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New Challenges in Low-Vision Research (Guest Editorial)

Susana T. L. Chung, OD, PhD, FAAO,

Univ of California, Berkeley, CA

Ian L. Bailey, OD, DSc, FAAO,

Univ of California, Berkeley, CA

Gislin Dagnelie, PhD, FAAO,

Johns Hopkins Univ, Baltimore, MD

Jonathan A. Jackson, OD, PhD, FAAO,

Univ of Melbourne, Melbourne, Victoria, Australia

Gordon E. Legge, PhD,

Univ of Minnesota, Minneapolis, MN

Gary S. Rubin, PhD, and

University College, London, UK

Joanne Wood, OD, PhD, FAAO

Queensland University of Technology, Brisbane, Queensland, Australia

In recent years there has been a surge in interest and activities in low-vision research. There are now national and international conferences and workshops dedicated to low-vision research, the number of presentations related to low vision has increased at the annual meetings of the AAO and ARVO, and many journals on vision science have seen an increase in the number of published articles on low-vision research. A quick survey on PubMed for articles that contained the keywords *low vision*, *visual impairment* and *visually impaired* in the title or abstract returned that the number of these articles doubled in the past decade, from 35 published in 2002 to 72 published in 2011. Many of the advances in vision science have seen their applications in the arena of low-vision research, for example, the application of standardized questionnaires to evaluate the effectiveness of low-vision rehabilitation or the quality of life of individuals with low vision. Another example is the use of a gaze-contingent method to simulate the loss of visual field, a method that provides an improved methodology to study how individuals with specific types of visual field loss perceive visual targets and carry out their daily activities. In this feature issue of *Optometry and Vision Science (OVS)*, we showcase many facets of low-vision research, highlighting how recent advances in vision science can be applied to low-vision research and patient care.

Low vision, whether research or patient care, emphasizes the functional capabilities of the individuals. We are pleased to include two perspective papers in this feature issue, one on a basic determinant of visual function — visual acuity¹ and the other on an activity of daily living — driving with bioptic telescopes². The authors of these two papers, authorities in their respective fields, nicely summarize the critical issues related to their topics, offer insightful suggestions to improve patient care and identify the critical issues which will help shape future research work on these topics.

The emphasis on functional capability in low vision is further demonstrated by our collection of articles on original research. The development of the Berkeley Rudimentary Vision Test allows the quantification of vision at much lower levels of acuity, which is useful in both clinical and research settings.³ The measurement of three-dimensional scotomas (volume scotomas) will allow clinicians to better evaluate the impaired functional vision for tasks at different distances.⁴

As most low vision clinicians know well, reading and mobility are the two top reasons for patients with visual impairment to seek low-vision care. Many low-vision patients suffer from a loss in contrast sensitivity, therefore information on the dependence of reading ability on text contrast will be very helpful in offering advice or prescribing low vision devices to these patients. This is evaluated in two studies, one focusing on the general population of older adults⁵ and the other focusing on people with glaucoma.⁶ Another study investigates whether people with central vision loss suffer from more crowding because of the need to use the peripheral retina and if so, whether reading can be improved using text with increased letter spacing.⁷

Detecting and recognizing steps and ramps is an important component of mobility. One paper examines whether visual texture on the ground plane can improve the detection and recognition of steps and ramps in the presence of simulated low vision and whether the effects change with locomotion.⁸ The recent advances in retinal prostheses raise many interesting and important questions, including whether mobility can be improved with prosthetic vision.⁹

Several authors provide informed advice and guidelines on the prescription of optical low vision devices for reading¹⁰⁻¹¹ and information about the use of the prescribed devices and their impact on quality of life.¹² In addition to the task of reading, optical devices such as prisms have been used to 'expand' the visual fields and increase spatial awareness for patients with homonymous hemianopia. The effects of eye dominance, suppression and background on the use of these prisms for vision rehabilitation are reported in one study,¹³ while another article documents the interesting observation of how a torsional strabismus with harmonious anomalous retinal correspondence provides an effect similar to a visual field expander.¹⁴ Although it is clear that optical devices are very useful for the task of reading and field expansion, their use may be limited for other tasks such as identifying objects and faces in more complex settings, especially when the contrast of the objects is not high. Under these conditions, image enhancement may be helpful, but the question remains as to whether people with visual impairment prefer the enhanced images and/or exhibit improved search performance.¹⁵

The recent development of high-speed eye tracking technology combined with a gaze-contingent display paradigm allows us to study many interesting questions that were methodologically challenging a decade ago. In this feature issue, two groups of investigators independently report the use of this technique to stabilize an artificial central scotoma on normally sighted individuals and examine the effects of such an artificial scotoma on the performance on visual search tasks. The questions they asked are different. One paper investigates whether contour enhancement benefits searching for an object in the presence of central vision loss¹⁶; the other investigates how the oculomotor system adapts to the loss of central vision.¹⁷ These studies also elucidate a more fundamental question — are the visual experience and consequences due to an artificial central scotoma in normally sighted individuals the same as those due to an actual central vision loss in patients? An interesting related question is whether patients with bilateral central scotomas are aware of their field defects.¹⁸

Over the past decade, there have been many advances in the use of psychometrics to evaluate health outcomes. The application of these methods has helped answer many questions in low-vision research. In this feature issue, one article evaluates the effectiveness of low-vision rehabilitation in South Australia¹⁹ while another evaluates whether visual impairment has any impact on the daily life of pediatric patients.²⁰

Finally, we have a case report on the benefit of applying adaptive optics to correct for aberration at the preferred retinal locus of an individual with Stargardt's disease.²¹

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