

The Series of Plates
Designed as a
Test for Color Deficiency

by

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Introduction

This series of plates is designed to provide a test which gives a quick and accurate assessment of color vision deficiency of congenital origin. This is the commonest form of color vision disturbances.

Most cases of congenital color vision deficiency are characterized by a red-green deficiency which may be of two types; first, a protan type which may be complete (protanopia) or partial (protanomalopia), and secondly, a deutan type which may be complete (deutanopia), or partial (deutanomalopia).

In protanopia the visible range of the spectrum is shorter at the end compared with that of the normal, and that part of the spectrum which appears to the normal as blue-green, appears to those with protanopia as grey. The whole visible range of the spectrum in protanopia consists of two areas which are separated from each other by this grey part. Each area appears to those with protanopia as one system of color with different brightness and saturation within each area, the color in one area being different from that of the other. The red with a slight tinge of purple which is the complementary color of blue-green appears also as grey.

In deutanopia, that part of the spectrum which appears to the normal as green, appears as grey, and the visible range of the spectrum is divided by this zone into two areas, each of which appears to be of one system of color. The visible range of the spectrum is not contracted, in contrast to protanopia. Purple-red which is the complementary color of green appears also as grey.

In protanomalopia and deutanomalopia, there is no part of the spectrum which appears grey. But the part of spectrum which appears to those with protanopia as grey, appears to those with protanomalopia as a greyish indistinct color, and likewise, the grey part of the spectrum seen by the person with deutanopia appears to those with deutanomalopia as an indistinct color close to grey.

Consequently, one of the peculiarities of red-green deficiencies is that blue and yellow colors appear to be remarkably clear compared with red and green colors. The application of this peculiarity to the test for color vision deficiencies is the distinguishing feature of this series.

In the congenital color vision deficiencies, although very rare, there is total color weakness. The color sensitivity of the total color weakness to red and green, as well as to yellow and blue is very low and only the clear colors can be perceived; but, except for the color sensitivity, there is no abnormality in the visual functions. The plates in this book form an easy method of establishing the diagnosis on such cases and in distinguishing them from cases of red-green deficiencies.

There is also a very rare group of persons who suffer from total color blindness and show a complete failure to discriminate any color variations, usually with an associated impairment of central vision with photophobia and nystagmus.

Furthermore, a failure in the appreciation of blue and yellow may be termed tritanomalialia if partial, and tritanopia if complete, but, even if such cases do exist, they are extremely rare. The plates in this book are not designed for the diagnosis of such cases.

How to use the test

The plates are designed to be appreciated correctly in a room which is lit adequately by daylight. The introduction of direct sunlight or the use of electric light may produce some discrepancy in the results because of an alteration in the appearance of shades of color. When it is convenient only to use electric light, it should be adjusted as far as possible to resemble the effect of natural daylight. The plates are held 75 cm. from the subject and tilted so that the plane of the paper is at right angles to the line of vision. The numerals which are seen on plates are stated, and each answer should be given without more than three seconds delay.

It is not necessary in all cases to use the whole series of plates. Plates 12, 13 and 14 may be omitted if the test is designed merely to separate the color defectives from those with normal color appreciation.

Explanation of the plates

No. 1. Any subject, whether with normal or defective color vision will read correctly the figures "12". This plate is used mainly for preliminary explanation of the test process to the subjects.

No. 2. Normal subjects will read "8" and those with red-green deficiencies "3".

No. 3. Normal subjects will read "5" and those with red-green deficiencies "2".

No. 4. Normal subjects will read "29" and those with red-green deficiencies "70".

No. 5. Normal subjects will read "74" and those with red-green deficiencies "21".

No. 6-7. Correctly decipherable by normal subjects, but illegible or hard to read for those with red-green deficiencies.

No. 8. Clearly "2" for normal subjects but obscure for those with red-green deficiencies.

No. 9. Normal subjects can hardly read it, but most of those with red-green deficiencies see the figure "2" in it.

No. 10. Normal subjects can usually read the figures "16", but most of those with red-green deficiencies cannot.

No. 11. In tracing the winding line between the two x's, the normal trace the bluish-green line, but the majority of those with color vision deficiencies are unable to follow the line or follow a line different from the normal one.

No. 12. Normal subjects and those with mild red-green deficiencies see the figures "35" but protanopia and strong protanomaly will read "5" only and

deuteranopia and strong deuteranomalopia "3" only.

No. 13. Normal subjects and those with mild red-green deficiencies see the figures "96" but protanopia and strong protanomalopia will read "6" only, and deuteranopia and strong deuteranomalopia "9" only.

No. 14. In tracing the winding lines between the two x's, the normal race along the purple and red lines.

In protanopia and strong protanomalopia only the purple line is traced, and in case of mild protanomalopia both lines are traced but the purple line is easier to follow.

In deuteranopia and strong deuteranomalopia only the red line is traced and in case of mild deuteranomalopia both lines are traced but the red line is easier to follow.

Analysis of the results

As assessment of the readings of plates I to 11 determines the normality or defectiveness of color vision. If 10 or more plates are read normally, the color vision is regarded as normal. If only 7 or less than 7 plates are read normal, the color vision is regarded as deficient. However, in reference to plate 9, only those who read the numerals 2 and read it easier than those on plate 8 are recorded as abnormal.

It is rare to find a person whose recording of normal answers is 9 or 8 plates. An assessment of such a case requires the use of other color vision tests, including the anomaloscope.

Care of the plate

It is important that the book of test plates should be kept closed, except during use, because undue exposure to sunlight causes a fading of the color of the plates.

Answers to each plate

Number of Plate	Normal Person	Person with Red-Green Deficiencies				Person with Total Colour Blindness and Weakness
1	12	12				12
2	8	3				x
3	5	2				x
4	29	70				x
5	74	21				x
6	7	x				x
7	45	x				x
8	2	x				x
9	x	2				x
10	16	x				x
11	traceable	x				x
		Protan		Deutan		
		Strong	Mild	Strong	Mild	
12	35	5	(3) 5	3	3 (5)	
13	96	6	(9) 6	9	9 (6)	
14	can trace two lines	purple	purple (red)	red	red (purple)	x

The mark x shows that the plate cannot be read. The numerals and winding lines in parenthesis show that they can be read or traced but they are comparatively unclear.