

Lab 6 – Contrast Sensitivity and clinical interferometry

Clinical Contrast Sensitivity testing

Optometrists routinely test spatial vision, to see how well their patients see images. This is important because sub-normal spatial vision may indicate an uncorrected refractive error or ocular diseases. The **contrast sensitivity function** (CSF) provides more complete information about spatial vision than Snellen visual acuity. It plots the limits of spatial vision; that is, the border between seeing and non-seeing for targets that vary in terms of spatial frequency and contrast. By making a target with fixed contrast smaller, it becomes harder to see, until it exceeds the resolution limit. Or, we may keep target size constant, but decrease contrast until the target can no longer be seen. Either way, we are finding a point on the CSF. To get a complete picture of a person's CSF, we should plot many points along the curve, but for convenience, it may be sufficient to measure just a few points and compare them to norms.

Vector Vision CSV-1000 Contrast Sensitivity tester

1. Verify that the test distance is eight feet, and test each person's better eye monocularly.

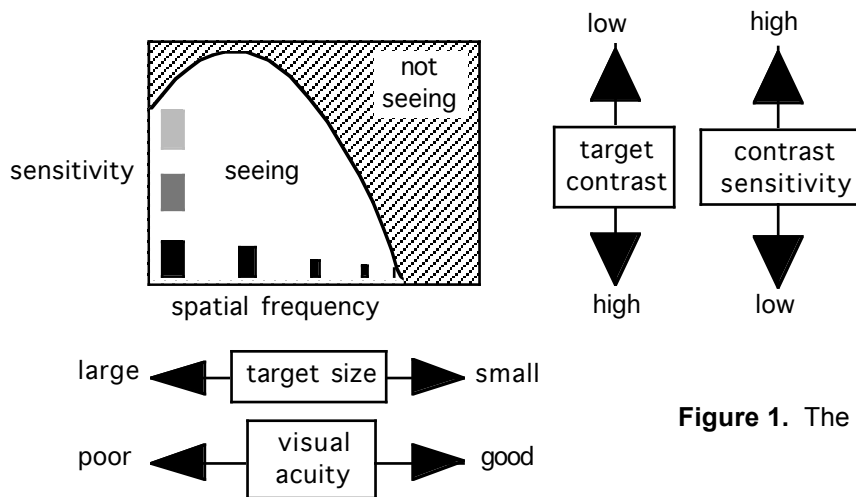


Figure 1. The CSF.

2. Starting from row A, progress from left to right, and ask the patient to say whether the striped circle is on the top, bottom or if they are both blank (3 alternatives). Follow the patient's responses on the recording form (it includes the answers), and mark the **last correct response**.
3. Repeat for row B, C, D.
4. Connect the response points with lines, and compare the CSF to the expected normal range.
5. Enter numerical data for your subject on the Excel spreadsheet on the lab computer.
6. Study more about clinical contrast sensitivity test by visiting the Vector Vision web site (<http://www.vectorvision.com/>). Select "Contrast sensitivity education" and read the pages.
7. Convert your contrast sensitivity scores to Boxer Wachler (BW) normalized scores. These are computed by dividing the log CS values for each spatial frequency by the normal log CS values, which are listed on the top row of Table 1. BW normalized scores rescale the results from 0 to 1.0 relative to normal and simplify interpretation.

Table 1. VectorVision results

Row ->	A (3)	B (6)	C (12)	D (18)
Normal log sensitivity	1.84	2.09	1.76	1.33
Number correct				
Contrast sensitivity				
Log CS				
BW normalized score				

Contrast sensitivity with the Morphonome visual psychophysics software

Follow the instruction given by Dr. Salmon and measure the better eye’s CS using Morphonome.

1. On the **Stimulus Setup** menu set the frequency to 3 c/d and test distance to 150 cm in the 9th box from the top.

Unit * | Freq = 3.0 c/d >> | @ 150 cm*

Verify the test distance. In the bottom box, select “**SETUP EXP**” to go to the Experiment Setup menu.

2. In the **Experiment Setup** menu set starting contrast to about 10%.

+ | Mod Contr = +10.0% >>>>

In the bottom box, select “**RUN EXP**” to begin the test.

3. Present the target to the patient and adjust the contrast by selecting one of the boxes.

INCR MODULATION & GO
GO (MODULATE)
DECR MODULATION & GO

Ask the patient if he/she saw the stripes and note the contrast. Repeat until you determine the contrast threshold for that spatial frequency. When done, press **FINISH**.

4. Return to the **Stimulus Setup** menu and reset the spatial frequency to 6, and 12 c/d and repeat. For 18 c/d you will need to leave the frequency at 12 c/d, but test at a distance of 225 cm. Why?
5. Enter numerical threshold contrast data (decimal, not percent) in Table 2, and complete the table.

Table 2. Morphonome results

Spatial frequency	3	6	12	18
Contrast threshold (decimal)				
Contrast sensitivity				
Log CS				
BW normalized score				

Contrast sensitivity using the Mars near contrast sensitivity chart

Use the Mars chart to test near contrast sensitivity according to following test protocol.

- Test distance = 50 cm
 - Letter size will be 20/480
 - Recommended background luminance = 60-120 cd/m²
1. Monocularly test the better eye
 2. Note the Form number and refer to the appropriate answer key on the score sheet.
 3. Ask the patient to read the letters in succession until he/she misses 2 consecutive letters.
 4. The patient must choose one of the following letters: CDHKNORSVZ
 5. Mark any missed letters with an x on the answer sheet.
 6. Compute the log contrast sensitivity score as shown on the score sheet. **Score = _____**
 7. Expected norms: 1.8 in young adults or > age 60, 1.68.

Enter your raw data on the lab computer and make a graph showing three contrast sensitivity curves: the VectorVision results, Morphonome result and expect norms.

Lotmar interferometer

With the Lotmar Visometer mounted on a slit lamp, adjust the controls, from top to bottom as follows:

Filter: green

Aperture: 0.15

Visus: 0.2

Field of view: 3.5°

Orientation: vertical

While viewing from the doctor side, hold a white card in the interferometer's focal plane and catch an image of the light projected from the interferometer. Try to view the image through the slit lamp microscope. You can get a clearer view of the image if you replace the card (Lambertian reflector) with a mirror (specular reflector).




What do see?

Observe the image seen from the patient side.

Change the Visus setting to 0.5 and note how the light pattern changes, as seen from both the doctor and patient side.

Change the orientation setting and note how the light pattern changes, as seen from both the doctor and patient side.

Complete the chart below by drawing what you saw. In addition, estimate the corresponding spatial frequencies. Feel free to adjust the settings and observe how the pattern changes.

Visus	Orientation	Pupil plane image	Retinal plane image	Spatial frequency (c/d)
0.2				
0.5				
0.2				
0.5	