BERKELEY DISCS -- Contrast Sensitivity Test

This test of contrast sensitivity has three double-sided cards.
On each of the six sides, there is a 6-cell grid of 80 mm squares.
On each of the sides, three of the 6 cells contain large (50mm) discs of different contrasts.
The patient's task is to identify which cells contain a disc.

On each of the three cards there are 6 discs of different contrasts.

Log Contrast Sensitivity Values for the Berkeley Discs

Card 1	**Side 1A**	0.10	0.70	1.30
	Side 1B	0.40	1.00	1.60
Card 2	**Side 2A**	0.20	0.80	1.40
	Side 2B	0.50	1.10	1.70
Card 3	**Side 3A**	0.30	0.90	1.50
	Side 3B	0.60	1.20	1.80

The contrast sensitivity values are expressed in log units of contrast sensitivity
using the Weber contrast ratio.

Weber contrast ratio $C_w = (L_{max} - L_{min}) / L_{max}$

TESTING METHODS:

It is not important which card is presented first.
Nor is it important which side is presented first or how the card is oriented.
After the two sides of any card have been presented, the clinician will have an initial estimate of the patient's contrast sensitivity having tested 6 different contrasts with increments of 0.3 log units.
The other two cards can then be used to refine the estimate.
Generally, the clinician will only need to present one selected side on each of the other two cards.

Consider a few examples:

Example 1.

The clinician begins by presenting Card 1.

On Side 1A the patient locates the 0.10 and the 0.70 discs, but fails to locate the 1.30 disc.
The card is then flipped and Side 1B is presented.
On Side1B, the patient should easily locate the 0.30 and fail to locate the 1.60 disc.
Now the critical question becomes whether the patient can locate 1.00 disc.
If the patient cannot locate the 1.00 disc on Side 1B, one would concluded the contrast sensitivity is at least 0.70 but less than 1.00 log units.

Then, in order to refine the estimate of contrast sensitivity, the 0.80 and the 0.90 discs should be presented, and these are on Sides 2A (0.80) and 3A (0.90).
Depending on the responses for Sides 2A and 3A, the estimate of contrast sensitivity could be 0.70, 0.80 or 0.90 log units.

Example 2.

The clinician begins by presenting Card 2.

On Side 2A the patient locates the 0.20 and the 0.80 discs, but fails to locate the 1.40 disc.
The card is flipped and Side 2B is presented.
On Side 2B, the patient should easily locate the 0.50 and fail to locate the 1.70 disc.
Now the critical question becomes whether the patient can locate 1.10 disc.
If the patient correctly locates the 1.10 disc on Side 2B, one would concluded the contrast sensitivity is at least 1.10 but less than 1.4 log units.

Then, in order to refine the estimate of contrast sensitivity, the 1.20 and the 1.30 discs should be presented, and these are on Sides 3B (1.20) and 1A (1.30).
Depending on the responses for Sides 3B and 1A, the estimate of contrast sensitivity could be 1.10, 1.20 or 1.30 log units.

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Example 3.

The clinician begins by presenting Card 3.
Card 3 might have been chosen because the clinician thought that patient had excellent contrast sensitivity and possibly be able to see all discs.

On Side 3A the patient locates the 0.30, 0.90 and 1.50 discs.
The card is flipped and Side 3B is presented.
On Side 3B, the patient should easily locate both the 0.60 and 1.20 discs.
Now the critical question becomes whether the patient can locate 1.80 disc.
If the patient cannot locate the 1.80 disc, it would be concluded that the contrast sensitivity is be at least 1.50 but less than 1.80 log units.

Then, in order to refine the estimate of contrast sensitivity, the 1.60 and the 1.70 discs should be presented, and these are on Sides 1B (1.60) and 2B (1.70).
Depending on the responses for Sides 1B and 2B, the estimate of contrast sensitivity could be 1.50, 1.60 or 1.70 log units.

After making an initial estimate of the contrast sensitivity it is good practice to make repeat presentations to check of the consistency of the patient's responses and to improve the clinician's confidence in the contrast sensitivity estimate.

When making repeated measurements, the clinician should change the orientation of the cards.
This makes it difficult for patients to remember the layouts for the discs.
Near the corners on each side, there are boxes in which location and contrasts of the discs are identified.

Care should be taken to avoid getting fingerprints or marks on the test cards.
Patients should not touch the cards. A soft-tipped pointer may be used.
Patients may be asked
"How many discs can you see?"
"Where are the discs located on this card?"
"Where is the faintest disc that you can see? "
Patients may to identify locations by pointing or by giving verbal responses (e.g., in the top left corner)

Changing the obliquity of gaze can change the detectability of the discs and consequently patients should not be allowed to make significant changes of head position or changes to the tilt of the cards.

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Log CS	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80
Side 1A	0.10						0.70						1.30					
Side 1B				0.40						1.00						1.60		
Side 2A		0.20						0.80						1.40				
Side 2B					0.50						1.10						1.70	
Side 3A			0.30						0.90						1.50			
Side 3B						0.60						1.20						1.80

WEBER CONTRAST Weber contrast ratio = $(L_{max} - L_{min}) / L_{max}$

Log CS	**0.10**	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**	**1.00**	**1.10**	**1.20**	**1.30**	**1.40**	**1.50**	**1.60**	**1.70**	**1.80**
Contrast (Weber)	80.0%	63.0%	50.0%	40.0%	32.0%	25.0%	20.0%	16.0%	12.5%	10.0%	8.0%	6.3%	5.0%	4.0%	3.2%	2.5%	2.0%	1.6%
L_{min}/L_{max} Ratio	0.200	0.370	0.500	0.600	0.680	0.750	0.800	0.840	0.875	0.900	0.920	0.937	0.950	0.960	0.968	0.975	0.980	0.984

MICHELSON CONTRAST Michelson contrast ratio = $(L_{max} - L_{min}) / (L_{max} + L_{min})$

Log CS	0.18	0.34	0.48	0.60	0.72	0.85	0.95	1.06	1.18	1.28	1.38	1.49	1.59	1.69	1.79	1.90	2.00	2.09
Contrast (Michelson)	67%	46%	33%	25%	19%	14.3%	11.1%	8.7%	6.7%	5.3%	4.2%	3.25%	2.56%	2.04%	1.63%	1.27%	1.01%	0.81%

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