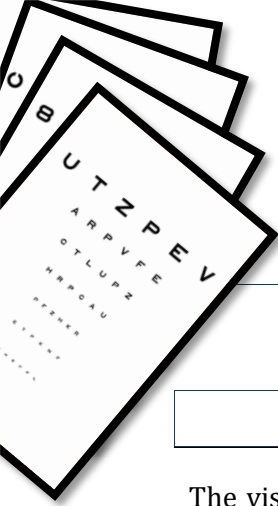


VISIOLITE®

Description and Interpretation of Vision Tests

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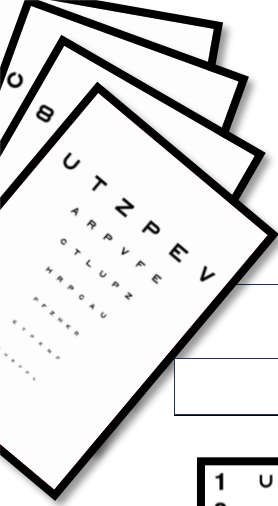
Purpose

The visual acuity test is the starting point for all eye testing. It ensures a patient has the most adapted correction and evaluates his ability to read everyday life information. During a test, we aim, in theory, to reach a visual acuity of 20/20 (10/10). It is thus possible for a patient to read everyday life information such as street names or magazine articles. The test is performed in different ways: monocularly, binocularly, from far, from intermediate, from near, with compensation, without compensation, in photopic light or even mesopic. These different acuities provide us with information on the visual capacity of a patient. Amongst these tests, the Visiolite® performs the following:

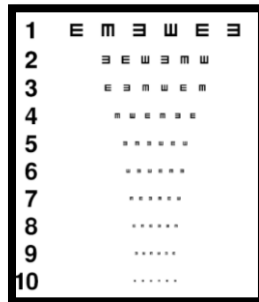
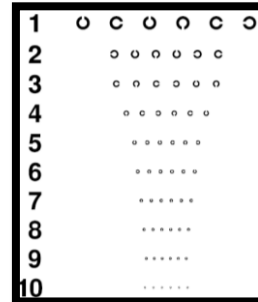
- ✓ Far visual acuity (at 20ft)
- ✓ Intermediate visual acuity (at 24in)
- ✓ Near visual acuity (at 16in)
- ✓ It is also possible to blur a patient's eye by one diopter to estimate his level of hyperopia
- ✓ Visual acuity in mesopic light to test a patient's dusk vision
- ✓ Low vision to evaluate patient aptitude for vehicle driving, by testing monocular visual acuity of 0.5/10 and 1/10

The different tests proposed evaluate two types of visual acuity: recognition acuity, also called morphoscopic acuity and resolution acuity. It can be useful to test the two so as to evaluate specific problems. Optotypes used:

- ✓ Letters
- ✓ Raskin E
- ✓ Landolt rings



Presentation

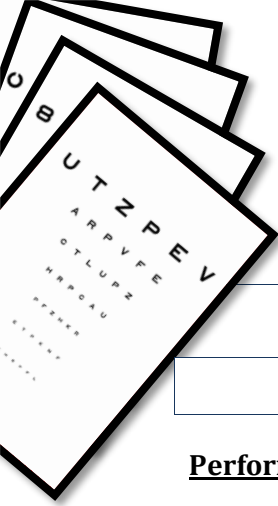


Construction & Description

These tests are composed of ten lines and six characters, covering the acuities: 20/200 (1/10) to 20/20 (10/10). The characters are viewed at a specific angle depending on the acuity tested. They are constructed according to the NF EN ISO 8596: 2009 standard. See table below for the size of an optotype (in mm) depending on its presentation distance. These calculations are based on the logMAR scale.

MAR	VA	VA (/10)	VA Snellen 20 ft	5 m	60 cm	33 cm	16 ft	2 ft	1 ft
19.95	0.05	0.5/10	20/400	145.10	17.41	9.58	5.71	0.69	0.377
10.00	0.10	1/10	20/200	72.72	8.73	4.80	2.86	0.34	0.189
5.01	0.20	2/10	20/100	36.45	4.37	2.41	1.44	0.17	0.095
3.16	0.32	3/10	20/63	23.00	2.76	1.52	0.91	0.109	0.06
2.51	0.40	4/10	20/50	18.27	2.19	1.21	0.72	0.086	0.048
2.00	0.50	5/10	20/40	14.51	1.74	0.96	0.57	0.069	0.038
1.58	0.63	6/10	20/33	11.53	1.38	0.76	0.45	0.054	0.030
1.42	0.7	7/10	20/29	10.34	1.24	0.68	0.41	0.049	0.027
1.26	0.79	8/10	20/25	9.16	1.10	0.60	0.36	0.043	0.024
1.11	0.9	9/10	20/22	8.07	0.97	0.53	0.32	0.038	0.021
1.00	1.00	10/10	20/20	7.27	0.87	0.48	0.29	0.034	0.019
0.79	1.26	12/10	20/16	5.78	0.69	0.38	0.23	0.027	0.015

The green and yellow-coloured boxes represent the real size (in mm and inches) of the optotypes used for each acuity, depending on presentation distance.



Utilisation

Performing the Test:

- ✓ Ideally start the visual acuity tests brute, with the weakest eye, so as to avoid memorization of optotypes. Then follow the acuities of the second eye, then binocular acuities.
- ✓ This test should firstly be performed in far vision, then near vision, and possibly in intermediate vision.
- ✓ Then perform the same procedure to measure the patient's compensated acuities.

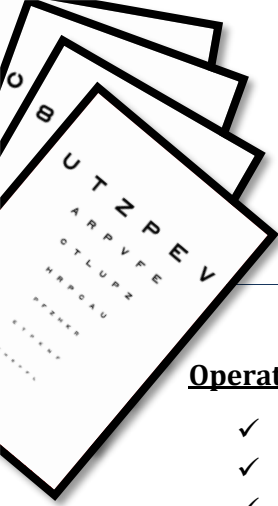
Interface Description:

- ✓ The upper left button modifies the light level of the test. By default it is set to **High Photopic** (160 cd/m²), but can be changed to **Low Photopic** (80 cd/m²).
- ✓ Beside is the **Parameters** button, represented by small spirals, is used to specify minimum monocular and binocular acuities to reach. If these options are activated, two areas are displayed on the graph. In white, the acuities lower than this value, and in gray, the acuities above. These can be used to determine the success or failure of a test, depending on the operator's own parameters.
- ✓ Below are three other buttons: **ABC**, **123** and **C**, used respectively to display the letters, the numbers and the rings.
- ✓ The **Correction** box should be ticked if a patient is tested with his correction.
- ✓ The diagram on the right lists the different measurements performed. A patient's brute and compensated acuities, in monocular and binocular, can be retrieved. These acuities are displayed in tenths, by default, but this can be changed in the **Options/Parameters** menu. The **Acuity** drop-down menu then proposes three different display modes: **Tenth, Snellen 20 ft, Snellen 6 m**.
- ✓ Three buttons on the right are used to test the different acuities. From highest to lowest: binocular acuity, monocular acuity right eye and monocular acuity left eye.

Patient Instructions:

- ✓ « You will see some letters. From the first line, read aloud the letters you can easily see. It doesn't matter if you make mistakes. Don't squint or turn your head. Keep both eyes open throughout the test. »
- ✓ If drawings are used, the patient must name the optotype presented.
- ✓ If rings or Raskin E are used, the patient must indicate in which direction the opening is, from the eight possible rings below:





Operating Mode:

- ✓ Click on one of the buttons on the right, depending on what you would like to test.
- ✓ **Low Photopic** and **Correction** options can be changed.
- ✓ Ask the patient to read you the different lines that he sees, starting from the top one.
- ✓ When the patient makes more than two mistakes on a line, ask him to stop reading. Tick the last line read without mistakes.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit** to return to the main interface.
- ✓ The patient's visual acuity will be drawn on the graph of the window. Brute acuities appear in **blue**, while compensated acuities appear in **green**.

Hyperopic Vision

If hyperopia is suspected (or residual hyperopia) in a patient, this test can be used to blur his vision by one diopter. Settings and procedure are identical to the preceding one. This is performed when a patient has an acuity above 20/20 (10/10), and is used to determine if this ametropia is above or below 1 δ .

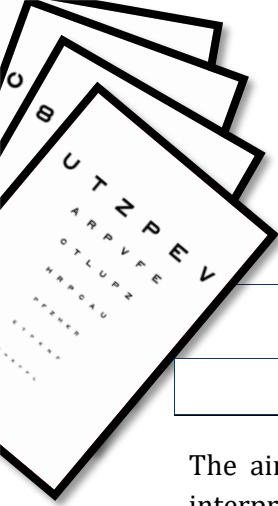
Mesopic Vision

This test is identical to the preceding one, with the exception of the reduced light level, to mesopic (3cd/m²). This corresponds to dusk vision. It is performed in the same way as the acuity test but only in binocular and far vision.

Low Vision

This test should be done when the patient has a binocular acuity of less than 5/10. It is done in monocular, to test the minimum aptitude required for vehicle driving. The procedure is identical to the previous test, but proposes visual acuities in low vision, respectively: 0.5/10 and 1/10. Maximum number of mistakes permitted:

- ✓ 1 for the 0.5/10 acuity line.
- ✓ 2 for the 1/10 acuity line.



Interpretation of Results

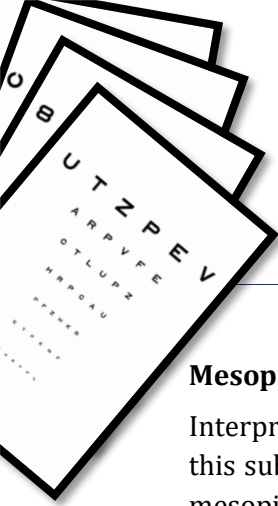
The aim of this first test is to indicate the presence of an ametropia in the patient. These interpretations at the beginning of the test will guide the operator to the most likely pathway, but the results are not truly reliable until taken into account with the results of the other tests. They are valid for the study of brute acuity as well as compensated acuity.

		<i>Near Vision</i>	
		$\geq 20/20$ (10/10)	$< 20/20$ (10/10)
Far Vision	$\geq 20/20$ (10/10)	The patient may be: ✓ Emmetropic ✓ Hyperopic ✓ And/or slightly astigmatic	The patient may be: ✓ Hyperopic ✓ And/or slightly astigmatic
	$< 20/20$ (10/10)	The patient may be: ✓ Myopic ✓ And/or slightly astigmatic	The patient may be: ✓ Highly myopic ✓ Hyperopic ✓ Amblyopic ✓ And/or slightly astigmatic

For patients with $\geq 20/20$ (10/10) vision in near vision **AND** far vision, in order to differentiate between emmetropia and hyperopia ($>1\delta$), the convex lens test should be performed.

Far Vision with Convex Lens (+1δ)	
$< 20/20$ (10/10)	$\geq 20/20$ (10/10)
The patient is probably emmetropic or hyperopic 1δ maximum	The patient is probably more than 1δ hyperopic

Intermediate Vision	
$< 20/20$ (10/10)	$\geq 20/20$ (10/10)
The patient may be: ✓ Myopic ✓ Hyperopic	The patient may be: ✓ Emmetropic ✓ Hyperopic



Mesopic Vision

Interpretation of this test is difficult as there are currently very few standards or publications on this subject. However, Robert Alexander WEALE made a link between ageing and a decrease in mesopic acuity. The following table lists the «average» mesopic acuities of the population according to age. All acuities in the red area may indicate night vision troubles.

Patient Age	20/100 (2/10)	20/63 (3/10)	20/50 (4/10)	20/40 (5/10)	20/32 (6/10)	20/29 (7/10)	20/25 (8/10)	20/22 (9/10)	20/20 (10/10)	20/16 (12/10)
25 years										
45 years										
60 years										



Normal acuity for a patient of this age



Acuity is lower than the average, suggesting a night vision problem

Low Vision

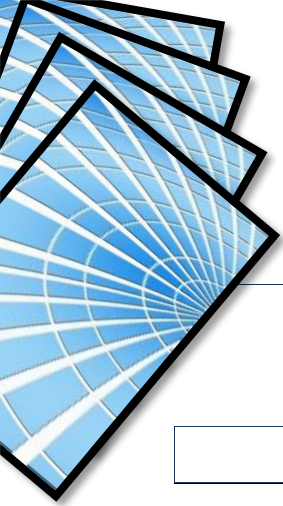
This test determines the capacity of a patient to drive a light vehicle. Legend:

- ✓ RE: Right Eye
- ✓ LE: Left Eye
- ✓ RLE: Binocular

RE	LE	RLE	Results
$\geq 20/40$ (5/10)			Fit to drive
$< 20/200$ (1/10)	$\geq 20/40$ (5/10)		Fit to drive
$\geq 20/40$ (5/10)	$< 20/200$ (1/10)		Fit to drive
$< 20/200$ (1/10)	$< 20/40$ (5/10)		Not fit to drive
$< 20/40$ (5/10)	$< 20/200$ (1/10)		Not fit to drive

Bibliography (non-exhaustive)

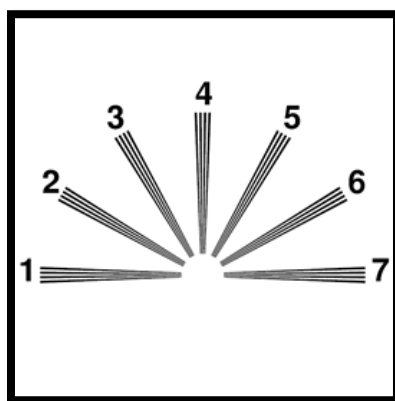
- Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.
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- Weale R. A., *The Senescence of Human Vision*, Oxford Medical Publication, 1992, p.272.
- Zalonghi, X., Quinton-Fantoni, S., *Aptitudes visuelles*, BSOF, 2013, p. 496.
- Zalonghi, X., *La vision de la personne âgée*, <http://www.ophtalmo.net/ariba>, 2001.



Purpose

This test is used to screen astigmatism defects in a patient. Astigmatism causes a deformed view in one particular direction. If the astigmatism is excessive, the patient will have poor acuity for all distances. This type of defect can be compensated by astigmatic lenses.

Presentation



Construction & Description

This test is composed of seven meridians each spaced 30° apart. Each axis is represented by three lines to increase the test sensitivity. The numbers are presented at an acuity of 20/100 (2/10).

Utilisation

Performing the Test:

- ✓ This test is performed monocularly.
- ✓ This test is best performed in far vision, so as to limit patient accommodation as much as possible.
- ✓ The patient may or may not wear their correction, depending on what the operator wants to test.
- ✓ This test is usually done in high photopic.

Interface Description:

- ✓ The upper left button modifies the test display distance. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ Use the side button to modify the lighting level of the test. Default setting is **High Photopic** (160 cd/m²) but it can be switched to **Low Photopic** (80 cd/m²).

Patient Instructions:

- ✓ «You will see a fan shape with numbered branches. Tell me if you see some of the branches more clearly than others. If not, tell me if you see the fan shape as generally clear or fuzzy.»

Operating Mode:

- ✓ Click on the **Right Astigmatism** or **Left Astigmatism** button.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient if he sees some of the branches more clearly than others.
 - If so, he is astigmatic. Ask him which branches seem the fuzziest and tick them.
 - If the branches spaced 90° apart were ticked, this tells the operator that the patient responses were illogical. The test should be repeated, giving the patient instructions once again.
- ✓ If this is not the case, ask the patient if the fan shape seems generally clear or fuzzy.
 - If so, click on **Identical**.
- ✓ If, for whatever reason, the test could not be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit**.

Interpretation of Results

This test can reveal astigmatism, but not specify its axis or degree. In fact, since patient eye accommodation is not controlled, it is risky to make these kinds of interpretations, and best left to an ophthalmologist or an optometrist.

Patient Reponses	Interpretations
The patient sees one or two branches side by side clearer than the others.	Astigmatism presence.
The patient sees the clearer branches forming a right angle.	Impossible. Restart the test, repeating patient instructions.
Branches are identically clear.	No astigmatism.
Branches are identically fuzzy.	Patient is myopic, no astigmatism.
	If the patient is very myopic, he may not see one branch more clearly than the others. Inconclusive.
	If the patient is hyperopic, his eye can accommodate. Inconclusive.

Bibliography (non exhaustive)

Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.



Purpose

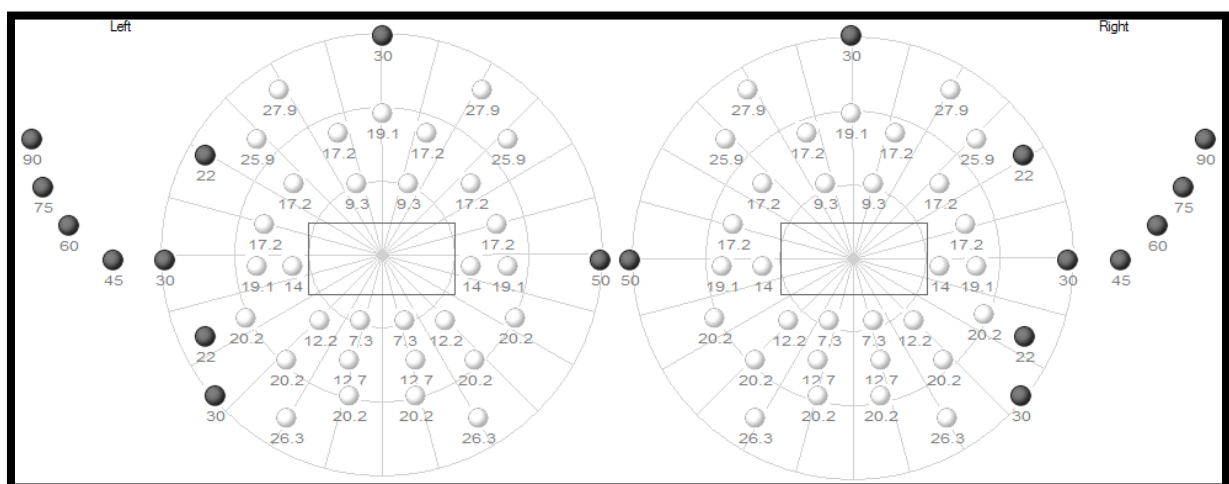
Visual field reveals different visual problems. It is essential for diagnosing visual problems caused by scotoma, optic nerve impairment, or directly from the cerebral cortex. The table below shows the range of visual field tested by the Visiolite®. These values are not symmetrical, notably due to the shape of the nose. For binocular, the horizontal fields will be added, giving a common area to both eyes of 120° surrounded by two 30° monocular crescents, called half-moon fields. Thus, the total horizontal binocular field measured is 180°.

The visual field test is divided into two parts: analysis of central field and analysis of peripheral field. The first tests the central 30° of vision, whilst the second tests the rest of the visual field. Peripheral field is evaluated according to a procedure similar to the Goldmann test, while central field is checked using an Esterman grid.

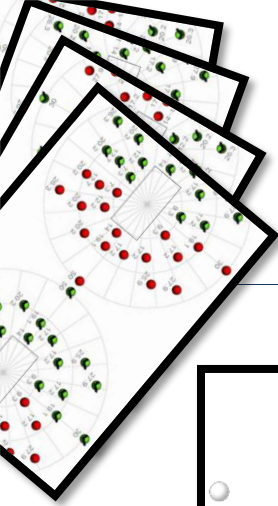
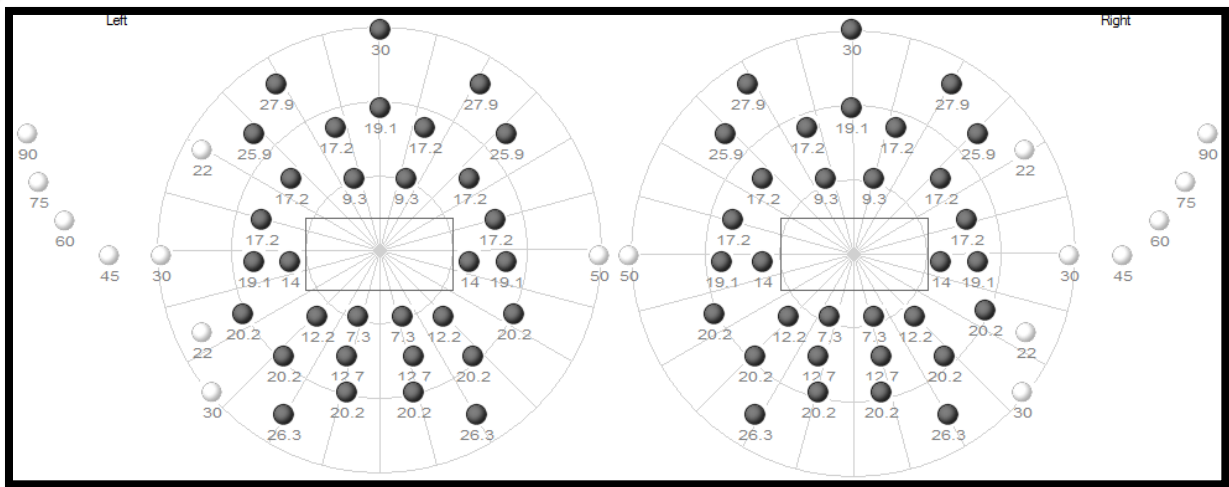
Monocular	Ranges	Binocular	Ranges
Nasal	50°	Horizontal	180°
Temporal	90°	Vertical	60°
Upper	30°		
Lower	30°		

Range of visual field tested by the Visiolite®

Presentation



Peripheral field is tested by 20 light stimuli (represented above by dark points)



Central field is tested by 64 light stimuli (represented above by dark points)

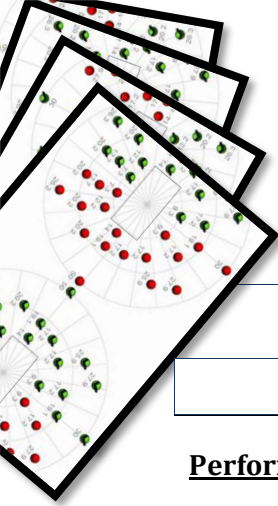
Construction & Description

Peripheral field is tested by the means of 10 diodes per eye, distributed in the following manner:

- ✓ Nasal: 50°
- ✓ Temporal: 30°, 45°, 60°, 75°, 90°
- ✓ High: 22°, 30°
- ✓ Low: 22°, 30°

Central field tests the central 30° of vision with 32 diodes per eye, distributed as per an Esterman grid, which gives more importance to low vision and the horizontal line.

Here, perimetry is performed in static mode, which means the stimulus is activated for a short time during which the patient must succeed in seeing it. The light stimulus is activated for about 200 ms.



Utilisation

Performing the Test:

- ✓ This test is performed in monocular.
- ✓ The patient wears his correction.

Interface Description:

- ✓ Start the test with the **Peripheral Field** button on the right.
- ✓ A graph of the different points tested is represented. The **green** circles indicate a point seen, while a **red** triangle indicates a point not seen.
- ✓ The visual field horizontal and vertical ranges of the patient are displayed below, as well as a summary of the points seen and not seen in three different areas of the eye: 10°, 20° and 30°.

Patient Instructions:

- ✓ «A very quick light stimulus will appear around the point on which you are focused. Tell me if you see the point or not. Answer just yes or no.»

Operating Mode:

The Visiolite® has two test modes: manual and automatic. Manual mode tests only the points the operator judges useful. Automatic mode runs a sequence of central field, peripheral field tests, or both. The test is performed as follows:

- ✓ Start by clicking on the **Peripheral Field** button.
- ✓ To perform a **Manual** procedure:
 - It is important to tell the patient to continue blinking normally.
 - Ask the patient to focus on the central point of the grid which is displayed before him. Both eyes must focus on the point (even though each eye is tested separately). The patient's eyes must remain focused or the test results will be false.
 - Click on the point you wish to test. The diode lights up immediately. Ask the patient if he sees the luminous flash.
 - If yes, press on the **Perceived** button or click left on the point tested.
 - If the flash was not seen, click on the **Not Perceived** button or right click on the point tested.
 - If there is a problem, a point can be retested by clicking on **Restart a Point** and by clicking on a point already tested.



- ✓ To run an **Automatic** sequence:
 - Choose what sequence you want from: **Complete Visual Field, Central Visual Field, or External Visual Field.**
 - The peripheral field will test the right and left eye separately.
 - The central field and the complete field will test firstly the right eye, then the left eye.
 - Give the same explanations to the patient as above for blinking, focusing on the point, as well as the instructions.
 - For each point tested, repeat the same as above, asking if the patient sees the flash and clicking on the **Perceived** or **Not Perceived** buttons.
- ✓ The test can be repeated at any moment by clicking on **Re-start the Test**.
- ✓ If, for whatever reason, the test could not be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ When you have finished, click on **Exit**.

Interpretation of Results

If the patient has one of these symptoms, he must be urgently referred to an ophthalmologist. Neglecting the results of these tests can have serious consequences for the patient.

Symptoms	Interpretations
Unilateral blindness Hemianopia Quadrantanopia	The patient may be suffering from an optic nerve impairment.
Peripheral vision reduction	The patient may have a retinal problem, e.g. glaucoma or retinitis pigmentosa.
Visual «hole»	Scotoma can be suspected. If the area is only blurred, we would tend towards a relative scotoma. If the area disappears completely, we would favor an absolute scotoma.
Central vision «hole»	The patient may suffer from ARMD.

Bibliography (non exhaustive)

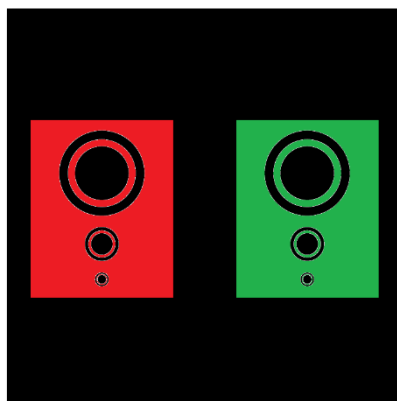
Risse, J.-F., *Exploration de la fonction visuelle : application au domaine sensoriel de l'œil normal et en pathologie*, Ed. Masson, 1999, p. 765.

Zalonghi, X., Quinton-Fantoni, S., *Aptitudes visuelles*, BSOF, 2013, p. 496.

Purpose

Also called the bichrome or red-green test, this test is used to confirm hyperopia. It is based on the chromatic aberration of the eye. As an optical system, the eye breaks down light like a prism. The green wavelengths are thus more deflected than the red. The patient's ability to see on a red or green background can detect ametropia. If the patient is hyperopic, the green wavelengths will be closer to the retina, but if the patient is myopic, the red wavelengths will be closer to the retina. This test can have false results due to the patient's eye accommodation, so it is mainly used to screen for hyperopia.

Presentation



Construction & Description

This test is based on maximum eye transmission within red and green wavelengths. Red wavelengths are 620 nm and green, 535 nm. These are thus the wavelengths used for the colours of this test. As such, the diopter interval between these two values is 0.5 δ. The circular diagrams of the tests are used to compare a patient's vision on red and green backgrounds.

Utilisation

Performing the Test:

- ✓ This test is done monocularly, then binocularly.
- ✓ This test can be performed with or without optical correction, depending on what the operator is looking for: ametropia, or simply an optical correction check.
- ✓ This test is done in photopic.
- ✓ This test is recommended in far vision, so as to limit patient eye accommodation as much as possible.

Interface Description:

- ✓ The button on the upper left modifies the display distance of the test. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ The button on the side modifies the test lighting. By default it is set to **High Photopic** (160 cd/m²) but can be switched to **Low Photopic** (80 cd/m²).
- ✓ The three buttons on the right are used to test the different acuities. From top to bottom: binocular acuity, monocular acuity right eye and monocular acuity left eye. Click on one of these buttons to start the test.

Patient Instructions:

- ✓ «You will see two sets of three circles, one on a red background, the other on a green background. Tell me if you see the circles more clearly or blacker on one of the two backgrounds, or if they look identical. »

Operating Mode:

- ✓ Depending on what you want to test, click on one of the right-side buttons.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient to look at the circles on the red and green backgrounds, and ask him if they are clearer or blacker on one of the two backgrounds, or if they are identical.
 - If the patient sees the circles better on the red background, tick **Red**.
 - If the patient sees the circles better on the green background, tick **Green**.
 - If the patient sees them the same, tick **Identical**.
 - If, for any reason, the test cannot be performed, tick **Failed**, to specify that the test was not forgotten.
 - Then click **Exit** to return to the main interface.

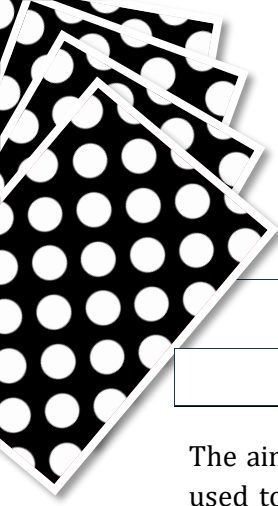
Interpretation of Results

If the results of the monocular and binocular tests do not suggest the same thing, it is recommended to pay more attention to the binocular test. This test can be false in patients with yellowing of the eye lens; the green radiations are absorbed more, so the circles on the red background appear more clearly.

Patient Responses	Interpretations
Clearer on green background	Strongly suggests hyperopia.
Identical	The patient may be emmetropic, or hyperopic and accommodating.
Clearer on red background	The patient may be either myopic, emmetropic or hyperopic. This case is thus inconclusive.

Bibliography (non exhaustive)

Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.



Purpose

The aim of this test is to check a patient's binocular vision. It is known as the Worth test. It is used to establish whether a patient's brain is able to merge the images of the right eye with those of the left eye. Fusion requires good visual acuity in each eye. Fusion problems can be more or less advanced, from fixation disparity to total suppression of one of the two images. They are also often the cause of heavy eye strain during screen work.

Presentation

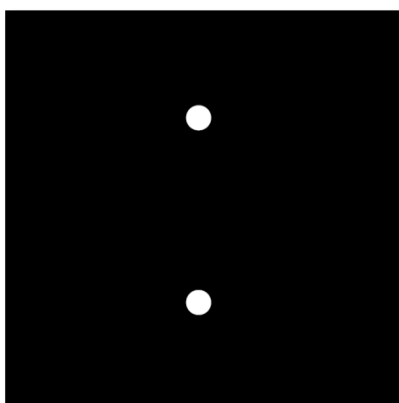


Image seen by left eye

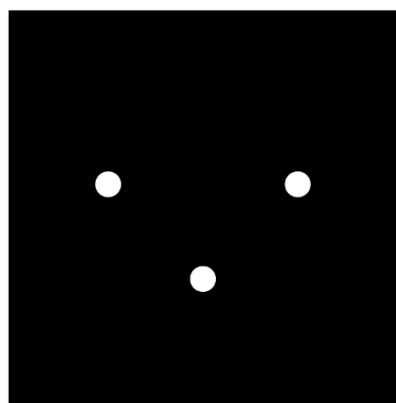


Image seen by right eye

Construction & Description

This test is composed of two different images. The one for the left eye contains two dots, and the one for the right eye contains three dots. Fusion is done with the lower dot, which is common to both images.

Utilisation

Performing the Test:

- ✓ This test is done binocularly.
- ✓ This test should be done with the patient's eye correction.
- ✓ This test can be performed in both far and near vision.
- ✓ This test should be performed in photopic.

Interface Description:

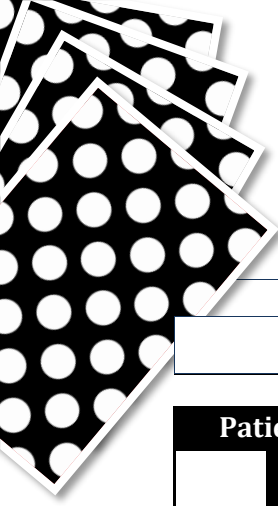
- ✓ The upper left button modifies the display distance of the test. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ The button on the side modifies the test lighting. By default it is set to **High Photopic** (160 cd/m²) but can be switched to **Low Photopic** (80 cd/m²).

Patient Instructions:

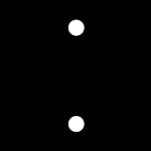
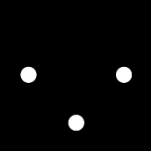
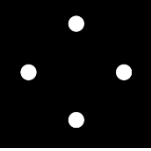
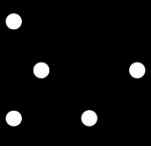
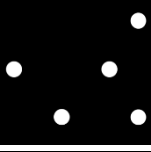
- ✓ «You will see some white dots. Tell me how many you can see. »

Operating Mode:

- ✓ Click on the **Fusion** button.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient to count the number of white dots he sees and tick the corresponding response.
 - If the patient sees 5 dots, ask him if he sees more dots on the left or on the right.
- ✓ If, for any reason, the test cannot be performed, tick **Failed**, to specify that the test was not forgotten.
- ✓ Then click **Exit** to return to the main interface.

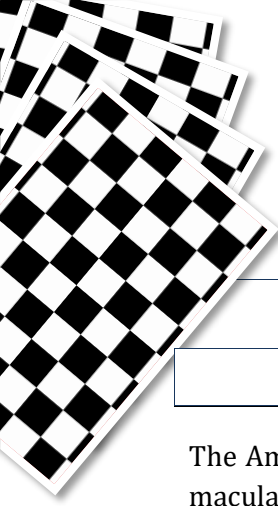


Interpretation of Results

Patient Responses		Interpretations
		The patient neutralises the right-eye image.
		The patient neutralises the left-eye image.
		The patient is able to merge the images.
		The patient is unable to merge the images, and suffers from uncrossed diplopia (due to esotropia or decompensated esophoria).
		The patient is unable to merge the images, and suffers from crossed diplopia (due to exotropia or decompensated exophoria).

Bibliography (non exhaustive)

Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.

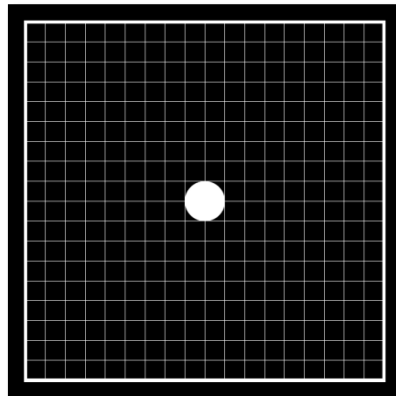


Purpose

The Amsler grid test reveals visual troubles linked to retinal problems, and more precisely, the macula. The aim of this test is to check the central 20° of the retina. It is used, notably, to reveal Age-Related Macular Degeneration (ARMD), a disease occurring mainly in persons over the age of 50. This test is essential as it screens the following pathologies:

- ✓ Glaucoma
- ✓ Scotoma
- ✓ Optic nerve problem
- ✓ ARMD
- ✓ Metamorphopsia
- ✓ Loss of peripheral or central field

Presentation



Construction & Description

This test was developed by the Swiss ophthalmologist, Marc Amsler. It is composed of a square grid seen at an angle of 20°. Each line, as well as each column is made up of 20 squares, with a fixation point in the center of the grid, on which the patient focuses. We opted for a white grid on a black background, but there are different versions.

Utilisation

Performing the Test:

- ✓ This test is done monocularly.
- ✓ This test can be performed in near vision or, possibly, intermediate vision.
- ✓ This test should be performed with patient eye correction.
- ✓ This test should be performed in photopic.

Interface Description:

- ✓ The upper left button modifies the display distance of the test. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ The button on the side modifies the test lighting. By default it is set to **High Photopic** (160 cd/m²) but can be switched to **Low Photopic** (80 cd/m²).
- ✓ Two buttons on the right are for testing the right eye or the left eye.

Patient Instructions:

- ✓ «You will see a grid. Focus on the central point and tell me if you see one, or several deformations or holes in the grid. »

Operating Mode:

- ✓ Click on the button of the eye you wish to test.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Once the test is displayed, ensure the patient can see the central point.
 - If the patient can see the central point, he should focus on it, then answer the following questions:
 - Can you see the 4 corners of the grid?
 - Are some of the squares fuzzy or absent?
 - Are some of the squares larger, or smaller?
 - Are some of the lines twisted or deformed?
 - Are some parts of the grid sparkling?
 - If the patient cannot see the central point, he suffers from a central scotoma (see interpretations). He should, thus, try to focus on approximately the center of the grid. Then ask the same questions as above.
- ✓ If the patient sees the grid normally, tick the **Normal Grid** box.
- ✓ If a problem with a patient's vision is detected, when asking the above questions, tick the **Distorted Grid** box.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click **Exit**.
- ✓ The patient's other eye is then tested in the same way.

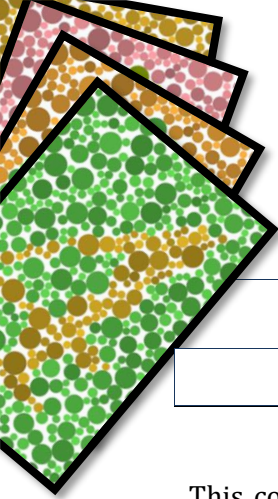
Interpretation of Results

If symptoms are detected, the patient is referred to an ophthalmologist as quickly as possible.

Patient Responses	Interpretations
Central point not even seen	The patient may have central scotoma. This may suggest ARMD.
Some corners not seen	Suspect glaucoma, which reduces the patient's peripheral field vision.
Some squares fuzzy or absent	Scotoma can be the cause of this symptom.
Some squares seen larger or smaller	Suspect several pathologies. The patient should be sent to an ophthalmologist.
Some lines twisted or deformed	This may be due to metamorphosia. This is generally a precursor to ARMD.
Some parts of the grid sparkle	The patient may be subject to luminous scotoma. This is generally due to neuropathic problems.

Bibliography (non exhaustive)

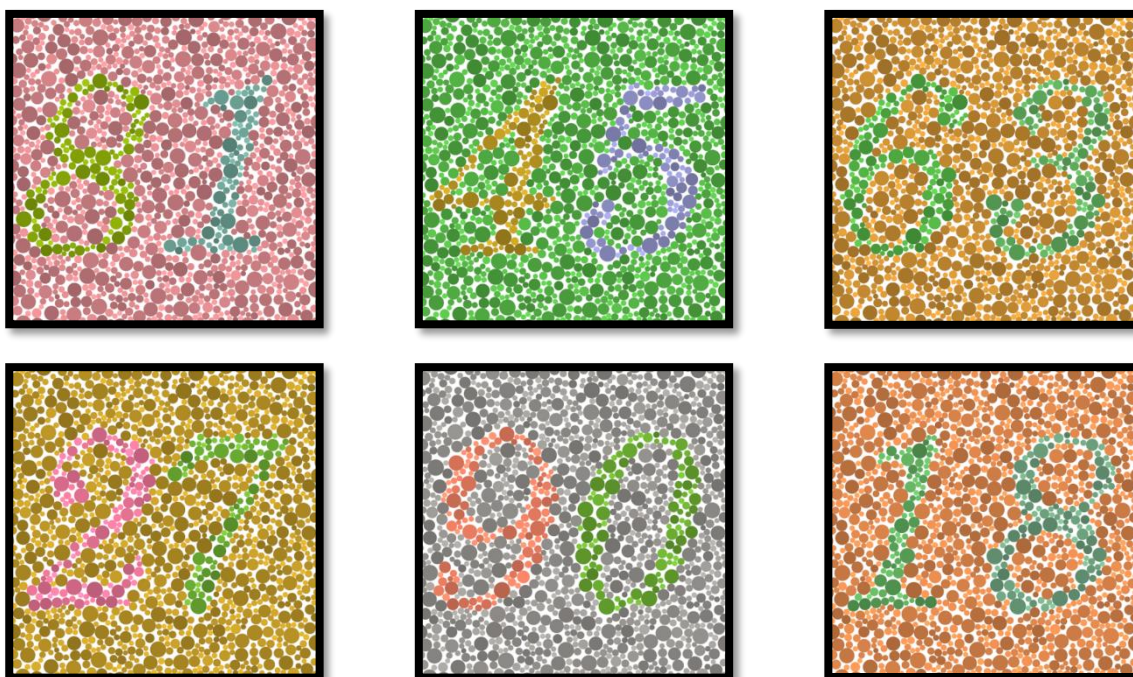
Amsler, M., *Earliest symptoms of diseases of the macula*, Br. J. Ophthalmol., 1953, vol.37,pp.521-537.



Purpose

This colour perception test, composed of pseudoisochromatic plates, screens abnormalities of colour vision, mainly Protan, Deutan and Tritan colour blindness. Colour perception in a patient is determined by reading the numbers on the plates and can reveal problems in recognising certain numbers and thus, certain colours.

Presentation



Construction & Description

The colour perception test is based on visualizing pseudoisochromatic plates (PIP). The test is composed of 6 plates of numbers using the principle of colour confusion based on the CIE-xy diagram (International Commission on Illumination). Background and motif colours are strategically chosen so that the motif is visible for a person with normal vision, but not for a colour blind person.

This collection of tests presents 12 lines of colour confusion in three axes: protan, deutan and tritan.

Each test is composed of a mosaic of multicoloured dots of different shapes and sizes. Each plate presents 3 different colours (one for the background, one for the first letter and another for the second letter). Each colour itself is composed of several shades.

Utilisation

Performing the Test:

- ✓ This test is done binocularly, but can also be performed monocularly.
- ✓ This test is recommended in near vision.
- ✓ This test should be performed with the patient's correction.
- ✓ This test should be performed in photopic.

Interface Description:

- ✓ The button on the upper left modifies the display distance of the test. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ Use the side button to modify the lighting level of the test. Default setting is **High Photopic** (160 cd/m²) but it can be switched to **Low Photopic** (80 cd/m²).
- ✓ Three buttons on the right are used to test binocularly, to test the right eye or the left eye.

Patient Instructions:

- ✓ « You will see coloured plates. Read aloud the two numbers that appear on each plate. »

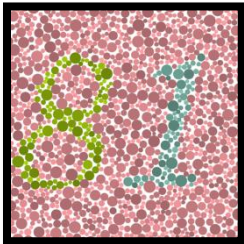
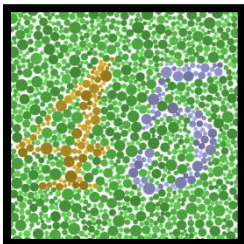
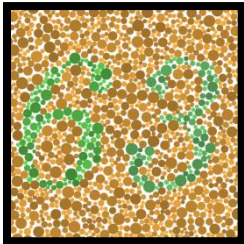
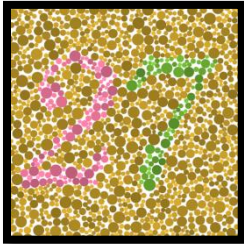
Operating Mode:

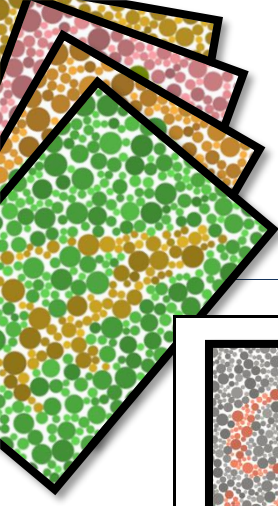
- ✓ Click on one of the buttons on the right to start the test.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient to read the numbers, starting from plate no. 1.
 - If the patient is able to read the two letters, tick the upper box.
 - If the patient is able to read only one letter, tick the lower box, matching this letter.
 - If the patient is unable to read any letter, do not tick any box.
 - If the patient is able to read all the plates, tick the **All** box.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit**.

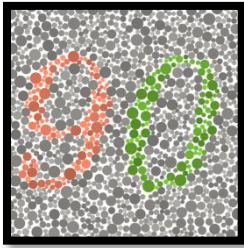
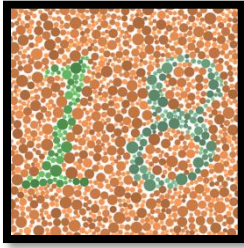
Interpretation of Results

Results should be interpreted with care, especially in persons over 40 years of age, in whom colour vision may naturally be altered.

The PIP plates are intended for screening purposes and do not indicate the type and degree of colour blindness with certainty. Moreover, interpretation is dependent on correct patient responses. It is up to the operator to determine if the patient's responses can be considered reliable.

Plate	Response	Interpretation
	81	Normal colour vision
	8	Deutan colour deficiency
	1	Tritan colour deficiency
	45	Normal colour vision
	4	Tritan colour deficiency
	5	Protan colour deficiency
	63	Normal colour vision
	6	Protan colour deficiency
	3	Deutan colour deficiency
	No number	Most colour blind people see nothing
	27	Normal colour vision
	2	Deutan colour deficiency
	7	Tritan colour deficiency



	90	Normal colour vision
	9	Tritan colour deficiency
	0	Protan colour deficiency
	18	Normal colour vision
	1	Protan colour deficiency
	8	Deutan colour deficiency

Bibliography (non exhaustive)

Birch J., *Diagnosis of Defective Colour Vision*, Ed. Oxford University Press. Oxford, 1993.

Roth A., *La vision des couleurs normale et pathologique : Les dyschromatopsies héréditaires et acquises, terminologie et classification*, Bulletin des sociétés d'ophtalmologie de France, 2001, pp.51-77.

Purpose

The phorias test reveals a tendency for ocular deviation from the binocular fixation position, in the absence of fusional stimuli. This test is used for screening heterophorias or dissociated phorias, which are measured in prism diopters (Δ). Several types:

- ✓ Esophoria: deviation of the visual axis toward that of the other eye.
- ✓ Exophoria: deviation of the visual axis of one eye away from that of the other eye.
- ✓ R/L or L/R Hyperphoria: upward deviation of the visual axis of one eye.
- ✓ Incyclophoria or Excyclophoria: an eye rotates inwards or outwards.

It can, however, be normal that a patient is not orthophoric. In fact, most of the population falls into the following categories, which cause no visual problems:

- ✓ Most people fall between 0 Δ and 2 Δ exphoria in far vision.
- ✓ Most people fall between 0 Δ and 6 Δ exophoria in near vision.

A poorly-compensated phoria can ultimately lead to important eye strain, diplopia, and even neutralisation of the image by one eye. This test allows for complete dissociation of the two eyes by proposing no fusion difficulty between the two.

Presentation

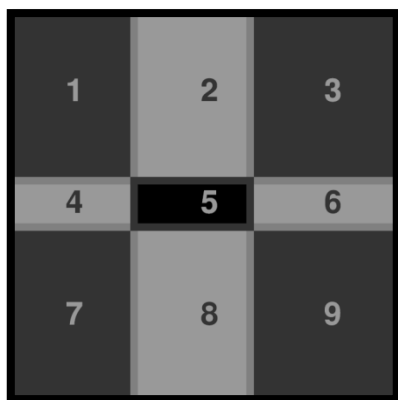


Image seen by left eye

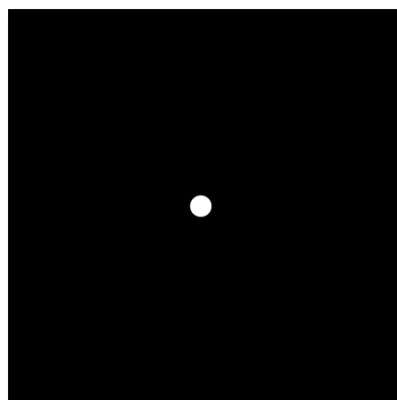


Image seen by right eye

Construction & Description

This test, which evaluates a patient's heterophoria, is composed of two images. The first is a grid containing nine boxes, while the second is composed of just one dot. Phoria values:

- ✓ Horizontal:
 - Phorias above 9 Δ.
 - Phorias between 3 Δ and 9 Δ.
 - Phorias below 3 Δ.
- ✓ Vertical:
 - Phorias above 9 Δ.
 - Phorias between 1 Δ and 9 Δ.
 - Phorias below 1 Δ.

Utilisation

Performing the Test:

- ✓ This test is done binocularly.
- ✓ This test is recommended in far vision, then in near vision.
- ✓ This test should be performed with patient correction.
- ✓ This test can be performed in photopic and possibly in mesopic.
- ✓ This test should be performed when monocular acuities are around the same. If the difference is too great, this test will have no diagnostic value.

Interface Description:

- ✓ The upper left button modifies the test display distance. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ Use the side button to modify the lighting level of the test. Default setting is **High Photopic** (160 cd/m²) but it can be switched to **Low Photopic** (80 cd/m²) or even **Mesopic** (3 cd/m²).
- ✓ Use the **Parameters** button, represented by small spirals, to perform the test in **Static**, **Dynamic** and **Flashing**.
 - The first evaluates the position of the point in the grid.
 - The second evaluates also the movement of this phoria.
 - The third flashes the point to better dissociate the images.

Patient Instructions:

- ✓ «You will see a white dot moving on a grid containing nine boxes. Tell me in which box you see the dot.»

Operating Mode:

- ✓ Click on the **Phorias** button.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient in which box he sees the white dot and tick the corresponding box.
 - If the test is performed in **Dynamic**, ask the patient in which direction the dot is moving. Specify that the dot will appear a few seconds after the grid. Then use the arrows on your right. Click on the arrow of the appropriate direction without letting go of the mouse, and place it in the box in which the patient states the dot lands.
 - If, for example, the patient sees the white dot moving from box 4 to box 5, select the arrow pointing to the right, and place it in box 5.
 - If the test is performed with a blinking stimulus, don't forget to warn the patient.
- ✓ If it is found outside the grid, tick **Outside Grid**.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit**.

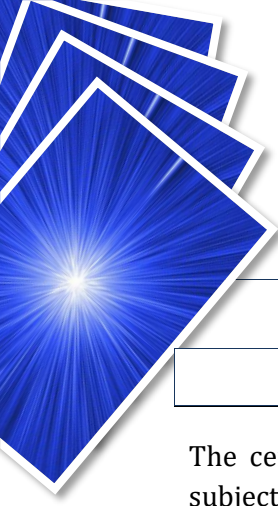
Interpretation of Results

It is important to take into account that fact that the normal values given below are valid for 68% of the population only. It is usual to find people «outside the norm» with no binocular vision problems and people «within the norm» who are very troubled by their phoria, with a great deal of trouble compensating. Thus, it is very important to rely firstly on the problems evoked by the patient.

Patient Responses	Interpretations
Grid not seen	The patient neutralises the left eye.
Dot not seen	The patient neutralises the right eye.
Dot appears in box 1	The patient suffers from an exophoria between 3 Δ and 9 Δ and a L/R hyperphoria between 1 Δ and 9 Δ.
Dot appears in box 2	The patient suffers from a L/R hyperphoria between 1 Δ and 9 Δ.
Dot appears in box 3	The patient suffers from an exophoria between 3 Δ and 9 Δ and a L/R hyperphoria between 1 Δ and 9 Δ.
Dot appears in box 4	The patient suffers from an exophoria between 3 Δ and 9 Δ.
Dot appears in box 5	The patient suffers from an esophoria or an exophoria lower than 3 Δ.
	The patient may suffer from a L/R or R/L hyperphoria lower than 1 Δ.
	The patient presents no phoria, but rather orthophoria.
Dot appears in box 6	The patient suffers from an esophoria between 3 Δ and 9 Δ.
Dot appears in box 7	The patient suffers from an exophoria between 3 Δ and 9 Δ and a R/L hyperphoria between 1 Δ and 9 Δ.
Dot appears in box 8	The patient suffers from a R/L hyperphoria between 1 Δ and 9 Δ.
Dot appears in box 9	The patient suffers from an esophoria between 3 Δ and 9 Δ and a R/L hyperphoria between 1 Δ and 9 Δ.
Dot appears outside the grid	Heterophoria is above 9 Δ.

Bibliography (non exhaustive)

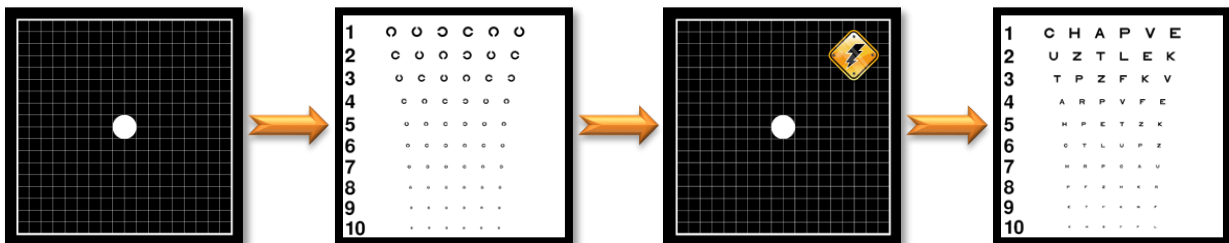
Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.



Purpose

The central glare resistance test measures recovery time of a patient's central vision when subjected to an intense source of light. Certain pathologies lengthen this time, so this test can reveal certain macular deficiencies in a patient. All the contra-indications for this test should be checked so as not to cause undesirable reactions in a patient. It is also important to inform the patient that the light source is intense.

Presentation



Construction & Description

This test uses other Visiolite® tests, and is composed of four steps:

- ✓ The Amsler grid is presented to the patient in mesopic lighting (3 cd/m²).
- ✓ An acuity test with rings is then presented in mesopic lighting.
- ✓ The patient is then blinded by a 3 lux light.
- ✓ An acuity test with letters is then presented in mesopic lighting.

Utilisation

Performing the Test:

- ✓ This test is done binocularly.
- ✓ This test is performed in far vision.
- ✓ This test is performed with the patient's correction.
- ✓ This test is performed in mesopic.

Interface Description:

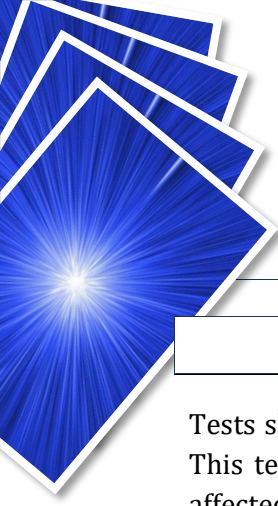
- ✓ A summary of test results is found on the interface:
 - **Acuity before:** Patient's acuity before blinding.
 - **Acuity after:** Patient's acuity after blinding.
 - **Recovery time:** recovery time of the patient's vision.

Patient Instructions:

- ✓ *«You will see a grid. Focus on this grid. After 10 seconds, you will see lines of numbers. They will appear dark, which is normal. Read the lines that you can see, starting from the top one. You will see the grid once again, but with an intense light in the middle. Focus on this light, which is blinding. After 10 seconds, you will see lines of letters. They will appear dark, which is normal. Read the smallest line that you can, starting from the top. Allow a little time to completely recover clear vision.»*

Operating Mode:

- ✓ Click on the **Central Glare** button.
- ✓ A message displays, warning against certain contra-indications (notably for photosensitive medications or certain ocular or psychic pathologies). Then click **OK** to run the test. Click **Cancel** if in doubt.
- ✓ A grid is displayed before the patient for 10 seconds. Remind him to focus on the central dot.
- ✓ Lines of numbers are then automatically presented to the patient, in mesopic lighting. Ask him to read the lines he can, starting from the top one. If the patient hesitates too long or the line contains more than 3 mistakes, tick the last correctly read line.
- ✓ Then click **Validate** to continue the test.
- ✓ The grid is presented to the patient once again, but with an intense central light source. It is presented for 10 seconds during which the patient should focus on the central dot.
- ✓ Lines of letters are then automatically presented to the patient in mesopic lighting. The patient must read the smallest line that he perceived in the previous test. If he is unable to read after about 30 seconds, ask him to try and read the larger line.
- ✓ The time the patient takes to recover his acuity is counted.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit**.



Interpretation of Results

Tests should be interpreted with care as not everyone has the same glare resistance threshold. This test is based on the general average and some patients could fail the test without being affected by any type of pathology. Caution must also be taken with patients having undergone laser surgery. Many studies have shown that these types of operations can affect the results of glare resistance tests. Only after one or two years are the effects of laser operation considered negligible.

Observation	Interpretation
Patient has trouble recovering vision after 50secs	The patient may have a macular problem, eg: oedema, atrophy or even degeneration. However, recovery time can be lengthened with a patient's age.

Bibliography (non exhaustive)

Risse, J.-F., *Exploration de la fonction visuelle : application au domaine sensoriel de l'œil normal et en pathologie*, Ed. Masson, 1999, p. 765.

Zalonghi, X., Quinton-Fantoni, S., *Aptitudes visuelles*, BSOF, 2013, p. 496.

Purpose

Blinding is a level of light with which the eye cannot cope. Glare sensitivity decreases a patient's comfort as well as visual performance and can worsen over time, even after the blinding light ceases. The goal of this test is to reveal light sensitivity problems by showing a night driving scene where the patient must decipher as much information as possible. The more glare sensitive a patient is, the more the light appears unfocused and the more difficulty the patient will have to read the information close to the light source. This test thus demonstrates the visual capacity of a blinded patient. It is important to check all the contraindications for this test, to avoid undesirable patient reactions. It is also important to inform the patient of the high light intensity.

Presentation



Construction & Description

This test represents a normal night driving scene. It is composed of six objects which the patient must decipher:

- ✓ A licence plate
- ✓ An information sign
- ✓ A speed limit sign
- ✓ Three directional signs

The different optotypes in the scene are formed from random letters and numbers. They are presented at a visual acuity of between 20/63 (3/10) and 20/50 (4/10). The contrast levels are different and the different objects are positioned so as to create real-life situations. A light-emitting diode placed on the left provides the glare source.

Utilisation

Performing the Test:

- ✓ Test is performed binocularly.
- ✓ Test is performed in far vision.
- ✓ Test is performed with patient eye correction.
- ✓ Test is performed in mesopic light.
- ✓ Patient should have a visual acuity of at least 20/50 (4/10) to be able to read the different information.

Interface Description:

- ✓ An image of the driving scene viewed by the patient can be seen on the right.
- ✓ The time taken by the patient to decipher the different information can also be seen.

Patient Instructions:

- ✓ « *This test represents a night driving scene. A light coming from the left will blind you. You will be shown different information, such as road signs. Read me the different information that you see. »*

Operating Mode:

- ✓ To start the test, click on **Glare Sensitivity**.
- ✓ Ask the patient to read whatever information he can see.
- ✓ Click on the deciphered objects; they will be framed in green.
- ✓ The small light located on the top right indicates that the diode is lit and that it is in the process of blinding the patient.
- ✓ If, for whatever reason, the test cannot be performed, tick **Failed**, to specify the test was not forgotten.
- ✓ Then click on **Exit**.

Interpretation of Results

Tests should be interpreted with care as not everyone has the same glare sensitivity threshold. This test is based on the general average and some patients could fail the test without being affected by any type of pathology. Caution must also be taken with patients having undergone laser surgery. Many studies have shown that these types of operations can affect the results of glare tests. Only after one or two years are the effects of laser operation considered negligible.

Observation	Interpretation
Patient failed 1 or 2 answers	If the patient was unable to read the information near the light source, his eye is more sensitive than average. This could be the case for patients with myopia or some contact lens wearers. Dirty or scratched glasses could also be the cause.
That patient is unable to decipher the information	Firstly check the patient has a corrected visual acuity of at least 20/63 (3/10). If not, test failure is normal.
	The problem could be linked to the presence of a foreign body in the transparent media of the eye.
	The patient may suffer from a keratopathy.
	The patient may also suffer from a lens problem, eg cataract.

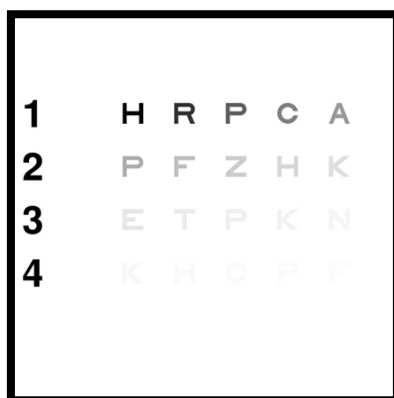
Bibliography (non exhaustive)

Risse, J.-F. (1999). *Exploration de la fonction visuelle*. (Masson, Ed.) (p. 765). Paris.
Zalonghi, X., & Quinton-Fantoni, S. (2013). *Aptitudes visuelles* (BSOF., p. 496).

Purpose

This test demonstrates a decrease in contrast sensitivity, which could indicate an alteration in the retina due to disease such as cataracts, chronic glaucoma or diabetic retinopathy. A decrease in contrast sensitivity can also appear after corrective eye surgery.

Presentation



Construction & Description

The test is based on the Mars contrast sensitivity test. The test proposes 20 different levels of contrast, which decrease according to the division as seen below. Contrast sensitivity is expressed in percentage: 100% is the highest contrast, while 1.2% is the lowest. So as not to disadvantage patients, optotypes are presented at an acuity level of 20/100 (2/10). The tables below represent the different contrasts used in the test, expressed in a percentage.

1	H	R	P	C	A
2	P	F	Z	H	K
3	E	T	P	K	N
4	K	H	C	P	F

1	100	80	63	50	40
2	32	25	20	16	12,5
3	10	8	6,3	5	4
4	3,2	2,5	2	1,6	1,2

Utilisation

Performing the Test:

- ✓ This test is done binocularly.
- ✓ This test is recommended in far vision.
- ✓ This test is performed with the patient's correction.
- ✓ This test is recommended in high photopic, but can also be done in low photopic.
- ✓ The patient must have a visual acuity of at least 20/100 (2/10)

Interface Description:

- ✓ The upper left button modifies the light level of the test. It can be performed in **Far**, **Near** and **Intermediate**.
- ✓ Use the side button to modify the lighting level of the test. Default setting is **High Photopic** (160 cd/m²) but it can be switched to **Low Photopic** (80 cd/m²).
- ✓ A scale of the different contrast levels seen by the patient is also displayed.

Patient Instructions:

- ✓ «You will see lighter or darker contrasting letters. Starting from the first line, read aloud the letters you can read easily. It doesn't matter if you make mistakes. Don't squint or turn your head. Keep both eyes open throughout the test.»

Operating Mode:

- ✓ Click on the **Contrasts** button.
- ✓ Option of performing test in **Low Photopic** here.
- ✓ Ask the patient to read the different lines that he sees, starting from the highest one.
- ✓ When the patient makes two successive mistakes, ask him to stop reading.
- ✓ If, for any reason, the test cannot be performed, tick **Failed**, to specify that the test was not forgotten.
- ✓ Then click **Quit** to return to the main interface.
- ✓ The contrast level legible to the patient is noted in **blue** on the graph.

Interpretation of Results

Minimum Contrast Level Read by the Patient (%)	Interpretation
50 - 100	Retina very severely affected
25 - 40	Retina severely affected
12.5 - 20	Retina moderately affected
6.3 - 10	Retina slightly affected
1.2 - 5	Typical values for persons below 60 years of age

Bibliography (non exhaustive)

Dougherty B. E., Flom R. E., Bullimore M. A., *An evaluation of the Mars Letter Contrast Sensitivity Test*, Optom Vis Sci., 2005, Vol.82, No.11, pp.970-975.

Thayaparan K., Crossland M. D., Rubin G. S., *Clinical assessment of two new contrast sensitivity charts*, Br J Ophthalmol, 2007, Vol.91, pp.749-752.

Arditi A., *Improving the Design of the Letter Contrast Sensitivity Test*, IOVS, 2005, Vol. 46, No.6.



Purpose

Test used to check the quality of stereoscopic vision, essential for good binocular vision. This acuity allows for depth perception and 3-dimensional structure. Stereoscopic vision troubles may reveal certain problems such as anisometropia, amblyopia, strabismus, or even image suppression. Average depth perception acuity is about 40 arcseconds ("), and all acuity above 60" may imply binocular vision problems.

Presentation

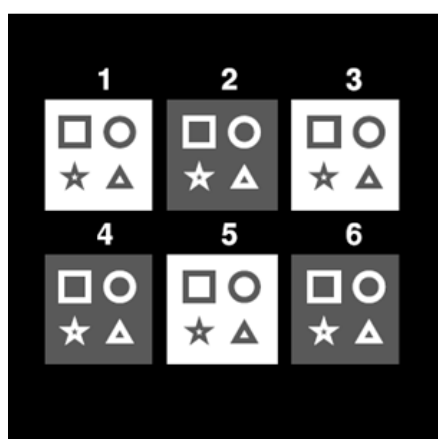


Image seen by the left eye

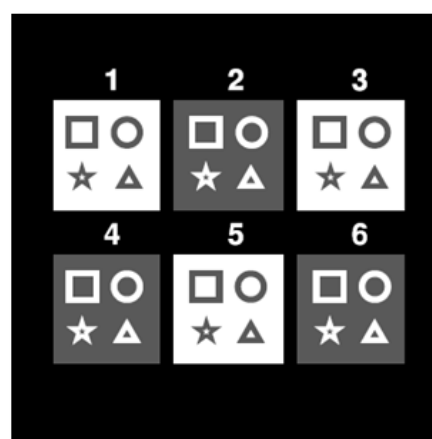


Image seen by the right eye

Construction & Description

This test is composed of six boxes, each containing four different shapes. In each box, one of the shapes appears to be in front of, or behind, the others. Consequently, this shape appears to the patient to stand out in relief. This is because the brain attempts to fuse together these two almost identical images. The greater the distance between the position of a shape on the right eye and the left eye, the greater the impression of the shape standing out in relief. Fixation disparities are expressed in arcseconds (") (1 arcsecond = $1^\circ/3600$), as follows for this test:

- ✓ Box 1: difference in position of the triangle between right and left eye = 1600"
- ✓ Box 2: difference in position of the circle between right and left eye = 800"
- ✓ Box 3: difference in position of the star between right and left eye = 400"
- ✓ Box 4: difference in position of the square between right and left eye = 200"
- ✓ Box 5: difference in position of the star between right and left eye = 100"
- ✓ Box 6: difference in position of the circle between right and left eye = 50"



Utilisation

Performing the Test:

- ✓ This test is done binocularly.
- ✓ This test is performed in both far and near vision.
- ✓ This test should be performed with the patient's optical correction in place.

Interface description:

- ✓ Use the button on the top right to adjust the test display distance. It can be performed in **Far**, **Near** and **Intermediate** vision.
- ✓ Use the button next to this one to adjust the light level of the test. By default it is set to the **High Photopic** (160 cd/m²) level, but can be changed to **Low Photopic** (80 cd/m²).

Patient Instructions:

- ✓ «You will see some boxes containing four geometric shapes. These boxes are numbered 1 – 6. For each box, tell me which shape appears to be in front of, or behind, the others.»

Operating Mode:

- ✓ Click the **Depth Perception** button.
- ✓ The **Low Photopic** option can be modified here.
- ✓ Ask the patient to tell you which shape seems to be in front of, or behind, the others in the first box.
- ✓ The correct response is displayed.
 - If the patient responds correctly, tick the box.
 - If the patient responds incorrectly, the test stops.
- ✓ If, for any reason, the test cannot be performed, tick **Failed**, to specify that the test was not forgotten.
- ✓ Then click **Quit** to return to the main interface.



Interpretation of Results

Awaited Responses	
Box 1	Triangle
Box 2	Circle
Box 3	Star
Box 4	Square
Box 5	Star
Box 6	Circle

Patient Responses	Interpretation
Patient sees boxes 1, 2 and/or 3 or doesn't see anything	The patient may have a binocular vision problem.
Patient sees boxes 1, 2 and 3 + box 4	The patient may have a binocular vision problem that requires investigating.
Patient sees boxes 1, 2, 3 and 4 + boxes 5 and/or 6	The patient has good stereo vision and does not apparently suffer from any binocular vision problem.

Bibliography (non-exhaustive)

Allary, J.-C., *Cours d'optométrie*, Ed. Opto-Com., 2012, p.758.