The Pelli-Robson Chart for Near Distance

Instructions

Setting Up

i. *The Chart*. These instructions accompany a chart as well as scoring sheets (PDF Available). The chart and scoring sheets are printed for all charts. The different charts have different letter sequences but are otherwise identical. The letters on the chart are organized into groups of three, i.e. "triplets", there being two triplets per line. Within each triplet all letters have the same contrast. The contrast decreases from one triplet to the next. The division into triplets is indicated on the scoring sheet- but not on the chart itself- by an extra-large gap. (Unlike an acuity chart, in which the difficulty increases in the middle of each line as well.)

ii. *Mounting the chart.* The chart should be hung so that its center will be approximately at the level of the patient's eyes.

iii. *Illuminating the chart.* The chart should be illuminated as uniformly as possible, so that the luminance of the white areas is about 85 cd/m^2. (The acceptable range is 60 to 120 cd/m^2, which corresponds to an incident illumination of 240-480 lumens per square meter (lux)) Avoid glare. The patient should not see the lamps themselves or any mirror-like reflections of the lamps on the chart's surface.

Contrast Sensitivity Testing

1. *Testing a patient*. Test patients *before* dilating their pupils or applying any other drugs to their eyes. To closely replicate testing of the original Pelli-Robson Chart, which has a test distance of 1 meter, the patient should sit or stand directly in front of the chart so that the distance from the eyes to the chart is about 33cm (13 inches). Patients should wear their best distance correction and, if necessary, an additional +0.75 diopters for the 1 meter distance. (The patient's sensitivity will be unaffected by small refractive errors because the letters are large.)
2. *Recording the patient's performance*. Fill in the patient's name, the date and the examiner's name on the scoring sheet. The patient should make a single attempt to name each letter on the chart, starting with the dark letters in the upper left-hand corner and reading horizontal across the entire line. On the scoring sheet, underline or circle each letter read correctly, strike through any letter read incorrectly.
3. *Don't let the patient give up too soon*. Patients should be made to guess even when they believe that the letters are invisible. You should allow several seconds for the faintest letters to appear, but don't let the patient give up until he or she has guessed incorrectly 2 of the 3 letters in a triplet. The reliability of the results depends on this.
4. *Scoring the test*. The patient's sensitivity is indicated by the faintest triplet for which 2 of the 3 letters are named correctly. The log contrast sensitivity for this triplet is given by the number on the scoring sheet nearest to the triplet. The number may be to the right or the left of the triplet; use the one *nearest* to the triplet. Enter this number as the Log Contrast Sensitivity.
5. *Testing the other eye*. The patient should be tested three times: each eye separately and both eyes together. When testing one eye the other eye should be covered. The three measurements should take no more than 8 minutes in all. Binocular log contrast sensitivity is normally 0.15 higher than monocular.

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Notes

a) *The calibration.* Printing processes have unavoidable variations which make it impossible to consistently produce contrast-sensitivity charts which meet the standards required of a clinical instrument. Therefore, each letter on every Pelli-Robson chart is photometrically calibrated (by an extremely precise reflection densitometer developed by Robson and Pelli) to determine whether its contrast is within specification. Charts that fail this test are discarded. Your chart has a serial number either on the front or back which relates to its specific calibration.

b) *Life and care of the chart.* The chart's substrate and special ink were chosen for their great stability, and should not change the chart's contrast significantly within the first five years of normal use. This chart should be replaced if it's marred by visible marks, e.g. fingerprints. The chart should not be cleaned or gotten wet under any circumstances.

c) *Explaining the test.* This test will be unfamiliar to most of your patients, and they may cooperate more readily if they understand why it is being performed. Here is one possible set of instructions: "In everyday life we don't just look at small black objects. Contrast sensitivity is a more realistic assessment of how well we see large faint objects around us. This chart is a little different from the regular eye chart. With this chart the letters are all uniformly large, and they face out towards the bottom of the chart. The top line has high-contrast letters, black on white. The letters below them are gray and more difficult to see, very much like looking through a fog or dirty glasses. What you must do is read as many letters as you can. The letters at the bottom of the chart are difficult for everyone to read, so don't be discouraged." When the patient begins to have trouble, it may be useful to provide some strategies to help him or her make the best attempt at seeing the letters. "Try blinking, or viewing the letter a little eccentrically, moving your head from side to side." Indicate (without touching the chart) the particular letter you want the patient to concentrate on. "Try reading this one. Do you see something against the white background? Is there a smudge? Is it round or square? Does it have corners or lines you can see? Keep trying. The whole letter may suddenly appear to you. Go ahead and guess."

d) *Log contrast sensitivity.* For a chart of this kind, contrast is best defined as the difference in luminance between the letter and background, divided by the luminance of the background. This ratio of luminance, known as the Weber contrast, should not be confused with Michelson contrast, which is a different luminance ratio commonly used for grating stimuli. The lowest visible contrast is called the contrast threshold. It is usual to take the reciprocal of contrast threshold to obtain contrast sensitivity. This has the advantage that the better a patient's vision, the higher the sensitivity score. Taking the base-10 logarithm of the sensitivity has the further advantage that equal steps on this scale correspond to equal effects. For example, looking through a fogged window (or a cataract) which reduces contrast by a factor of 2 would reduce the log contrast sensitivity of any observer by 0.3, regardless of the observer's initial log contrast sensitivity. If it is necessary to compute the contrast threshold c from the log contrast sensitivity s, use the formula $c = 1/10^s$

e) *Standardizing.* These instructions and accompanying chart have been designed to achieve the highest possible comparability of results among different users. To this end, the chart follows the luminance, font, and letter spacing recommendations of the Committee on Vision of the National Academy of Sciences and National Research Council *(Adv. Ophthal. 41, 103-148, 1980)*. Of course, this comparability will be achievable only if the user strictly follows these instructions.

f) *Accuracy.* The accuracy of a single determination of a patient's log contrast sensitivity is determined primarily by two factors: the accuracy of the contrast calibration of the chart (Guaranteed to be at worst ±0.075) and the intrinsic variability due to the probabilistic nature of the patient's responses, which as a result of careful design, results in a standard deviation of only about 0.11 (see Pelli et al. 1988).

g) *Further Reading.* Pelli, D.G., Robson, J.G., and Wilkins, A.J. (1988) Designing a new letter chart for measuring contrast sensitivity. *Clinical Vision Sciences2:*187-199. (Note that the article describes an early prototype version of the chart which had a different viewing distance.) Other articles of interest are contained in the same issue of *Clinical Vision Sciences.*

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