



## LETTERS TO THE EDITOR

### Review of using the Dyop optotype for acuity and refractions



Dear Editors,

I am delighted to have your publication of research relating to the Dyop as a "revolutionary" optotype for use by Eye Care Professionals and Vision Scientists.<sup>1</sup>

However, there are some additional insights as to Dyop functionality which were not fully explained in the paper.

When Snellen created his optotype in 1862 it WAS a breakthrough in the use of a standardized visual target for calculating acuity and refractions. Despite its wide and rapid acceptance by the Eye Care Profession, there are some (minor) assumptions made by Snellen which only were elucidated after decades of use.

1. While the 5 arcminute standard **height** of the optotype (and 1 arcminute MAR) corresponding to 6/6 acuity was convenient and relatively reproducible, it is not as precise as it might be when using 21st century technology. The disparity in acuity measurement between a Dyop and Snellen-type letter charts is primarily because a Dyop has a smaller MAR (a Minimum **AREA** of Resolution of 0.54 arcminutes squared) versus Snellen-conforming charts (with their 1.0 arcminutes squared Minimum **AREA** of Resolution).
2. While the term "Dyop" was coined as a form of "dynamic optotype" it is distinctly different from previous concepts of dynamic optotypes. Rather than measuring motion detection across a horizontal or vertical plane, a Dyop creates a strobic stimulus perception within a specific area of the fovea. This provides the ability to more precisely measure the Dyop MAR.
3. The use of a panoply of European-style letters was convenient for use in Europe and by educated patients, but it is culturally deficient, especially in geographic areas where letter-based words are still NOT used.
4. The methodology of validation by correctly identifying 4 out of 5 letters per line might provide statistical validation for Snellen/Landolt optotypes, but inherently reflects the cognitive inconsistency of those tests.
5. The cognition required by letter-based optotypes obviates those tests from use in pre-literate children and infants or non-literate adults.
6. The use of "symbolic tests" such as Landolt or Tumbling "E" or Lea or Patti Pics still does not eliminate the

Recognition Acuity cognitive factor in those optotypes. A comparison of Landolt versus Snellen by Wolfgang Grimm identified a 15% acuity disparity. [https://www.dyop.info/documents/Correlation\\_of\\_Optotypes\\_with\\_the\\_Landolt\\_Ring.pdf](https://www.dyop.info/documents/Correlation_of_Optotypes_with_the_Landolt_Ring.pdf) <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1475-1313.1988.tb01076.x>. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3972650/>

7. Acuity and refraction methodologies using repetitive "line by line" per line size validation might be applicable with the use of a variable letter-based optotypes. However, it is unnecessary and counterproductive when using a Dyop as a visual target due to the sharp threshold of detecting, or not-detecting, the Dyop spin and direction. That unnecessary repetition not only obviates the inherent efficiency of Dyop testing (typically taking 10 to 30 s per eye for acuity and 60 to 90 s per eye for refractions), but it essentially "punishes" the subject by having to unnecessarily give the same response.
8. The recognition of the Snellen versus Dyop acuity endpoint variance and additional Snellen minus spherical power is a valid concern, however, not in the way as described by the authors. One of the contradictions of "modern" Optometry is the discovery that additional minus spherical power induces elongation of the eye and increases myopia. The current "Global Epidemic of Myopia" creates an ironic possibility that, rather than the Dyop test being the aberrant methodology due to its lower index of necessary spherical power, the higher measure of Snellen/Landolt necessary power might indicate that Snellen/Landolt is contributing to that myopia epidemic.
9. One of the inherent Dyop refraction features is the visibility and precision of detecting Dyop spin. With Snellen and other static optotypes, increased spherical blur and increased cylinder and axis, reduces cognition and the subjects' ability as to letter identification. To properly measure Dyop refraction values and the measurement of cylinder and axis, the diameter of the Dyop needs to be reduced. Induced astigmatism makes the Dyop ring increasingly appear tilted, irregular and abnormal, but spinning can still be detected. Reducing the Dyop size to a sub-acuity diameter for refractions is the benchmark of cylinder and axis determination as well as determination for acuity. We have developed a distinct Dyop methodology to properly utilize its attributes, especially to compensate for the excess in minus preference by hyperopes, but we were not consulted as to our advised refraction methodology. [https://www.dyop.info/documents/Dyop\\_Refraction\\_Procedure.pdf](https://www.dyop.info/documents/Dyop_Refraction_Procedure.pdf)

I regret feeling the need to provide this "after publication" commentary, but as a literally and figuratively "revolutionary" optotype, it would be a disservice to the Eye Care Profession and Vision Science to not elucidate a clarification as to Dyop applications.

## Reference

1. Gantz L, Paritzky D, Wunch I, et al. Validation of the DYOP visual acuity test. *J Optom.* 2022. <https://doi.org/10.1016/j.optom.2022.09.006>.

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## Letter to the Editor - Reply to Mr. Hytowitz



*To the Editor,*

Thank you for the opportunity to respond to the letter by Mr. Hytowitz.<sup>1</sup> As the creator and developer of the Dyop, it is not surprising that he is seeking to promote his design. However, we note that almost nothing in his letter actually relates to the results of our paper.<sup>2</sup> For example, none of Mr. Hytowitz's comments refer to our initial two studies (validation and inter-session repeatability). Further, the results of our third study clearly demonstrated that the Dyop target performed significantly worse with regard to the detection of uncorrected astigmatism. Examination of Table 3 indicates that when plotting the effect of induced astigmatism on visual acuity, the slope of this function using the Dyop chart was less than 50% of the values obtained using standard clinical optotypes. These differences, which were statistically significant ( $p < 0.001$ ) confirm that visual acuity measurement using the Dyop chart is affected less by the presence of uncorrected astigmatism than standard optotype charts. We believe that this would make subjective refraction using the Dyop much more challenging, since many patients will lack sufficient sensitivity to detect the small changes in resolution. Indeed, the results support the use of conventional targets (Snellen letters, Landolt Cs and Tumbling Es), since each diopter of uncorrected astigmatism will produce a greater decline in visual acuity. It should also be noted that subjects reported significantly greater frustration with the Dyop test ( $p < 0.004$ ), compared with standard optotypes.

While little else in Mr. Hytowitz's letter is actually relevant to our study, we were most intrigued to read his proposal that the ongoing global epidemic of myopia resulted from clinical testing with a conventional Snellen chart, and we eagerly look forward to seeing any data that he might have to support such a proposition.

## References

1. Hytowitz AN. Review of using the Dyop optotype for acuity and refractions. *J Optom.* 2022. <https://doi.org/10.1016/j.optom.2022.12.002>.
2. Gantz L, Paritzky P, Wunch I, et al. Validation of the DYOP visual acuity test. *J Optom.* 2022. <https://doi.org/10.1016/j.optom.2022.09.006>.

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