

Ishihara Instructions

The Series of Plates
Designed as a
Test for Color Deficiency
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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 not 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 grayish indistinct color, and likewise, the grey part of the spectrum seen by the person with deutanopia appears to those with deutanomalopia as a 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 tritanomalopia 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 correct position of each plate is indicated by the number which is printed on the back of the plate. The numerals which are seen on plates 1-17 are stated, and each answer should be given without more than three seconds delay. If the subject is unable to read numerals, plates 18-24 are used and the winding lines between the two X's are traced with the brush. Each tracing should be completed within ten seconds.

It is not necessary in all cases to use the whole series of plates. Plates 16 and 17 may be omitted if the test is designed merely to separate the color defectives from those with normal color appreciation. In a large scale examination the test may be simplified to an examination of six plates only; No 1, one of the Nos 2, 3, one of Nos 4, 5, 6, 7, one of Nos 8, 9, one of Nos 10, 11, 12, 13 and one of Nos 14, 15. It may be necessary to vary the order of the plates if it is suspected that there is a deliberate deception on the part of the subject.

Explanation of the plates

- No. 1. Both the normal and those with all sort of color vision deficiencies read it as 12.
- No. 2, 3. The normal read them as 8 (No 2) and 29 (No. 3). Those with red-green deficiencies read them as 3 (No. 2), and 70 (No. 3). Those with total color blindness can not read any numeral.
- Nos. 4-7. The normal read them as 5 (No. 4), 3 (No. 5), 15 (No. 6) and 74 (No. 7). Those with red-green deficiencies read them as 2 (No. 4), 5 (No.5), 17 (No.6) and 21 (No.7). Those with total color blindness can not read any numeral.
- No. 8, 9. The normal read them as 6 (No.8) and 45 (No.9). The majority of those with color vision deficiencies can not read them or read them incorrectly.
- Nos. 10-13. The normal read them as 5 (No.10), 7 (No.11), 16 (No.12) and 73 (No.13). The majority of those with color vision deficiencies can not read them or read them incorrectly.
- Nos.14, 15. The majority of those with red-green deficiencies read them as 5 (No.14) and 45 (No.15). The majority of the normal and those with total color blindness cannot read any numeral.
- Nos. 16, 17. The normal read them as 26 (No.16) and 42 (No.17). In protanopia and strong protanomaly only 6 (No.No 16) and 2 (No.17) are read, and in case of mild protanomaly both numerals on each plate are read but the 6 (No.16) and 2 (No.17) are clearer than the other numerals. In deuteranopia and strong deuteranomaly only 2 (No.16) and 4 (No.17) are read, and in case of mild deuteranomaly both numerals on each plate are read but the 2 (No.16) and 4 (No.17) are clearer than the other numerals.
- No. 18. In tracing the winding lines between the two X's, the normal trace along the purple and red lines. In protanopia and strong protanomaly only the purple line is traced, and in the case of mild protanomaly both lines are traced but the purple line is easier to follow. In deutaneropia and strong deutanomaly only the red line is traced, and in case of mild deutanomaly both lines are traced but the red line is easier to follow.
- No. 19. In tracing the winding line between the two X's, the majority of those with red-green deficiencies trace along the line, but the majority of the normal and those with total color blindness are unable to follow the line.
- No. 20. 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. 21. In tracing the winding line between the two X's, the normal trace the orange 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. 22. In tracing the winding lines between the two X's, the normal trace the line connecting the bluish-green and yellowish-green, those with red-green deficiencies trace the line connecting the bluish-green and purple, and those with total color blindness can not trace any line.
- No. 23. In tracing the winding lines between the two X's, the normal trace the line connecting the purple and orange, those with red-green deficiencies trace the line connecting the purple and bluish-green, and those with total color blindness and weakness can not trace any line.
- No. 24. Both the normal and those with all sort of color vision deficiencies can trace the winding line between the two X's.
- The typical readings of the normal person and the person with color vision deficiencies on plates 1 to 25 are listed on the last page.

Analysis of the results

As assessment of the readings of plates 1 to 15 determines the normality or defectiveness of color vision. If 13 or more plates are read normally, the color vision is regarded as normal. If only 9 or less than 9 plates are read normally, the color vision is regarded as deficient. However, in reference to plates 14 and 15, only those who read the numerals 5 and 45 and read them easier than those on plates 10 and 9 are recorded as abnormal readings.

It is rare to find a person whose recording of normal answers is 14-16 plates. An assessment of such a case requires the use of other color vision tests, including the anomaloscope.

In the assessment of color appreciation by the short method involving 6 plates only as described on page 4, a normal recording of all plates is proof of normal color vision. If there is a discrepancy in any of the recordings, the full series of plates should be used before diagnosing a red-green deficiency.

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

Plate	Normal Person	Person with Red-Green Deficiencies		Person with Total Color Blindness and Weakness	
1	12	12		12	
2	8	3		X	
3	29	70		X	
4	5	2		X	
5	3	5		X	
6	15	17		X	
7	74	21		X	
8	6	X		X	
9	45	X		X	
10	5	X		X	
11	7	X		X	
12	16	X		X	
13	73	X		X	
14	X	5		X	
15	X	45		X	
		Protan		Deutan	
		Strong	Mild	Strong	Mild
16	26	6	(2) 6	2	2 (6)
17	42	2	(4) 2	4	4 (2)

The mark X shows that the plate cannot be read. Blank space denotes that the reading is indefinite. The numerals in parenthesis show that they can be read but they are comparatively unclear.