

Instructions for

The
CARDIFF
ACUITY
TEST

The CARDIFF ACUITY Test

The Cardiff Acuity Test is designed specifically for acuity measurement in toddlers aged 1 to 3 years. The test may be used successfully with other age groups, but younger infants may respond better to grating targets, while older children will usually perform picture or letter-matching tests. The Cardiff Test can also be used for older children or adults with intellectual impairment.

THE TARGETS

The principle of the target design is that of the vanishing optotype. The targets are drawn with a white band bordered by two black bands, each of half the width of the white band, all on a neutral grey background; thus the average luminance of the target is equal to that of the grey background. If the target lies beyond the subject's acuity limit, it merges with the grey background, and simply becomes invisible. Thus resolution, detection and recognition acuity thresholds are all brought together.

The targets used are pictures, all of the same overall size, but decreasing in width of white and black bands. The acuity is given by the narrowest white band for which the target is visible.

The principle of the test is that of Preferential Looking – a young child will choose to look towards a target rather than towards a plain stimulus. In the Cardiff Test, each target is positioned either in the top half or in the bottom half of the card. If the target is visible, the child will look towards it, and the examiner, watching the child's eye movements, can judge the position of the target from those eye movements. An important feature of the preferential looking technique is that the examiner **should not know in advance the position of the target**. For any given target width, if the examiner can reliably estimate the position correctly, the target is assumed

to be visible to the child. If the examiner incorrectly estimates the target position, or is unable to make a judgement from the child's responses, then the target is assumed to be beyond the child's acuity limit.

The Cardiff Test includes three cards at each acuity level, although only two are usually presented. This is so that once one card at a particular acuity level has been presented, the position of the next card to be presented cannot be predicted by either child or examiner.

We have chosen to employ an up-down rather than a right-left separation of the targets, so that the eye movements are easier to discriminate in cases of congenital nystagmus. We have found the inclusion of an examiner peep-hole, such as is used in conventional grating acuity cards to be unnecessary and sometimes to act as a distraction for this particular age group of children.

A working distance of 1 meter is recommended. At this distance eye movement position judgements are reliable, while a useful range of acuity levels from 6/48 to 6/3.8 (20/160 to 20/12.5) can be obtained, with the standard set. A closer working distance of 50cms may be used, if necessary to obtain a lower acuity, or to allow closer interaction with the child; at this distance the measureable acuities are 6/95 to 6/7.5 (20/230 to 20/25).

PROCEDURE

Beginning with the widest target (lowest acuity), shuffle the three cards, and present the first card at the child's eye level, with the centre of the card at your own eye level (Figure 1). In order to maintain the child's attention, talk about the picture, or encourage the child to name or point to the picture. However, in order to ensure a constant procedure amongst children of different ages and levels of understanding, we believe it is important to use ONLY the child's eye movements/position to establish the acuity limit, and not to use the child's verbal or pointing responses. (It is also important to present the card quickly and note the child's immediate response – often a child will glance at the target and then look away, and if you are slow

in bringing the card up to your eye level the child will have seen the picture and looked away before you note the eye movements!) From the child's eyes movement/position, estimate the position (top/bottom) of the target. Once you have made your decision present the second card; you may then check to corroborate your decisions. If two correct estimates are made, proceed to the next level and repeat along the sequence.

Once an incorrect estimate is made (or no estimate is possible). return to the next LARGER target, and repeat the test at this and the 'failed' level. At this stage in order to avoid any expectations on the part of the examiner or the child, shuffle the cards between each presentation. The end point should be taken as the highest acuity level at which two out of two presentations are scored correctly.

Note. Some authorities argue that 3 out of 4 presentations should be the end-point. However, this test is designed for clinical use, when the time taken to reach an end-point is an important factor in the success of a test. Few children have the attention span to co-operate with a test that is lengthy and repetitive, so in the clinical setting we recommend two presentations at each level.

The calibration for the cards is given in Table 1, which presents acuity levels for two testing distances, in both equivalent Snellen acuity and LogMAR.

It is important to note that, although you may record Cardiff acuity as a Snellen value, this does not mean that the same child would be expected to achieve an identical value of acuity on a letter matching or letter reading test. Both grating and Cardiff Preferential Looking tests tend to give a higher acuity than a letter test, simply because the child is required only to resolve the target, and not to identify it. Equally important, the Cardiff Test is carried out at a near distance. Any uncorrected refractive errors will also change the relationship between acuity recorded by this test and a Snellen test at 6 metres.

		Acuity at 1m			Acuity at 50cm		
<i>Card</i>	<i>Picture</i>	<i>LogMAR</i>	<i>Metres</i> <i>6/</i>	<i>Feet</i> <i>20/</i>	<i>LogMAR</i>	<i>Metres</i> <i>6/</i>	<i>Feet</i> <i>20/</i>
LVA	apple	1.2	96	320	1.5	192	640
LVB	sock	1.1	76	253.4	1.4	152	506.6
A	fish	1.0	60	200	1.3	120	400
B	house	0.9	48	160	1.2	96	320
C	boat	0.8	38	127	1.1	76	253.3
D	train	0.7	30	100	1.0	60	200
E	duck	0.6	24	80	0.9	48	160
F	car	0.5	19	63	0.8	38	126.7
G	fish	0.4	15	50	0.7	30	100
H	train	0.3	12	40	0.6	24	80
I	boat	0.2	9.5	32	0.5	19	63
J	car	0.1	7.5	25	0.4	15	50
K	duck	0	6	20	0.3	12	40
L	house	-0.1	4.8	16	0.2	9.5	32
M	train	-0.2	3.75	12.5	0.1	7.5	25

Figure 1. *Specification of acuity levels for the Cardiff Acuity Test. The new standard set incorporates cards B to M whilst the Low Vision Set incorporates cards LVA to J.*

Table 2 presents expected values for acuity in children with normally developing vision. These figures are taken from a study with a large population of children aged 1 to 3 years carried out in Cardiff.

Age (months)	Binocular Acuity (Snellen equivalent)		Monocular Acuity (Snellen equivalent)	
	Metres (6/)	Feet (20/)	Metres (6/)	Feet (20/)
12 — 17.9	48 — 12	160 — 40	48 — 15	160 — 50
18 — 23.9	24 — 7.5	80 — 25	30 — 7.5	100 — 25
24 — 29.9	15 — 7.5	50 — 25	19 — 7.5	63 — 25
30 — 36	12 — 6	40 — 20	12 — 6	40 — 20

Figure 2. *Norms for the Cardiff Acuity Test, with typically-developing children.*

Note. The norms were produced using an earlier version of the Cardiff test, in which the highest acuity recordable at 1m was 6/6 (20/20). This newer version incorporates a higher acuity (6/3.8, 20/12.5); it is feasible that children in the older age group will attain this acuity.



USES OF THE CARDIFF TEST

In informal use in the Cardiff clinic we find the test to be quick and readily enjoyed by most children in the toddler age range. We also use the test successfully with children and adults with intellectual impairment, and with adults with communication problems following stroke, head injury or age-related dementia.

Cases of suspected malingering may also be tackled with the Cardiff Test, since the patient is not aware of their own eye movements and may look consistently at the target even while insisting that they cannot see it.

USEFUL REFERENCES

Adoh, T. O. and Woodhouse J. M. (1994). "The Cardiff Acuity Test used for measuring visual acuity development in toddlers." *Vision Research* 34(4): 555-560

Jackson, A.J. and K.J. Saunders (1999). "The optometric assessment of the visually impaired infant and young child." *Ophthalmic and Physiological Optics* 19(1002): S49-S62

Woodhouse, J. M., Adoh T. O., et al. (1992). "New Acuity Test for toddlers." *Ophthalmic and Physiological Optics* 12: 249-251

LEGAL NOTICES

The measurements taken using The Cardiff Acuity Test are only an indication as to visual impairment.

The Licensee does not warrant that the Licensed Product:

- a) will be used correctly.
- b) guarantees detection of a visual impairment.

