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New method of assessing visual acuity with pictures

HAZEL KAY

From the Orthoptic Department Bolton Royal Infirmary, Chorley New Road, Bolton, Greater Manchester

SUMMARY It is never easy to assess accurately the vision of an illiterate child. Children under the age of 3 who are unable to understand and co-operate with tests using shapes and a key card present an even greater problem. All available subjective tests for this age group may maintain a small child's interest, but the accuracy of the recorded vision is very much in doubt. The new test described below is designed for 2-3-year old children. It combines the well recognised advantages of using pictures to gain the child's attention with the accuracy of a graded test based on Snellen's chart sizing. It is therefore both a practical and more accurate alternative test for this age group.

Pictures have been used to assess the vision of young children for many years, the most widely used tests today being Beale-Collins and Clement-Clarke pictures. While these provide a useful method of subjectively comparing the vision in the 2 eyes, most would agree that as a visual acuity test they are not as accurate as tests with shapes and a key card (Ffook's Symbols, Single Sheridan Gardiner).[1] However, many children under the age of 3 are unable to recognise and match corresponding shapes (or letters), and with such children an alternative vision test must be used.

The present available subjective vision tests for children under 3 (Worth's balls, Beale-Collins, etc.) are inaccurate for many reasons. They are poorly graded, not easily repeatable under the same testing conditions, and cannot easily be related to the accepted visual acuity standard—that of Snellen's chart. A test is required which is easily understood by 2-3-year old children, practicable for both examiner and child, and which is graded according to the Snellen's system.

The picture test described here has been designed to achieve these objectives (Fig. 1). The pictures are presented singly in 2 flip-over books (6/6–6/12 and 6/18–6/60) with a choice of pictures at each level of vision. Comparability with Snellen's chart can be achieved only by applying the same principles

Correspondence to Mrs H. Kay.

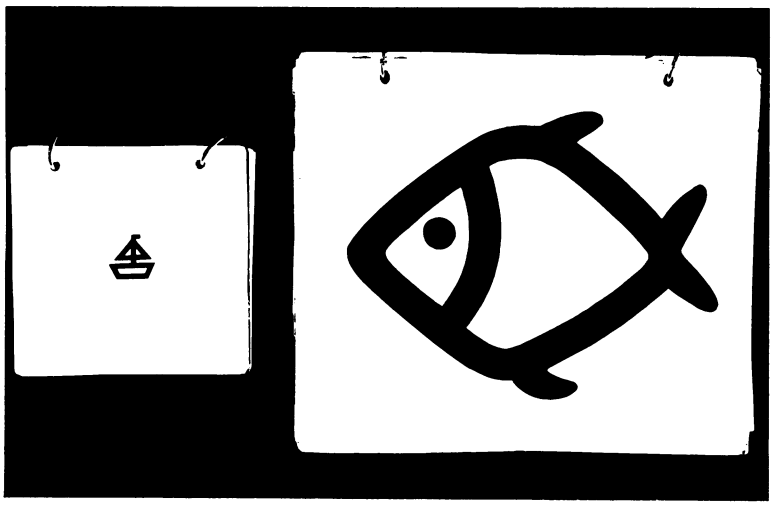

Fig. 1 *An example of pictures in the 2 prototype books.*

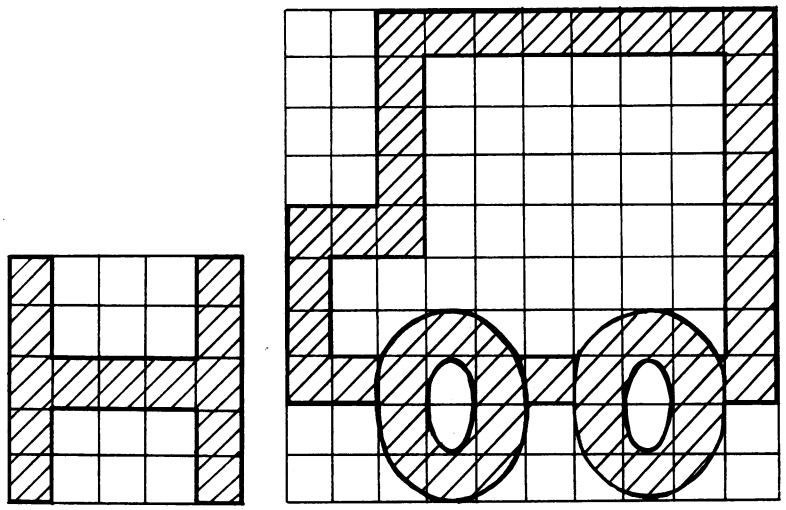

Fig. 2 Left: *Normal construction of Snellen's letters.* Right: *Construction of pictures.*

governing the sizing. However, pictures, in view of their more complex design, cannot be adapted to the Snellen's system without some modification.

Material and methods

The overall size of the pictures at each acuity level has been increased to twice its equivalent Snellen's chart dimensions in order to accommodate their more intricate shapes while maintaining the line width equal to that of Snellen's. Twice the size of Snellen's chart letters was found to be the minimum increase within which it was possible to achieve this (Fig. 2). All pictures were drawn within the confines of these squares, making optimum use of the space available.

The pictures are all of common objects with which 2–3-year old children are familiar. However, the simple way in which the pictures have been drawn means that some of them may not be recognisable to young children. In view of this possibility a survey was carried out to test it.

Fifty-six children between the ages of 2 years and 3 years 6 months (mean age 3 years) were asked to identify each picture (viewed at 33 cm as opposed to

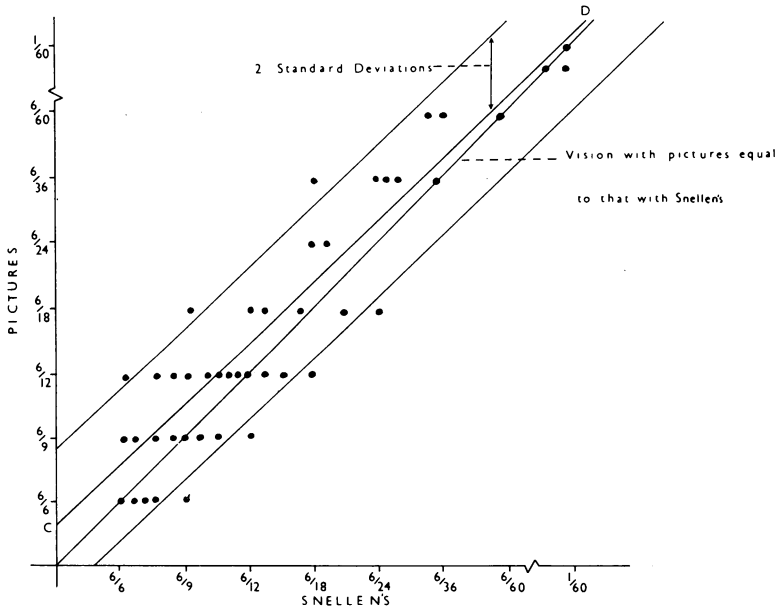

Fig. 3 *Comparison of vision with Snellen's chart and with pictures.*

Table 1 *Percentage of 2-3-year old children who recognised each picture*

Picture	*%*	*Picture*	*%*	*Picture*	*%*
House	98	Cup	86	Wheel	93
Fish	79	Apple	93	Pen	64
Bottle	21	Umbrella	93	Boat	88
Duck	100	Egg	89	Dog	98
Clock	95	Boot	96	Wheelbarrow	70
Car	100	Fork	55	Cat	100
Tree	91	Suitcase	88	Flag	59
Sun	70	Hat	70	Tea pot	91
Television	63	Plane	84	Tree	38
Train	98	Lollipop	45	Van	98
Teddy	75	Pram	84	Star	70
Telephone	89	Flower	91	Bird	100
Scissors	88	Girl	91		

the normal 6 metres in order to avoid the child's visual acuity influencing the results). Table 1 shows that the majority of the pictures could be identified by a high percentage of the children tested. Another survey was undertaken to determine the accuracy of the pictures compared with Snellen's acuity test.

Results

One hundred and sixty adults and older children with Snellen's vision from 6/6 to 1/60 inclusive were also tested with pictures. The scattergraph in Fig. 3 depicts the results. However, since many points on the graph must represent several repeated values the linear regression line C-D is shown as the line of best fit of all 160 values. There is a significant correlation between the 2 sets of values, the correlation coefficient being 0·9043, with 95% of values falling within 2 standard deviations of the mean.

A different comparison of these same results is given in Fig. 4. The histogram shows, as a percentage of the total number tested, the difference between the visions when tested with Snellen's chart and with pictures (in ½ line difference). In 90% of those tested the visual acuity was found to be the same or not more than 1 line less with pictures than with Snellen's chart (i.e., pictures were slightly more difficult to identify than Snellen's letters). A difference of greater than 1 line was rare.

Discussion

Any subjective assessment of young children incurs inaccuracies owing to their insufficient concentration, co-operation, and intelligence. Even the most

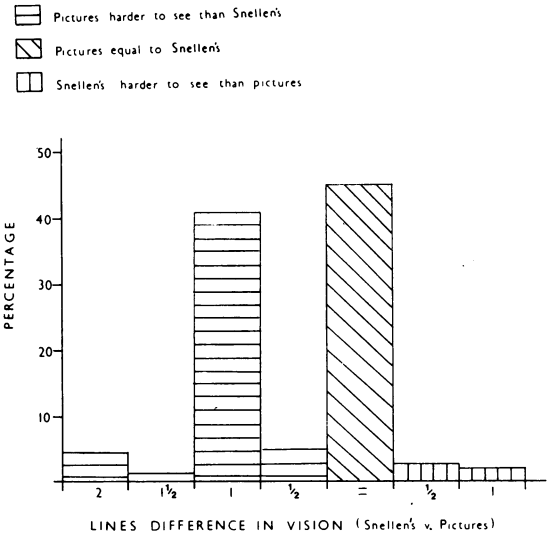

Fig. 4 *Difference between visions achieved with Snellen's chart with pictures as a percentage of the total number tested (160).*

sophisticated methods of measuring visual acuity may have inconsistencies in colour, contrast, luminance, and adaptation, all of which can affect the resultant subjective visual acuity.[2] It is therefore accepted by most orthoptists and others who test children's vision that a compromise must be sought in order to maintain a young child's interest in the test while providing a reasonably accurate assessment of vision which is repeatable under the same testing conditions on subsequent occasions.

The use of a wide variety of pictures maintains the child's interest in the test, and presented singly they avoid confusion and aid the examiner. They are consistently sized for each acuity level and based on the same principles as Snellen's acuity, which means a far more accurate recording of visual acuity is achieved than is possible with other picture tests.

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References

1 Keith CG, Diamond Z, Stansfield A. Visual acuity testing in young children. *Br J Ophthalmol* 1972; **56:** 827–32.
2 Voke J. Visual acuity: a review. *Optician* 9 October 1981; 32–51.