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A NEW READING-ACUITY CHART FOR NORMAL AND LOW VISION*

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INTRODUCTION

Functional measures of visual ability can be of great value in the treatment and care of patients with low vision, or in prescribing optical corrections for patients with normal vision. One such measure is reading ability. We have designed a new reading-acuity chart that is suited for testing observers with normal and low vision. Here we describe the new chart, and report preliminary data relating it to other measures of acuity.

CHART DESIGN

The MNREAD Acuity Chart is a test of reading acuity that uses a series of sentences printed with different sizes. Figure 1 is a reproduction of one side of the MNREAD Acuity Chart. The whole chart is printed on two sides of an 11 inch × 16 inch card. We have produced two versions, each carrying a different set of test sentences. Both versions are printed with black text on a white background, and with white text on a black background. The charts contain the following design charaterisitics:

- *Test sentences.* The test sentences provide samples of normal reading material, demanding corresponding visual processing capabilities and eye-movement control. The sentences on the two versions of the chart are matched for mean word length and word frequency. Each sentence contains 52 characters which are divided onto four lines of text. The text is printed with high contrast in a fixed-width typeface (Courier-Bold). The format of the sentences is the same as that used for measuring reading speed in the MNREAD Low-Vision Reading Test (Legge, Ross and Luebker, 1987). Our new acuity chart may be useful in evaluating reading speed for different print sizes and in the prescription of reading aids.

- *Range of print sizes.* A wide range of print sizes is necessary to accommodate the wide range of acuities found with normal and low vision. Each MNREAD Acuity chart contains 18 levels, with print size (taken as the height of a lower case 'x') ranging from 1.3 to −0.4 LogMAR (logarithm of the minimum angle of resolution) in 0.1 LogMAR steps. For comparison, the smallest print on the Sloan M Cards† is 1M (equivalent to 0.4 LogMAR). This size is well above the acuity limit for most normal and some low vision patients. The sentences on the two versions are matched for mean word length and word frequency.

- *Logarithmic progression.* The print size and line-to-line spacing of each sentence is 0.1 log units smaller than on the previous level. Logarithmic scaling allows easy calculation of

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†The Sloan-Lighthouse continuous text reading cards for low vision patients

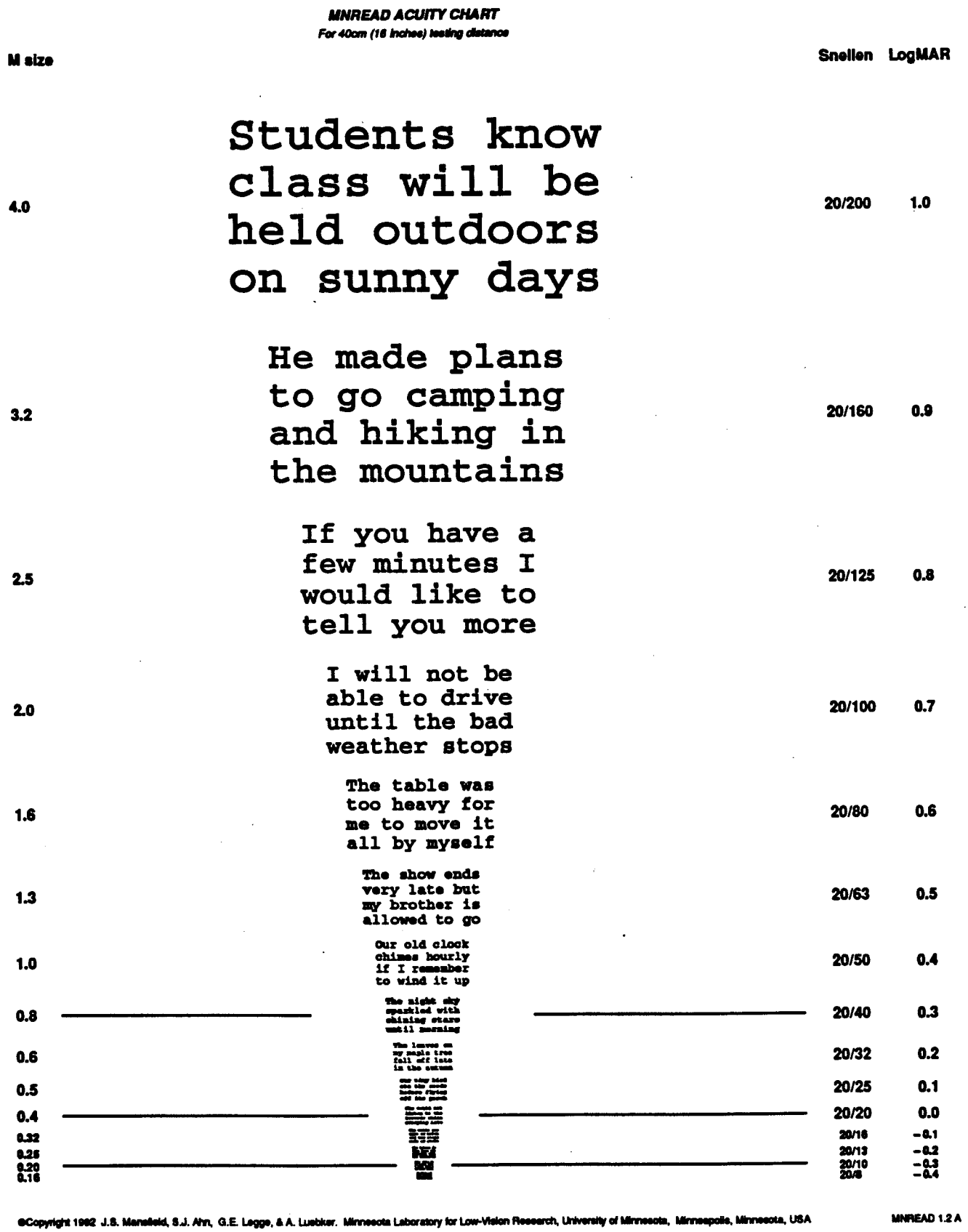

Figure 1. Sample from the MNREAD Acuity Chart. The chart has been reduced to 65% of the original size. The actual card is printed with 2400 dots per inch, which is sufficient to resolve the smallest print used.

reading acuity at non standard viewing distances (e.g. for low-vision patients with LogMAR acuity greater than 1.3).

- *Reversed contrast polarity.* Some low vision patients read better with white text on a black background. We have produced reversed contrast versions of the chart for evaluating differences in reading acuity due to contrast polarity.

We have compared measurements on the new chart with acuities measured on the Lighthouse Distance Visual Acuity Chart, the Lighthouse Near Visual Acuity Chart (each of which use Sloan Letters), and the Sloan M Cards (which uses continuous text). Acuities were measured from 56 individuals, 21 with low vision and 35 with normal vision. Reading acuity was taken as the smallest print size that the observer could read continuously (even if slowly) with few or no errors. Our observations indicate that this criterion can be applied equally to both low-vision and normally-sighted observers.

RESULTS

Comparison with the Sloan M Cards

The acuities measured with the MNREAD Acuity Chart and the Sloan M Cards were highly correlated ($r = 0.94$). The agreement between these charts is reassuring given that they each measure continuous text reading acuity. It should be noted, however, that all the observers with normal vision could easily read the smallest print on the Sloan M Cards and were not included in this anlysis.

Comparison with isolated letter acuity charts

Figure 2 shows the relationship between acuities measured with the MNREAD Acuity Chart and the Near and Distance Lighthouse Visual Acuity Tests. The correlations are high ($r = 0.97$) in both cases. It should be noted that 21 of the 35 normal observers could read all the letters on the Lighthouse Near Visual Acuity Chart and were not included in this analysis.

The diagonal line in Figure 2 indicates identical scores on the MNREAD and the other acuity measures. The data points are on average 0.1 LogMAR above this line indicating that the MNREAD Acuity chart gives higher acuities than the letter charts. This may suggest that smaller letters can be recognized in sentences than on isolated letter tests, or that the MNREAD Acuity criterion is more lenient.

Test - retest

The normally sighted participants were tested on the two versions of the MNREAD Acuity Chart, each containing different sentences. The mean difference between their scores on the two charts was 0.02 LogMAR. Of the 35 participants tested on the two charts, 23 had equal scores on the two charts 11 had scores that differend by 0.1 LogMAR, and one person had scores that differed by 0.2 LogMAR. The results acheived with both charts are very similar which may indicate that the effect of context on the reading task does not neccesarily reduce test reliability (as has been suggested by Bailey and Lovie, 1980).

CONCLUSION

We have introduced a LogMAR reading-acuity chart that is suited for testing poeple with low and normal vision. Our data indicate that the acuity scores obtained with this new chart are highly correlated with those from other acuity tests. The design of the test sentences may prove useful for evaluating reading speed in addition to measuring acuity, and the prescribing of reading glasses and magnifiers.

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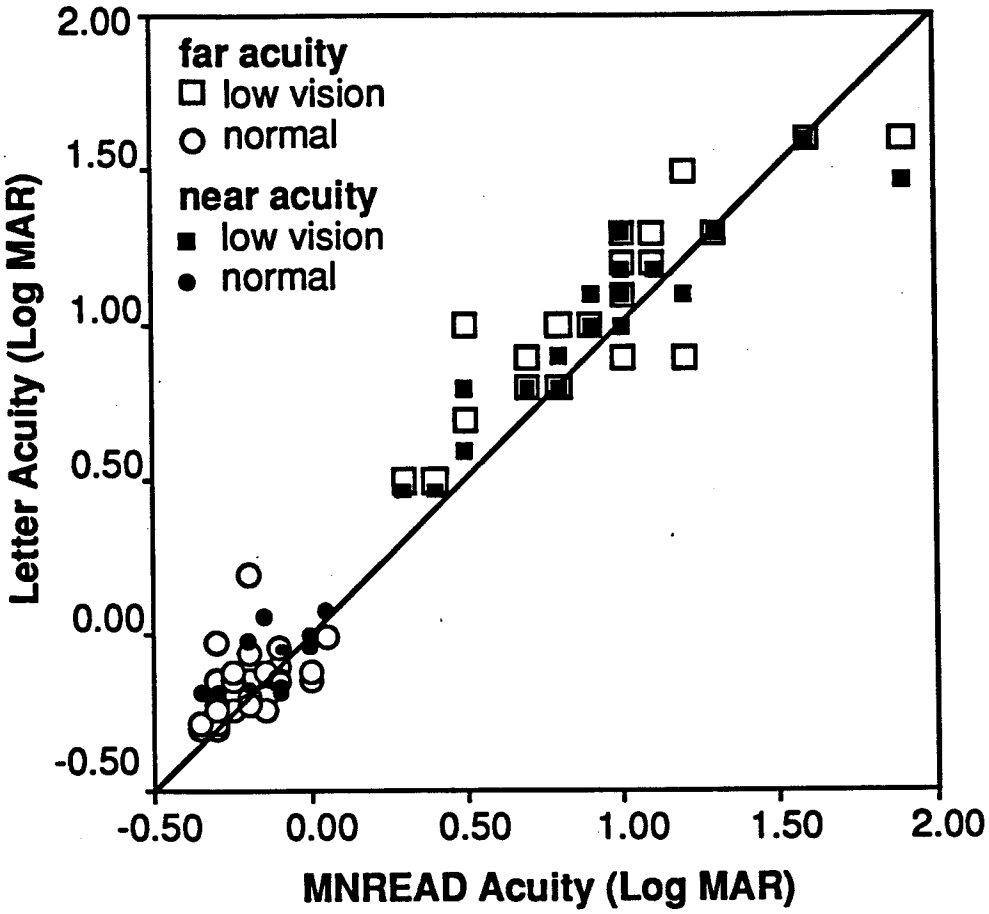

Figure 2. Comparison of MNREAD Acuity with Lighthouse Near and Far acuities for observers with normal and low vision..