

# Wormington Pocket Acuity Card

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## The Single Letter Acuity chart

1. This chart can be **used to obtain the patient's single letter visual acuity**.
  - a. Have the patient hold the chart at 40 cm (16 in.) and cover the left eye with an occluder or the palm of the hand.
  - b. Tell the patient to read the lowest line he or she can.
  - c. After the patient reads a line, tell him or her to read the next line down. If hesitation occurs, tell the patient to take a guess. The patient can usually read one to two lines further than he or she initially indicates. To overcome the patient's fear of getting a letter wrong, you usually need to encourage guessing.
  - d. **Threshold is reached when the patient gets 3 or more out of the 5 letters on the line (i.e., > 50%) correct and can not get at least 3 letters on the next smaller line correct.** Record the acuity indicated on the threshold line. **Many clinicians will give partial credit by adding plus or minus signs** to the VA score in order to indicate that the patient actually did a little better or a little worse than the numerical score indicates. For example, if the patient reads all the letters on the 0.40/0.80 M line and correctly identifies two letters on the next row (0.40/0.60), then the VA score can be recorded as 0.40/0.80<sup>+2</sup>.
  - e. Then have the patient cover the right eye, and repeat with testing the left eye.
2. This chart is **scientifically designed using the Bailey-Lovie format** (Bailey, 1998; Bailey & Lovie, 1976).
  - a. Sloane letters are used with the letter height equaling 5 stroke widths and the letter width equaling 5 stroke widths.
  - b. There is a geometric (logarithmic) progression of sizes. The lines change size in 0.1 log-unit steps. This corresponds to a geometric progression in which each row contains letters about 1.26 times smaller than the preceding row. Logarithmic scaling of size on visual acuity charts has long been advocated and is now broadly accepted (Bailey, 1998).
  - c. This allows the card to be **used at any distance** (i.e., not just 40 cm) to take an acuity. The best way to do this is to use M notation (e.g., 0.40/0.40 M which is equivalent to 20/20).
    - 1) M units are used to specify the size of the letter by indicating the distance in meters at which the height of the lower case letters subtends 5 min of arc. For example, 0.40 M letters subtend 5 min of arc at 0.40 meters. Regular newsprint is about 1.0 M in size. Thus, using M notation, the visual acuity is recorded as the Snellen fraction where the numerator is the testing distance in meters and the denominator is the M unit size of the smallest print that can be read at that distance. If a patient can just read 1.0 M print at 40 cm, then the visual acuity can be recorded as 0.40/1.0 M.
    - 2) Use of M notation allows quick conversion to 20-foot equivalent acuities via proportions or, when used at 40 cm, by multiplying top and bottom M notation numbers by 50. For example an acuity taken at 20 cm where the patient can just barely read the 4.0 M letters would be written as 0.20/4.0 M in M notation. The top number is the actual testing distance in meters and the lower number is the M size of the letters. In this case, where the acuity is 0.20/4.0 M, this is equivalent to 20/400 (i.e.,  $0.20/4.0 = 20/x$ , and solving for x, one obtains  $x = 400$ ).
  - d. **Letters used in the chart are of roughly equal legibility**, and each line has approximately the same overall difficulty.
  - e. Each row has the same number of letters (i.e., 5 letters), except for the larger letter sizes.
  - f. The spacing between the letters is equal to one letter-width. This is the spacing used on the Bailey-Lovie chart. The strength of the "crowding effect" varies as a function of the distance between letters, and, therefore, the distance between the letters should be homogeneous. In many of the available charts, the distance between the letters varies in a non-homogeneous manner.
  - g. The between-row spacing is equal to the height of the letters in the smaller row.
  - h. **The rows are marked for quick use at 40 cm** (16 inches). When the card is used at that distance **the 20-foot equivalent acuities are noted**.
  - i. **When used at other distances, as well as at 40 cm, M notation can be used.**
  - j. **Reducing the test distance can be useful when testing low vision patients.** Also, the logarithmic progression of the print size facilitates the prescribing of magnifiers or near adds in

order to allow the patient to read efficiently print of a particular size (see Bailey, 1998). Flexibility in the choice of testing distance can also be useful in detecting malingers.

### Number chart

1. This chart is **used with very young children, patients accustomed to a different alphabet, and illiterates**. A number of people can read numbers even though they can't read letters.
2. Again, the acuity notation is the 20-foot equivalent acuity when the card is used at 40 cm.
3. These numbers are specially designed so that the gap width is one-fifth of the stroke width. On most other cards that use numbers, the gap width is much larger than the stroke width. Therefore, the acuities measured with the Wormington card will correlate better with the single letter acuities. Due to varying legibilities of number symbols, it should still be noted, however, that the **use of numbers for measuring acuity should be reserved for those patients that would not respond to the letter chart**.

### The Reading Acuity chart

1. Many clinicians are interested in obtaining an **assessment of reading ability**.
2. This chart uses sentences where the letters are lower case and contain words of different lengths.
3. The font used is Times New Roman. This font is a **typical font used in newspapers and books**. This font has also been adopted by the British as the standard font for near-vision charts.
4. The progression in sizes is geometric (logarithmic) in steps of 0.1 log-units.
5. Each group of words is of approximately equal difficulty. The words used appear with high frequency in 2<sup>nd</sup> and 3<sup>rd</sup> grade reading material.
6. Each sentence contains 60 characters (including a space between each word and at the end of each line). The sentences are printed as three lines.
7. The recommended viewing distance is 40 cm (16 inches). At that testing distance, the 20-foot equivalent acuities are noted.
8. It should be kept in mind that **reading acuity is not necessarily the same thing as letter chart acuity**.
  - a. The letters in reading charts are not designed with the gap width equaling the stroke width. The letter design is determined by the font type.
  - b. In addition, the task is to resolve more complex and congested components arranged in sequences that must be recognized. This increase in task complexity can affect the measured visual acuity score.
  - c. Thus, **patients with macular lesions (e.g., ARMD) may have a reading acuity that is significantly worse than their letter chart acuity** (Kitchin & Bailey, 1981; Legge et al., 1992).
9. Because reading text is qualitatively different than recognition of individual letters, reading charts are **more appropriately used in evaluating visual impairment rather than in visual acuity measurement** (Brown, 1981; Kitchin & Bailey, 1981; Legge et al., 1985; Legge et al., 1992; Sloane, 1959). Letter chart acuity has little or no relationship to the maximum reading rate of a low vision patient (Goodrich et al., 1977; Legge et al., 1992).
10. This card is designed using principles similar to those used for the Minnesota Low-vision Reading Test (MN-READ) (see Ahn et al., 1995; Legge et al., 1989). Thus this card **can be used to obtain a quick and accurate assessment of a low-vision patient's reading speed**. This can aid in the selection of an optical aid for the patient (Ahn & Legge, 1995; Sloane & Brown, 1963).

### The Tumbling E chart

1. This chart is for **use with children and illiterates**.
2. The child is to indicate the position of the open side of the "E," right, left, up, or down. This can be done either verbally, or with the child's fingers pointing in the same direction as the E's fingers, or by manipulation of a cut-out E card to match the position of the E.
3. The acuity notation is the 20-foot equivalent acuity when the card is used at 40 cm.

### Pupil measurement

1. At one end of one side of the card are 8 "half-moon" shaped objects that can be used to assess pupil sizes.
2. Comparing these objects to the patient's pupil allows a comparison of the areas of the two. This leads to more accurate pupil assessment than using a millimeter rule to measure diameter.
3. Pupil sizes between the object sizes can be interpolated by comparison of the object that is just larger than the pupil with the object just smaller than the pupil.

### Millimeter rule

1. At one end of one side of the card is a ruler with millimeter gradations.
2. This can be used to measure interpupillary distances (PDs), interpalpebral fissure distances, corneal diameters, etc.

A number of articles have pointed out the **problems with** the commercially-available near visual acuity cards, especially the **Rosenbaum Pocket Vision Screener** (Horton & Jones, 1997; Jose & Atcherson, 1977; Romano, 1989). Most of the problems of the Rosenbaum card and the other cards are corrected in this new card. Jaeger (J) notation is not used in the new card because it is essentially meaningless. There is no standardization of the J notation (Bailey, 1982; Mehr & Freid, 1976). A J1 line of letters on one card is not necessarily the same size as a J1 line on a card from another manufacturer. In fact on one card, the J1<sup>+</sup> notation is stated to be equivalent to 20/20 acuity, but is in fact equivalent to 20/35 acuity at the stated testing distance.

## References

Ahn SJ, Legge GE. Psychophysics of reading. XIII. Predictors of magnifier-aided reading speed in low vision. *Vision Res* 35:1931-8 (1995).

Ahn SJ, Legge GE, Luebker A. Printed cards for measuring low-vision reading speed. *Vision Res* 35:1939-44 (1995).

Bailey IL. A call for the elimination of the Jaeger and reduced Snellen notations. *Optom Month* 73:676-9 (1982).

**\*Bailey I. Visual acuity. In: Borisch's clinical refraction. Philadelphia: WB Saunders Company, 1998. This is a good review article that also covers near acuity measurement.**

Bailey IL, Lovie JE. New design principles for visual acuity letter charts. *Am J Optom Physiol Opt* 53:740-5 (1976).

Brown B. Reading performance in low vision patients: relation to contrast and contrast sensitivity. *Am J Optom Physiol Opt* 58:218-26 (1981).

Goodrich GL, Mehr EB, Quillman RD, Shaw HK, Wiley JK. Training and practice effects in performance with low-vision aids: a preliminary study. *Am J Optom Physiol Opt* 54:312-8 (1977).

Horton JC, Jones MR. Warning on inaccurate Rosenbaum cards for testing near vision. *Surv Ophthalmol* 42:169-74 (1997).

Jose RT, Atcherson RM. Type-size variability for near-point acuity tests. *Am J Optom Physiol Opt* 54:634-8 (1977).

Kitchin JE, Bailey I. Task complexity and visual acuity in senile macular degeneration. *Austr J Optom* 64:235- (1981).

Legge GE, Ross JA, Isenberg LM, LaMay JM. Psychophysics of reading. XII. Clinical predictors of low-vision reading speed. *Invest Ophthalmol Vis Sci* 33:677-87 (1992).

Legge GE, Ross JA, Luebker A, LaMay JM. Psychophysics of reading. VIII. The Minnesota Low-vision Reading Test. *Optom Vis Sci* 66:843-53 (1989).

Legge GE, Rubin GS, Pelli DG, et al. Psychophysics of reading. II. Low vision. *Vision Res* 25:253-65 (1985).

Mehr EB, Freid AN. The measurement and recording of vision at near test distances. *Am J Optom Physiol Opt* 53:314-7 (1976).

Romano PE. An additional article on Rosenbaum cards [letter]. *Surv Ophthalmol* 42:492 (1998).

Romano PE. Optotype distortion on the "Rosenbaum Pocket Vision Screener." *Ann Ophthalmol* 21:362-3 (1989).

Sloane LL. New test chart for the measurement of visual acuity at far and near distance. *Am J Ophthalmol* 48:807-13 (1959).

Sloane LL, Brown DJ. Reading cards for selection of optical aids for the partially sighted. *Am J Ophthalmol* 55:1187-99 (1963).

