Objective: To describe a visual acuity test for use in identifying psychogenic visual impairment and malingering.

Methods: The test contained 32 white plates with a black Landolt C printed in the center. The sequence of the 4 alternative directions of the C was not predictable. After plate 21, 4 circles were interspersed among the remaining plates. The test is administered at a distance from which the subject is presumed to be able to recognize the optotypes. He or she is requested to identify the direction of the C within 2 seconds, and the responses are noted. Two elements were evaluated: (1) The number of correct answers was compared with the corresponding value of the distribution function of the binomial formula that represents the probability of reaching this rate of correct answers by pure chance. (2) The response to the first circle (appearing after plate 21) was compared with the responses to the previous 19 Cs. The test was administered to 20 volunteer pseudomalingerers and 15 patients believed to be true malingerers.

Results: Malingering was detected in 14 (74%) of 19 volunteers included in the evaluation and in 12 (80%) of 15 patients by too many or too few correct answers to the stimuli or by their response to one of the circles.

Conclusions: This test is useful in proving malingering. It may also provide evidence of a minimum visual recognition acuity within the gross dimension of the actual acuity.

Arch Ophthalmol. 2002;120:756-760

DECREASED VISUAL acuity is one of the most common nonorganic complaints encountered in the practice of ophthalmology. It may be psychogenic or the result of malingering. Most of the tests used in assessing this complaint can only roughly approximate the true visual recognition acuity. Objective methods using eye-movement recordings or visual evoked cortical potentials also only estimate acuity, as their accuracy is limited by patient cooperation and by the fact that response to the detection stimuli used is not necessarily equivalent to the recognition of a corresponding optotype. Many subjective tests are based on feints, deluding the subject by a change in the test distance and the detail size of the optotype. We present another visual acuity test method that is effective in proving presumptive malingering.

A statistical evaluation of answers to a large number of optotype presentations is a useful means to establish a test model, as a very high rate or a very low rate of correct responses proves the recognition of an optotype. For example, psychogenic superposition is proved if none of 32 Snellen Es are identified correctly, because the probability of this result by pure chance is low. (The probability of an incorrect answer is 3 out of 4 for each stimulus. The probability of 32 consecutive incorrect answers is \( \left(\frac{3}{4}\right)^{32} \approx .0001 \). The probability of a maximum number of correct responses \( k \) out of 32 optotypes with 4 possible alternative answers can be determined by the distribution function of the binomial formula: If \( k = 1, P \approx .001; \) if \( k = 2, P \approx .07; \) and if \( k = 3, P \approx .03 \). If a subject yields an abnormally low rate of correct answers, malingering or a psychogenic disturbance is likely. Such a melding of psychology and statistics can be informative in these cases.

Miller described a young man, claiming to be completely blind in 1 eye, who was shown a series of photographs from a popular men’s magazine that elicited no response. The young man then asked if he could see the set of photographs one more time because he thought he “just might have seen something out of the eye,” suggesting malingering. Another of Miller’s pa-
MATERIALS AND METHODS

TEST BOOK

A ring binder containing 37 white plates (20 × 30 cm) composed the test book. Plate 1 was blank. Thirty-two plates each had a black Landolt C printed in the center. The gaps in the C were at the 12-o’clock, 3-o’clock, 6-o’clock, and 9-o’clock positions. Each direction occurred 8 times in an unpredictable sequence. (Copies of the test plates are available from the authors.) The diameter of the C was 14.5 mm, corresponding to a visual acuity of 0.5 if recognized at 5 m. Four plates (22, 27, 31, and 35) showed a closed circle of the same size and proportion as the C. Using the Landolt C avoids overestimating the recognition acuity, which can occur when the Snellen E, a periodic stimulus, is used.

TEST PROCEDURE

The ring binder contents were presented at a distance from which the subject should easily recognize the Landolt C. At distances shorter than a half meter, persons 40 years and older were tested with adequate near vision correction. If the subject stated that he or she was not able to recognize the optotype at any distance, eg, 0.05 m, the test was discontinued. The distance was increased in decadal logarithmic steps. The feigned visual acuity was proportional to the farthest distance from which at least 3 of 4 optotypes were correctly identified. Because of the size of the optotypes, the acuity corresponded to one tenth of that distance in meters. Then it was explained to the subject that now a so-called threshold determination of visual acuity would be performed and the optotypes would be presented at a greater distance, so that it would be difficult or impossible to identify the gap in the C. Using a forced-choice strategy, the subject had to try to identify or otherwise guess the direction of C. The maximum time for reflection was set at 2 seconds with regard to the large number of questions prescribed in the test protocol. The examiner explained this procedure to be legally bound, although it might seem rather strange to a layperson. A monocular or binocular change was performed (group A or the presumed true visual acuity (group B). The responses to the stimuli were analyzed with regard to 2 criteria: (1) The direction of the C as identified by the subject was compared with the actual direction. If 17 or more answers were correct, the subject passed the test protocol. Fewer than 3 correct answers or more than 16 opposite answers were judged to be evidence of intentionally false responses, because the probability of attaining these rates by chance is low. Additionally (2) The reaction to plate 22 (the first circle) was compared with the reactions to plates 3 through 21. Plate 2 (the first C) was excluded, because subjects tended to be argumentative at the beginning of the test. Among group A, the answers were noted, and the delay between turning over the plate and the volunteer’s answer was measured using a audiometrically visualized recording of the soundtrack (Figure 2). The latency of response to the circle was considered suspicious if it was longer than any previous latency. Similarly, among group B, the verbal responses were recorded and the delays were evaluated, but no sound recording was done.

SUBJECTS

Informed consent was given by all subjects. In group A, 20 adult volunteers (9 male and 11 female medical students and hospital staff; age range, 21-53 years) with a visual acuity of at least 1.0 were tested to verify the applicability of the model and to observe possible telltale responses. Some of the subjects were acquainted with the statistical method of visual acuity assessment. They were asked to feign as credibly as possible a given reduction of binocular visual acuity, with a reward promised for success. Group B consisted of 15 patients who were suspect of malingering or functional visual loss (Table), who undertook the test as part of an expert examination, predominantly striving for a medical certificate of blindness. The major motive for malingering was presumed to be financial. Malingering was proved by other methods (Table) or by statistical evaluation of the results of the test itself. The test was performed monocularly or binocularly, depending on the individual. The test can be administered by one examiner, but the presence of a second observer is recommended.

EVALUATION

The responses to the stimuli were analyzed with regard to 2 criteria: (1) The direction of the C as identified by the subject was compared with the actual direction. If 17 or more answers were correct, the subject passed the test protocol. Fewer than 3 correct answers or more than 16 opposite answers were judged to be evidence of intentionally false responses, because the probability of attaining these rates by chance is low. Additionally (2) The reaction to plate 22 (the first circle) was compared with the reactions to plates 3 through 21. Plate 2 (the first C) was excluded, because subjects tended to be argumentative at the beginning of the test. Among group A, the answers were noted, and the delay between turning over the plate and the volunteer’s answer was measured using a graphically visualized recording of the soundtrack (Figure 2). The latency of response to the circle was considered suspicious if it was longer than any previous latency. Similarly, among group B, the verbal responses were recorded and the delays were evaluated, but no sound recording was done.

RESULTS

GROUP A

One male nurse was excluded, as he was unable to feign visual acuity. The remaining 19 volunteer pseudomalingersers feigned visual acuities ranging from 0.01 to 0.32 (median, 0.08). The test level exceeded the feigned acuity,
ity by 3 to 16 lines (median, 6 lines). Fourteen of the 19 volunteers were detected as malingerers. The test analysis factors were applied: (1) Nine volunteers failed the test because of too many or too few correct answers. Two volunteers gave more than 16 and 2 gave fewer than 3 correct responses. Four volunteers with 15 or 16 correct answers each had results that were inconsistent with the much lower feigned acuity, compared with the normal psychometric function. One volunteer answered with the opposite direction of the C on 16 plates. (2) Ten volunteers showed a marked reaction to the circle, either by laughing or giving an answer ("nothing" or "what's that?") that revealed they could differentiate the C from the circle. One young woman, for example, promptly answered "closed" when shown plate 22. She then repeated the same response to some of the following stimuli, trying to cover her mistake. Another volunteer raised his eyebrows and, before answering "top," hesitated for 4.0 seconds, significantly longer compared with the previous 19 plates, for which the latency ranged from 1.3 to 2.8 seconds. A suspicious latency, exceeding the maximum latency of the previous 19 plates, occurred with 6 volunteers.

**GROUP B**

The results of group B, consisting of 15 patients, are summarized in the Table. The test detected 12 malingerers. Three patients were uncooperative. The following test evaluation findings were observed: (1) The cooperation of 6 patients (2, 5, 6, 10, 12, and 13) significantly improved during the test because of repeated forced-choice questioning and positive feedback. In 5 patients (2, 5, 6, 12, and 13), after first stating that they did not recognize the optotype at all, the percentage of correct answers exceeded 60%. Four patients (9, 10, 11, and 14) had suspiciously few (<3) correct responses. Patient 1 gave only 3 correct answers, a rate that would also be unlikely by pure chance. A suspiciously high number of responses in the opposite direction of the C occurred in patients 3 and 14. (The probability of 16 accidental responses in the opposite direction is .002.) (2) Six pa-

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**Results of Group B**

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>&quot;Acuity&quot;</th>
<th>Diagnosis</th>
<th>Test Level</th>
<th>Test Result</th>
<th>Proof of Malingering or Psychogenic Origin by Other Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/36</td>
<td>0.01</td>
<td>Foveal cone dystrophy</td>
<td>0.10</td>
<td>3 of 32 Nystagmography</td>
<td></td>
</tr>
<tr>
<td>2/F/85</td>
<td>0.01</td>
<td>ARMD</td>
<td>0.10</td>
<td>24 of 32, &quot;Round&quot; Nystagmography, objective perimetry</td>
<td></td>
</tr>
<tr>
<td>3/F/35</td>
<td>0.01</td>
<td>Psychogenic</td>
<td>0.25</td>
<td>20 of 32 Opposite Nystagmography, objective perimetry</td>
<td></td>
</tr>
<tr>
<td>4/F/80</td>
<td>0.003</td>
<td>ARMD</td>
<td>0.05</td>
<td>&quot;Round&quot; Nystagmography, objective perimetry</td>
<td></td>
</tr>
<tr>
<td>5/F/61</td>
<td>&lt;0.003</td>
<td>Optic nerve atrophy</td>
<td>0.05</td>
<td>23 of 30 Objective perimetry, nystagmography, Ishihara plates</td>
<td></td>
</tr>
<tr>
<td>6/F/32</td>
<td>0.1</td>
<td>Psychogenic</td>
<td>0.50</td>
<td>24 of 32, &quot;Closed&quot; mERG, pVECP (but: increased latency)</td>
<td></td>
</tr>
<tr>
<td>7/M/37</td>
<td>def LP</td>
<td>Malingering</td>
<td>0.006</td>
<td>Testing impossible Nystagmography, pVECP, observation outside the hospital</td>
<td></td>
</tr>
<tr>
<td>8/M/49</td>
<td>LP</td>
<td>Malingering</td>
<td>0.006</td>
<td>Testing impossible Nystagmography: black stimulus (diameter of 4.5') interrupted OKN, pVECP</td>
<td></td>
</tr>
<tr>
<td>9/F/66</td>
<td>0.03</td>
<td>Keratoplasty</td>
<td>0.06</td>
<td>1 of 32, &quot;Oh!&quot; (Later admitted 0.12) Objective perimetry, nystagmography</td>
<td></td>
</tr>
<tr>
<td>10/M/62</td>
<td>0.2</td>
<td>Psychogenic</td>
<td>0.50</td>
<td>17 of 32 Not performed because of test result</td>
<td></td>
</tr>
<tr>
<td>11/F/45</td>
<td>0.05</td>
<td>Foveal scar</td>
<td>0.20</td>
<td>2 of 32 Objective perimetry, nystagmography</td>
<td></td>
</tr>
<tr>
<td>12/M/81</td>
<td>0.02</td>
<td>Branch vein occlusion</td>
<td>0.05</td>
<td>19 of 32 “Null” Not performed because of test result</td>
<td></td>
</tr>
<tr>
<td>13/M/51</td>
<td>0.03</td>
<td>Amblyopia</td>
<td>0.40</td>
<td>24 of 32 Not performed because of test result</td>
<td></td>
</tr>
<tr>
<td>14/M/71</td>
<td>0.02</td>
<td>Aphakia</td>
<td>0.20</td>
<td>0 of 32, Not performed because of test result</td>
<td></td>
</tr>
<tr>
<td>15/F/76</td>
<td>def LP</td>
<td>Diabetic retinopathy</td>
<td>0.02</td>
<td>18 of 32 Opposite Nystagmography, pVECP</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1.** Answer sheet of volunteer 6 (group A), containing the sequence of plates with the Landolt Cs and the closed circles (plate 1 is blank) and the corresponding responses. Filled symbols indicate the answer "closed."
tion (Table).

If the subject showed a similar response to one of the previous plates, it is difficult to quantify a statistical value representing the importance of a forced-choice strategy in obtaining results. In uncooperative subjects, repeated discussion was the dominant reaction. Two limitations of the test include the necessity of obtaining informed consent to electronic recording of the answers, and the use of response latency as an objective finding. Compared with the responses to the previous 19 plates, there was about a 5% probability that the longest pause would occur at plate 22. This calculation is appropriate if the differences between the latencies are small. In the case of a much longer hesitation over plate 22 than over the previous plates, it is difficult to quantify a statistical value in nongaussian distribution of the latencies. Therefore, the verbal response to plate 22 will usually be the dominant factor used in the evaluation. For example, if at plate 22 the subject starts to comment but the 19 previous plates had evoked answers without any discussion, this behavior is more obvious than a P value of .05 would express. If the subject showed a similar response to one of the previous plates (except plate 2), however, repeated discussion would not necessarily be suspicious. Such statistical considerations may be important concerning forensic issues. A one-word answer such as “closed” is unequivocal, which would probably be the most common reaction (Table).

The other strategy used, namely, to provide the chance either to achieve a sufficient rate of correct answers or to lie to a statistically evident degree, detected 14 (74%) of the 19 pseudomalingers in this series. Although many in group A were acquainted with the forced-choice procedure and knew that the rate of correct responses should be about 25%, the malingering in 9 people became statistically apparent. One volunteer who surpassed a 60% rate of correct answers in his attempt to avoid an abnormally steep slope of the psychometric function exceeded his tested visual acuity. Another volunteer attained a 55% rate at a level of 3 log units above his stated acuity. In 4 volunteers, their results of 15 or 16 correct answers each contrasted with their feigned acuity 4 to 16 log units below the tested level. One nurse subconsciously chose the opposite direction of the C in 16 of 32 answers. Among 6 (40%) of 15 patients in group B, cooperation significantly improved during the test, demonstrating the importance of a forced-choice strategy in obtaining results. In uncooperative subjects, repeated motivational and positive feedback are required. If a patient does not recognize numbers or letters, despite normal Snellen-E or Landolt-C acuity, the differential diagnosis of alexia should be considered.

Two subjects from group A and 4 from group B gave fewer than 3 correct answers and thus yielded evidence of malingering, because the chance of achieving such a low rate of correct answers by mere accident is slim. In the introduction, some values of the distribution function of the binomial formula were given, representing the statistical probability of achieving a certain number of correct answers out of 32 answers by pure chance (eg, with the eyes closed) if the chance of each single correct answer is 1 out of 4. A rate of 3 correct responses out of 32 would be unlikely (2.5%). If only 2 answers are correct, intentionally false statements may be suspected, because the probability of such a result occurring by pure chance is less than 1%. The absence of any correct
response to 32 consecutive questions is presumed to be blatant malingering. In these cases, one could continue the test on another level, but sooner or later, the subject would detect the method. When a sufficiently high or an extremely low rate of correct responses is expected after the first 20 plates, the circles should not be presented but kept in reserve for future testing. Generally, performance of the test at least 3 lines below the presumed acuity is recommended, because the intention would become obvious if performed too near the actual visual threshold. When recognition of the optotype becomes difficult, the subject may notice that guessing can cause a correct answer. When the test is not applicable because the subject refuses to given any answer or monotonously gives the same answer to every stimulus (as in patients 7, 8, and 15), other objective methods of evaluation are required.

These results demonstrate that statistical analysis of test responses is a useful addition to other critical and objective methods for diagnosing functional visual impairment and malingering.1-3 Compared with other methods using resolution or detection stimuli, this convenient test offers the advantage of proving a discrete minimum visual recognition acuity within the gross dimension of the actual acuity.

Submitted for publication November 30, 2001; final revision received February 25, 2002; accepted February 28, 2002.

Corresponding author and reprints: Michael H. Graf, MD, Department of Ophthalmology, Strabismology, and Neuroophthalmology, University of Giessen, Friedrichstrasse 18, D-35385 Giessen, Germany (e-mail: michael.h.graf@augen.med.uni-giessen.de).

REFERENCES

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Correction

Error in Text. In the Clinical Sciences article by Graf and Roesen titled “Ocular Malingering: A Surprising Visual Acuity Test,” published in the June issue of the Archives (2002;120:756-760), an error occurred in the “Introduction” on page 756. In the right-hand column, first paragraph, the sentence beginning on line 8 should have read as follows: “The probability of a maximum number of correct responses (k) out of 32 optotypes with 4 possible alternative answers can be determined by the distribution function of the binomial formula: if k = 1, P = .001; if k = 2, P = .007; and if k = 3, P = .03.”