amplitude of the fundamental required to detect flicker plotted over duty cycle for retinal eccentricities of 0.625 and 20 degrees.

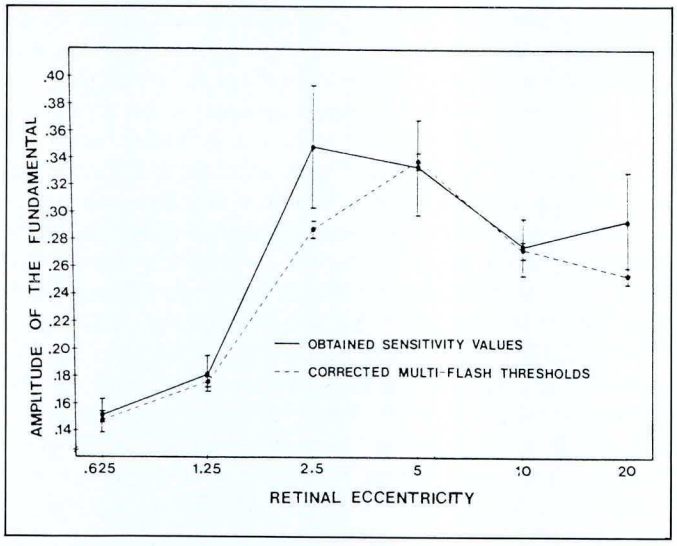


Figure 3. Amplitudes of the fundamental required to detect flicker in sensitivity experiment and in multi-flash campimetry for six retinal eccentricities. Multi-flash amplitudes are corrected for spurious increases due to reaction time.

main effect of duty cycle on the amplitude of the fundamental indicating that these functions did not have a slope of zero. Despite such statistical significance the finding that this effect accounts for only 4% of the variance causes us to conclude that these amplitudes are virtually the same for all duty cycles, and as such the amplitude of the fundamental is the principal determinant of flicker detection in this sensitivity study. Because these amplitudes seem to underlie the detection of flicker in both CFF studies, as well as the sensitivity study, it seemed reasonable to postulate that it would also account for duty cycle detection thresholds in the multi-flash paradigm. If this postulate is correct then we should be able to use the amplitude of the fundamental required to detect flicker in the sensitivity experiment to predict the performance of subjects in the multi-flash paradigm. Before we could test this hypothesis, however, it was necessary to equate the multi-flash procedure with the sensitivity task in terms of the effect of reaction time on the threshold amplitude of the fundamental.

In the multi-flash procedure, since the duty cycle of the flickering stimulus is decremented every 200 ms, the obtained amplitudes that occurred at the time of a manual response were comprised of two components, the amplitude at threshold, and increases in this amplitude due to reaction time. In order to equate the sensitivity and multi-flash procedures therefore, it was necessary to evaluate and subtract out increases in the amplitude of the fundamental due to reaction time.

To this end, eight subjects who participated in the sensitivity experiment, were administered both the time-average luminance version of the multi-flash procedure and a single quadrant of the multi-flash display which was used to measure reaction time. In the latter display, rather than systematically reducing the duty cycle of flicker only threshold duty cycles were presented, and based on the average of six replications for each of 30 points, reaction times were determined for each of the six retinal eccentricities common to both the sensitivity study and the multi-flash procedure. Increases in the amplitudes of the fundamental due to reaction time were then calculated using these average reaction times, and these reaction time induced increases were then subtracted from the obtained multi-flash amplitudes. Figure 4 compares these corrected multi-flash amplitudes to the amplitudes required by the same subjects in the sensitivity experiment. Overlap among the standard error bars indicate that differences between these amplitudes within a given eccentricity are due to chance. Because one can use the amplitude of the fundamental to predict the performance of subjects on the multi-flash paradigm based on their performance in the sensitivity experiment, it seems that this amplitude underlies the detection of flicker in both procedures.

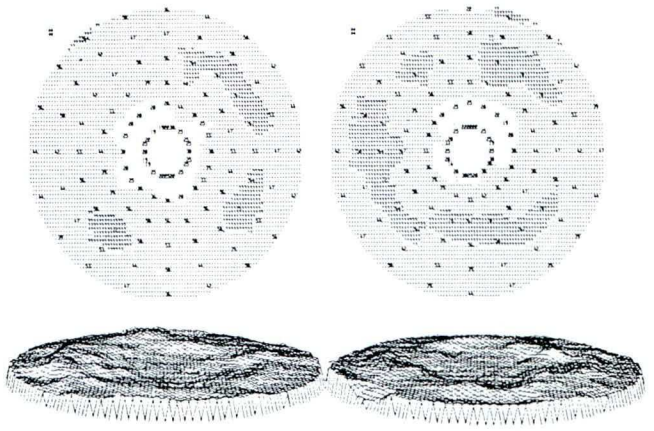
4. Discussion

The reliance of flicker detection on the amplitude of the fundamental in the CFF paradigms, as well as the sensitivity and multi-flash paradigms suggests that regardless of the task used to assess temporal resolution, this single measure may be used to quantify the magnitude of visual impairment reflected by any observed losses in temporal resolving power. The equivalence of the amplitudes required by normals in multi-flash and in the sensitivity study suggests that this amplitude could be used to compare healthy individuals' performance to that of patients, both between different paradigms, or within a particular design. For our present purposes, we have chosen to represent numerically the severity of any visual deficits that are illustrated using the multi-flash procedure by comparing the amplitude of the fundamental required by a patient in multi-flash to that required by a normal using this same temporal resolution technique.

In order to ascertain the best estimate of the normal amplitudes of the fundamental that are required to detect flicker, the amplitudes required by the eight subjects tested using the time-average luminance version of multi-flash were averaged to form a "control map". This control map was then used as a reference for evaluating patient performance in this task.

Figure 4 depicts the visual field maps of a healthy observer, a patient with anisometropic amblyopia and a patient with strabismic amblyopia. Presented along with these two and three dimensional representations are five statistics which serve to numerically summarize these data.

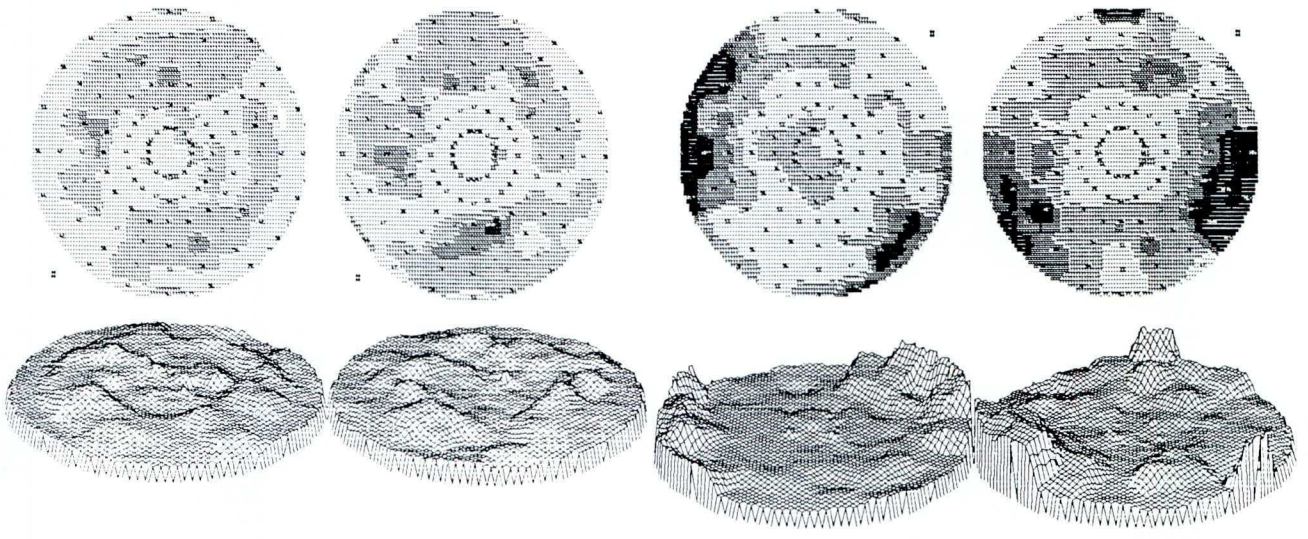
The first two statistics, the Average Deficit and the Local Deficit, draw on the work of Flammer *et al.*[6]. The Average Deficit, as the name suggests, reflects any overall increase in



CONTROL

A.D. = −0.16
L.D. = .089

A.D. = −.02
L.D. = .107



AMBLYOPE

A.D. = .160
L.D. = .182
Isl. = 9.0
Sev. = 49%
Ar. = .5%

A.D. = .155
L.D. = .188
Isl. = 7.0
Sev. = 55%
Ar. = .65%

STRABISMUS

A.D. = .264
L.D. = .333
Isl. = 7.0
Sev. = 67%
Ar. = 3.8%

A.D. = .295
L.D. = .342
Isl. = 9.0
Sev. = 69%
Ar. = 3.9%

Figure 4. Average Deficit (A.D.), Local Deficit (L.D.), Islands (Isl.), Average Severity (Sev.), and Average Area (Ar.) statistics, along with two and three dimensional field maps for a control subject, an anisometropic amblyope, and a strabismic amblyope.

the amplitude of the fundamental required to detect flicker in the Multi-flash paradigm. It is calculated by taking the amplitude required for each point on the patient's map and subtracting the corresponding amplitude from the control map. These differences are summed and divided by the number of points (120) tested. As can be seen in Fig. 4 the value of the average deficit for a healthy observer is near zero, but for the two patients is elevated by amounts corresponding to the severity of their condition.

The second statistic, the Local Deficit, is a measure of dispersion around this Average Deficit. Patients with localized areas of dysfunction in an otherwise normal field would show high variability around the Average Deficit, and therefore display high Local Deficit values. A patient with a uniform elevation in required amplitudes spread across the visual field, on the other hand, would show little variability around their obtained Average Deficit, thus affording low Local Deficit values. The strong localized nature of deficit in the two patients in Fig. 4 is illustrated by the elevation of this statistic. Interestingly, even normals show some elevation in Local Deficit because of the irregular placement of patches of reduced sensitivity beyond 1.25 degree of visual angle. Despite the irregularity of the location of such areas between subjects, the test-retest reliability of the technique was 0.87 when the subject depicted in panel A was given two administrations of this test.

The second strategy for quantifying visual impairment makes use of statistics that can be said to more accurately reflect what is visually depicted by the two-dimensional visual field maps. Unlike the Average and Local Deficit statistics, this latter category of measures makes use of values arrived at through the previously mentioned interpolation algorithm, and as such are subject to the same constraints as the maps themselves.

By using the amplitude of the fundamental as a measurement of visual deficit, we feel that we have chosen a measure that will enable researchers to predict performance on any temporal resolution task.

The "Islands" statistic reflects the number of areas in the visual field in which higher amplitudes of the fundamental than normal are required to detect flicker. The criterion used to determine whether an amplitude is to be considered abnormal involves the grey scale categories used in the two dimensional maps. Such grey scales are composed of ranges of amplitudes. Looking at the healthy observer in Panel A of Fig. 4, patches of reduced temporal resolving power are noted throughout areas of the visual field beyond 1.25 degrees. Because all healthy observers tested using multi-flash campimetry displayed such patches, they are considered to be part of a normal visual field. Because these patches are found only beyond 1.25 degrees (the second circle on the map), areas associated with this shade of grey that occur *within* 1.25 degrees of the fovea would be considered an Island of dysfunction. Beyond 1.25 degrees only areas reflecting amplitudes of the fundamental that are more severe than those associated with this shade of grey qualify as an Island. An example of a foveal Island can be found in the left eye of the strabismic amblyope, while parafoveal Islands are dispersed throughout the four fields of both patients.

The Average Severity statistic indicates how severe the deficiency is within a typical Island for a given map. Since the different shades of grey represent seven different ranges of amplitudes, an Average Severity measure can be obtained by taking all the points that are above normal amplitude values, assigning these points values equal to the midpoint of their respective range, summing these midpoint values and dividing by the total number of points. For ease of interpretation, the resulting value is then expressed as a percentage of the maximum possible severity. The correspondence between what is visually depicted by the maps and this average severity statistic is attested to by the fact that the strabismic patient has higher Average Severity values than the anisometropic amblyope.

Finally, the Average Area statistic reflects the average size of these Islands of deficit. This statistic is calculated by summing the number of sampled and interpolated points that have abnormal amplitudes and dividing by the number of Islands. Once again for clarity of interpretation this statistic is expressed as a percentage of total map area in order to provide an upper limit as a point of reference. Panels B and C of Fig. 4 indicate that the Islands of dysfunction in the strabismic map are larger than those found on the anisometropic amblyope.

To summarize, the Average Deficit and Local Deficit can be used to determine whether a patient has visual field deficiencies and whether such deficits involve local areas of reduced temporal resolving power, or are uniformly spread across the visual field. The Island, Average Severity and Average Area statistics serve to both corroborate these statistics and in so doing, numerically depict what is portrayed visually by the two and three dimensional maps. By using the amplitude of the fundamental as a measurement of visual deficit, we feel that we have chosen a measure that will enable researchers to predict performance on any temporal resolution task. As such, it reflects the functional capability of an integral part of the visual system, and will therefore enable the clinician to accurately distinguish between a healthy individual and a patient afflicted with one of the many ocular pathologies that affect the human visual system.

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The Clinical Profile of a Young Visually Handicapped Population

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1. Introduction

This paper presents the results of a study done at the low vision clinic at the Institut Nazareth et Louis-Braille in Longueuil, Quebec. The Institute offers rehabilitation services and visual aids to eligible visually impaired persons in western Quebec and serves both a partially sighted and functionally blind population, as defined by Genensky[1,2]. A low vision examination is part of the Institute's admission procedure. Information derived from clinical files offers data on a complete population of visually impaired people, since it includes all levels of visual impairment.

The study comprises data from 514 cases, approximately one fourth of the population served by the Institute, and includes more than 150 variables. For this presentation, we have selected several results which characterize this specific population. To better understand the particular nature of this visually impaired population, a brief look at the provincial program for the visually handicapped is necessary.

The Quebec law stipulates that a person is considered visually handicapped when acuity in each eye is less than 6/21 (20/70) after appropriate correction, with the exception of visual aids, or when the visual field in each eye is less than 60 degrees in the horizontal or vertical meridians. Every person who meets this definition is eligible to receive services from the Ministry of Social Affairs rehabilitation program and the AMEO program, which sees to the distribution of mechanical, electronic and optical aids.

The Institut Nazareth et Louis-Braille is one of the five centers in Quebec which received accreditation for the application of these programs. The rehabilitation services are free, but the aids program is limited by some conditions. Some types of aids, like the long cane, are universal, while some others depend on the patient's age (under 36) or, since 1984, on the need of a particular aid at work or at school. All kinds of aids can be loaned. A more detailed description of these aids is presented by Couturier *et al.*[3].

The introduction of this medicare program was progressive. At first, only those under 19 years of age were eligible. Then the program was extended for those under 36, and finally to everyone at work or at school. A Quebecer who does not respond to these conditions can receive free rehabilitation services, but is not eligible for the AMEO program. However he may buy any aid he wants at a low price. As a consequence of the medicare regulation, the population seen at the Institut Nazareth et Louis-Braille is relatively young.

2. Method

In order to reduce errors in our population sample because of heredo-familial diseases, we have randomly selected a first file, and then systematically every tenth file in alphabetical order. The data considered in this study are limited to the year following admission.

3. Results

Demographic data are presented in Fig. 1. The age (average 32 years and 11 months) is the main characteristic of this population. As shown in the figure, more than half of the population is under 40 years old. This is noteworthy, since on the basis of CNIB's statistics[4] more than one half of the legally blind

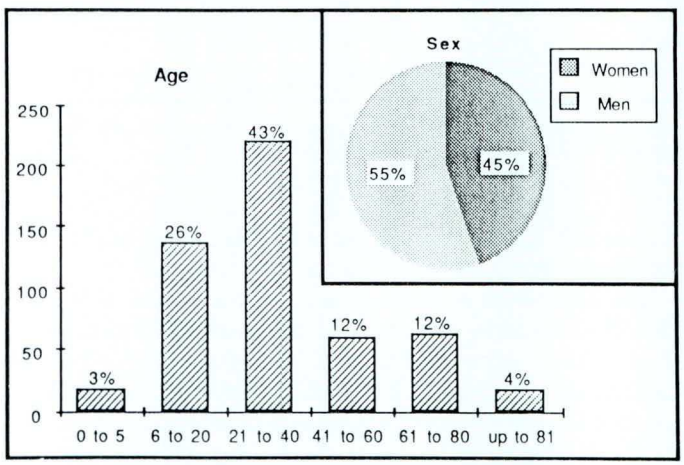

Figure 1. Demographic data (Age and Sex; Population N=514)

population in Canada is over 50 years old. We found a difference between sexes which has already been reported by Faye[5].

The classification of pathologies considering the type and

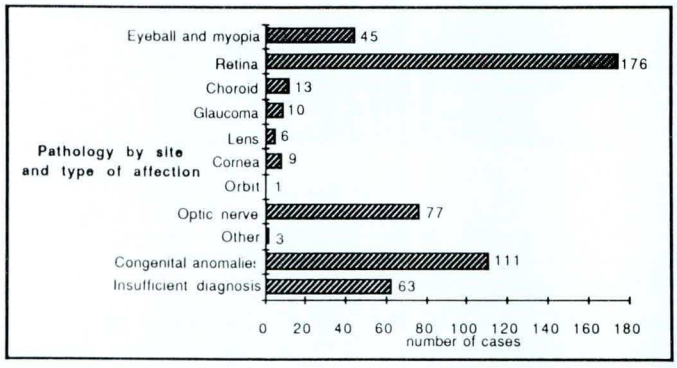

Figure 2. Causes of visual impairment (Population N=514)

location of the disorder is based on the World Health Organization's classification[6]. As shown in Fig. 2, the three main causes of visual impairment are retinal disorders, congenital anomalies and diseases of the optic nerve. When comparing these results with other studies[5,7,8], differences are noted (Fig. 3). The frequencies of the main retinal disorders of the present study are compared to those observed by Faye[5]. The differences in the frequencies of retinitis pigmentosa, macular degeneration and diabetic retinopathy in this study compared to that in Faye's study can be explained by the age difference between the two studies. This is why retinal disorders are seen in 34.24% of cases in the present study compared to 52.12% of cases in Faye's study.

The presence of an associated impairment is found in 7.7% of all cases. Another characteristic of our population is that one

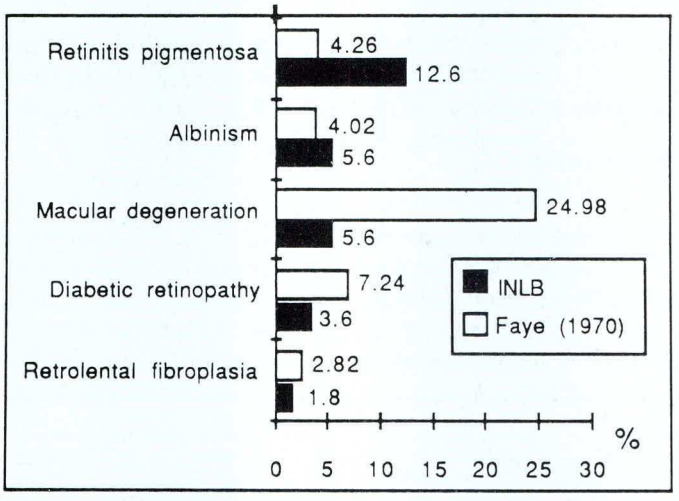

Figure 3. Main pathologies of the retina and comparison with the study of Faye (1970). Retinal pathologies are seen in 34.24% of cases in the present study and in 52.12% of cases in Faye's study.

functionally sighted eye is associated with a functionally blind fellow eye in 12.5% of all cases.

The distribution of the ametropia (both spherical and cylindrical) shows a more accentuated dispersion in our population than with a normal population[9] (Fig.4). The effect of emmetropization seems to be diminished in a visually impaired population. Another interesting fact concerning refraction is that visual acuity after refraction is significantly different from the entrance report's visual acuity recording. Mean acuity according to entrance report data is X = 0.1234 = 6/48 (20/160), while

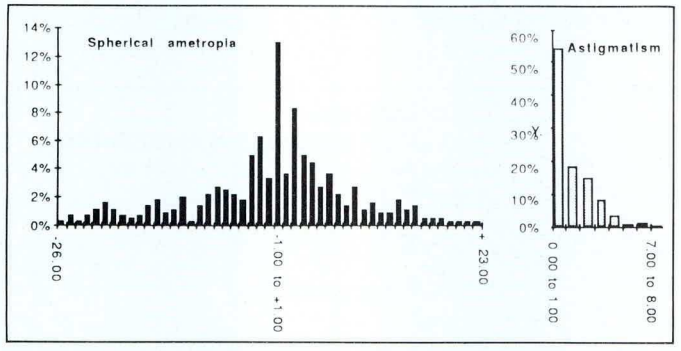

Figure 4. Refractive error distributions

mean acuity after refraction in the low vision clinic is X = 0.1534 = 6/38 (20/125) (T = 4.35 p<0.001 N=299). As mentioned by Faye, the first thing to do for visually impaired people

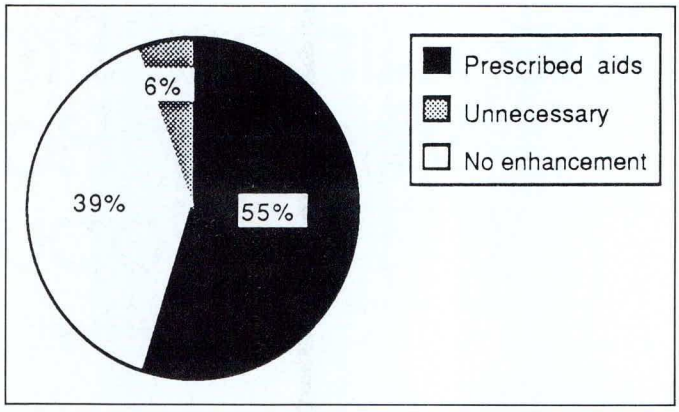

Figure 5. Frequency of prescription of visual aids. Total population (N=514)

is refraction.

The frequency of visual aids prescription is illustrated in Fig. 5. Fifty-five percent of all cases received at least one aid, 39% could not obtain any benefit from them or refused them, while 6% were functional without any visual aid. The percentage of visual aids prescription is lower than the one usually reported[5,10]. This difference can be explained by the fact that the population in the other study was restricted mostly to a functionally sighted population.

Aids for distance vision are prescribed in 36.4% of all cases while near vision aids are prescribed in 46% of all cases. The handheld telescope is the most frequent distance aid prescribed, while the microscope is the most frequent near vision aid used (Fig. 6).

The mean magnification for distance aids is 6.30X. The mean effective magnification, derived from the ratio between visual acuity with and without aid, is 6.38X. The paired T-test between these two variables is not significant at the 5% level; the null hypothesis has to be accepted (T=1.91, p=0.58, N=183). In the same way, the mean magnification for near vision aids is 5.98X while theoretical magnification is 6.083X. The paired T-test is not significant and the null hypothesis has to be accepted (T=0.13, p=0.9, N=218). These two computations have been

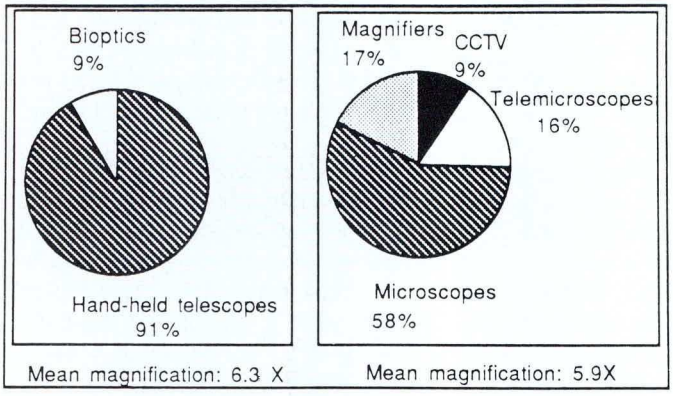

Figure 6. Type of aids prescribed.

done to verify the validity of the formula M=required VA/VA[11]. In both cases, the theoretical calculation of the magnification was useful.

The different levels of impairment based on the WHO's classification[6,12] were determined (Fig.7). Two main fields of impairment are considered: level of visual acuity and the degree of the visual field. The worst level of impairment, between acuity and field readings of the better eye, determine the actual level.

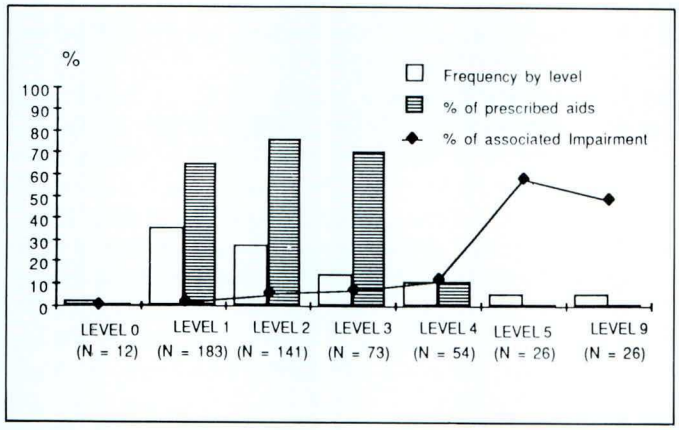

Figure 7. Frequency distribution by level of impairment.

Results show that 2.3% of the patients are not eligible for rehabilitation services, 35.6% are visually impaired without being legally blind, 27.4% of all cases are at level 2, 14.2% are at level 3, 10.5% are at level 4, 5% at level 5 and 5% at level 9. In levels 1 to 5, more than 50% of all people are under 40 years old. At level 9, more than half of the cases are under 10 years old.

The percentage of prescribed aids in each level of impairment is also presented (Fig. 7). The rate of attribution of aids in categories 1 to 3 varies between 65% and 75%. A 10% rate of optical and electro-optical aids is still found at level 4. According to Genensky's classification of impairment[1,2] there is a part of the population at level 4 who are functionally sighted. These people are probably the ones with a severe visual field impairment. Another particularity of our population is the growing occurrence of associated impairment, along with the visual impairment, as shown by the curve of Fig. 7. More details about the clinical management of the different categories of impairment are presented by Couturier *et al.*[3].

Facts about the use of the WHO's classification of impairment in general eye care practice are discussed. There seems

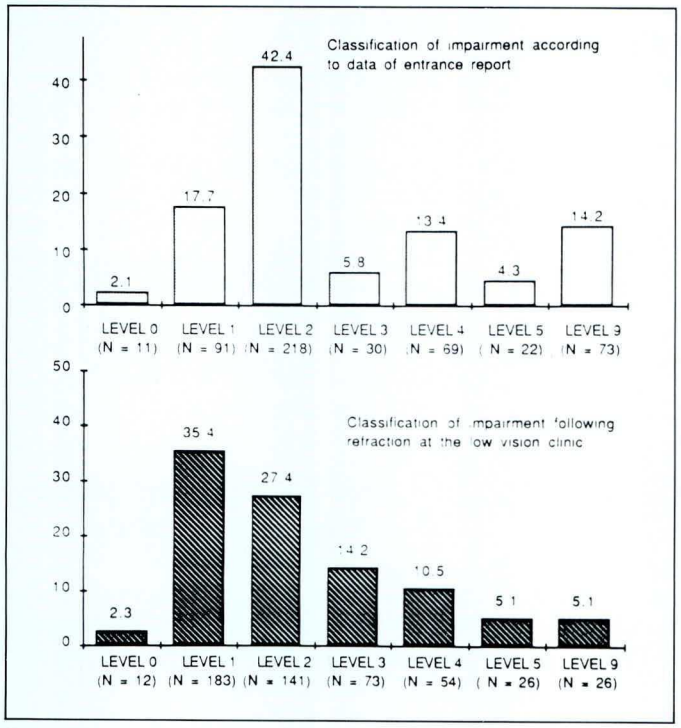

Figure 8

to exist an excessive number of cases in the legally blind categories (Fig. 8). Methods and charts generally used to measure visual acuity are not suited for a person who is visually impaired. Shortcuts for visual acuity measurements such as "count fingers", "hand movement" and so on, are too numerous and influence excessively the number of individuals in levels 4 and 9.

Some entrance reports do not include any quantified measure of visual acuity. However, acuity is measured through a low vision routine (Table 1). The study shows that although 6 eyes were considered as "no light perception", visual acuity obtained at the clinic was shown to vary between 6/2000 (20/6666) and 6/105 (20/350). Fourteen eyes classified as "light perception" were shown to have a visual acuity varying between 6/240 (20/800) and 6/60 (20/200). Four eyes classified as "light projection" obtained a measurement between 6/540 (20/1800) and 6/18 (20/60). The most frequent unquantified visual acuities are "count fingers" and "undetermined". In the first case, the visual acuity measured is between 6/240 and 6/30 (20/800 and 20/100), which excludes the value generally associated with "count finger", 6/360 (20/600). In the second case, "undetermined" readings were noted through a visual acuity range of 6/120 to 6/12 (20/400 and 20/40).

Table 1

Comparison of visual acuity readings between entrance report unquantified data (left) and low vision clinic evaluation data (right).

No light perception	6	0.003 ≥V.A.≥ 0.057 6/2000≥ V.A.>6/105
Light perception	14	0.041≥V.A≥0.1 6/240≥V.A≥6/60
Light projection	4	0.0417≥V.A.≥0.05 6/240≥V.A≥6/120
Hand movement	12	0.0111≥V.A.≥0.333 6/540≥V.A.≥6/18
Count fingers	74	0.0417≥V.A.≥0.2 6/240≥V.A.≥6/30
Undetermined	74	0.0476≥V.A.≥0.5 6/120≥V.A.≥6/12

In conclusion, the data shown here are varied and numerous. The purpose is to present some epidemiological facts about a young visually impaired population, functionally sighted and functionally blind, and a view of the services received by this population in a low vision clinic. The importance of computation of theoretical magnification in a low vision routine is stressed. Some facts about the classification of visual impairment from reports of general eye care practitioners raise the question that too many individuals may be considered as legally blind. The need for standardized methods to measure visual acuity in general eye care practice is brought out. These methods would impact on the quality of refraction and the appropriateness of the level of impairment in which the individual is classified.

Acknowledgement

The authors are indebted to the Institut Nazareth et Louis-Braille for permitting access to clinical files.

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VISION CARE NEWS/ACTUALITÉ OCULO-VISUELLE

CAO Delegate Elected to IOOL Executive

At its 1987 Annual General Meeting in Vienna, the International Optometric and Optical League (IOOL) elected Dr. Roland des Groseilliers, Canada's official delegate to the League, as Vice-President.

Dr. Roland des Groseilliers

Dr. des Groseilliers, an Ottawa optometrist, is very familiar to CAO members. A past Councillor for Ontario to the national Association, he was elected to the office of CAO President for 1982–1984. His role as official CAO delegate to the League began when he became past President of CAO.

Dr. des Groseilliers is actually the second North American Doctor of Optometry elected to the current IOOL executive. He follows last year's election of US optometrist Dr. G. Burtt Holmes as League President.

1987 CAO SYVW Poster Wins Design Award

"Life Is Worth Seeing!" was the message.

"Red Fox on the Prowl" was the Robert Bateman image around which the message was conveyed.

Together, they made up CAO's 1987 Save Your Vision Week poster, and it was recently announced in Ottawa that the design had been selected for an Award of Merit by the Ottawa Advertising and Sales Association.

The Award was presented to Acart Graphic Services at the OASA's Seventh Annual Awards dinner, held on May 29. Acart is the firm who produced the poster and who, incidentally, are also responsible for the design and layout of the *CJO • RCO*.

CAO's poster was one of several Awards claimed by Acart on May 29 and the Editors would like to offer congratulations, on behalf of the *CJO • RCO*, to Al Albania and his entire Acart staff.

British College Changes Practitioner Designation

Formerly the British College of Ophthalmic Opticians (Optometrists), the BCOO(O) — the "learned society which runs the professional qualifying examinations for all optometrists wishing to practise in Britain" — recently announced a three to one vote in favour of a new title.

Dropping "optician" entirely from their designation, the College will now be called simply the British College of Optometrists (BCO).

The new title was approved at a special meeting of the College held in early April this year.

. . . and so does the British *Columbia* Association

The British Columbia Optometric Association (BCOA) will henceforth be called the British Columbia Association of Optometrists (BCAO), according to a recent announcement in the provincial Association's newsletter.

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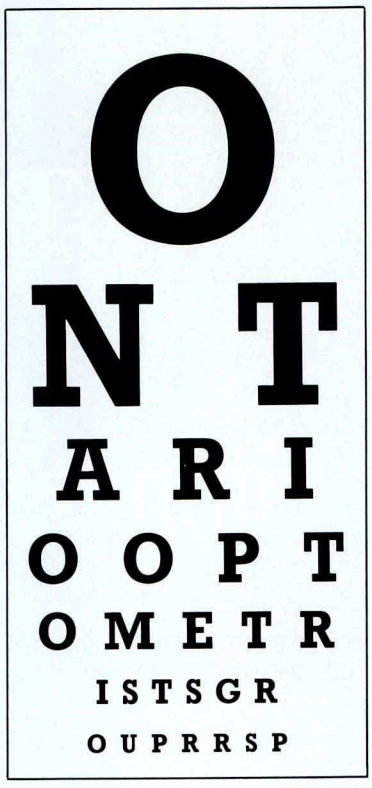

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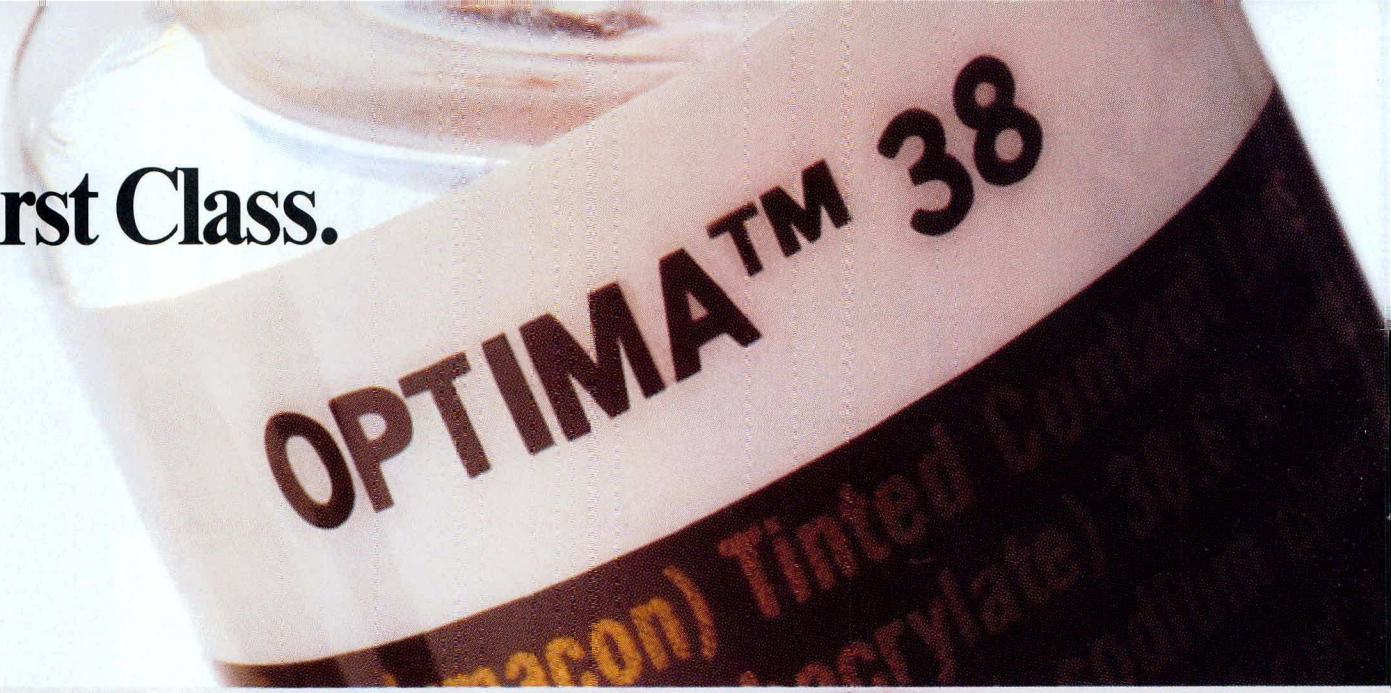

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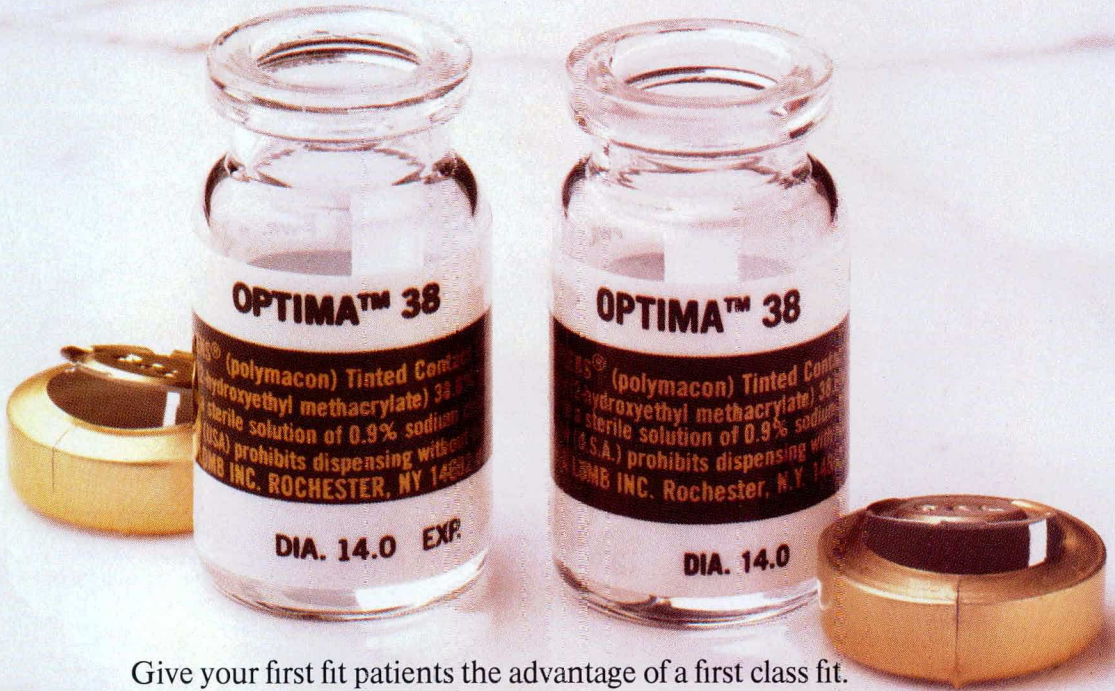

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