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Pacific University College of Optometry visual perceptual testing manual

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Abstract
The history of the Pacific University College of Optometry (PUCO) Visual Perceptual Testing Manual dates back to 1988. Daniel Kosterman, Marcus Morben, Terry Rudensey, and Samuel Soesbe from the class of 1988 put together a manual which included a battery of visual perceptual diagnostic tests and an accompanying slide presentation. These four students hoped to provide a thorough visual perceptual diagnostic test manual which would allow fourth year optometric interns to learn how to properly perform many of the common tests used in PUCO's Vision Therapy Clinic. The goal was to standardize the administration of each test and reduce reliability/validity problems found in educational settings created by the high turnover rate of student interns. In 1996, Stacy Bell (1997) and James Kundart (1999) updated the manual with the addition of two tables. The first table illustrates which visual perceptual factors are assessed in each visual perceptual diagnostic test. The second table that Bell and Kundart created lists which visual perceptual factors can be trained with common vision therapy training instruments. These tables can be found in Appendix A and B of the PUCO Visual Perceptual Testing Manual. The latest update to the PUCO Visual Perceptual Testing Manual brings us to this foreword. Karl Bakken (1998) and Melissa Severns (1998) revised two previous tests, added nine new tests to the manual, and added new research (since 1988) that has been conducted on several of the diagnostic tests already found in the manual. Bakken and Severns also conducted a survey of practicing behavioral optometrists to determine how applicable the diagnostic perceptual tests performed at PUCO were in the "real world". Bakken and Severns believed that the practicing optometrists utilize many different perceptual diagnostic tests and wanted their input. Results and analysis of the 1997 survey as well as the original survey can be found in Appendix D, E, and F. The PUCO Visual Perceptual Testing Manual now serves three purposes. 1) The manual will be an educational tool for the students of the Pacific University College of Optometry to be used in the Evaluation and Management of Patients with Perceptual Problems course (Optometry 727). Pacific University added the course to its third year core curriculum in 1997. The addition of this course provides the students at Pacific University a strong background on the many visual perceptual tests available for practicing optometrists and will make their transition into the Vision Therapy Clinic at PUCO easier. The PUCO Visual Perceptual Testing Manual will serve as an additional textbook for the class and will provide the students with a valuable reference manual to take with them into their future practice. The Pacific University Vision Therapy Clinic benefits from better prepared student interns and hopefully more standardized test administration. 2) The manual now contains a strengthened critique and analysis of each perceptual test allowing the student intern or practicing optometrist to review the norms, test validity and test reliability. We want the readers and test administrators to be aware of how accurate the test has been at diagnosing what it claims to diagnose. We encourage critical thinking, and hope that further studies can be done on these perceptual tests to further assess their validity and reliability. 3) The manual continues to be a quick "go-to" reference for the student interns at PUCO so they may better familiarize themselves with a test prior to administration. Within an education-based clinical setting, students interns do not have the years of experience to perform a battery of perceptual tests from memory, often they need to brush-up on proper administration prior to patient contact. Pacific University's Vision Therapy Services have a limited number of administration and scoring manuals for each perceptual test. Therefore, optometric interns often must locate and study these test administration manuals on the day of the evaluation. With every student owning the PUCO manual they will be able to prepare for the administration before their day in clinic. The ultimate goal is for a more proper and standardized test administration in the vision therapy clinics at Pacific University. What the manual cannot do. The PUCO Visual Perceptual Testing Manual is not intended to replace original test manuals. Although we
feel the manual is quite thorough, it by no means can replace all the information contained within the original scoring and administration manual of each test. The PUCO Visual Perceptual Testing Manual does not contain all of the age equivalent, grade equivalent, and other normative data for every test. Therefore, the clinician needs to use the official scoring and administration manual for each test. The authors of the PUCO Visual Perceptual Testing Manual encourage all students and clinicians to read the official scoring and administration manual for each diagnostic test when they purchase the test. It is in the clinician's best interest to be fully comfortable with administering and scoring the test before using it with patients. Failure to do so may result in invalid results and potentially skewed data. We believe the strength of this manual is in its simplicity and quick reference format. We feel that the "Purpose", "Indications", and "Administration" sections will allow the clinician or future vision therapist technician to brush-up on their administration skills prior to patient contact. One shortcoming we feel still exist with this manual is the thoroughness of the "Critique" sections. We would like to see more research data included in the critique sections in future revisions of this manual. We were unsuccessful in finding recent studies relating to many of the tests found within the manual. We strongly believe that more comprehensive critique sections will allow the clinician better insight into strength's and weaknesses of the tests included in this diagnostic perceptual test manual.

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VISUAL PERCEPTUAL TESTING MANUAL

PACIFIC UNIVERSITY COLLEGE OF OPTOMETRY

Contributing Authors:
Karl Bakken & Melissa Severns, 1998
Stacy Bell & James Kundart, 1996
Daniel Kosterman, Marcus Morben, Terry Rudensey, & Samuel Soesbe, 1988
PACIFIC UNIVERSITY COLLEGE OF OPTOMETRY
VISUAL PERCEPTUAL TESTING MANUAL
1998 REVISION

by

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and

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ABSTRACT

The history of the Pacific University College of Optometry (PUCO) Visual Perceptual Testing Manual dates back to 1988. Daniel Kosterman, Marcus Morben, Terry Rudensey, and Samuel Soesbe from the class of 1988 put together a manual which included a battery of visual perceptual diagnostic tests and an accompanying slide presentation. These four students hoped to provide a thorough visual perceptual diagnostic test manual which would allow fourth year optometric interns to learn how to properly perform many of the common tests used in PUCO’s Vision Therapy Clinic. The goal was to standardize the administration of each test and reduce reliability/validity problems found in educational settings created by the high turnover rate of student interns.

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What the manual can do. As the Pacific University College of Optometry Visual Perceptual Testing Manual has evolved over the years, so have its goals. The PUCO Visual Perceptual Testing Manual now serves three purposes.

1) The manual will be an educational tool for the students of the Pacific University College of Optometry to be used in the Evaluation and Management of Patients with Perceptual Problems course (Optometry 727). Pacific University added the course to its third year core curriculum in 1997. The addition of this course provides the students at Pacific University a strong background on the many visual perceptual tests available for practicing optometrists and will make their transition into the Vision Therapy Clinic at PUCO easier. The PUCO Visual Perceptual Testing Manual will serve as an additional
textbook for the class and will provide the students with a valuable reference manual to take with them into their future practice. The Pacific University Vision Therapy Clinic benefits from better prepared student interns and hopefully more standardized test administration.

2) The manual now contains a strengthened critique and analysis of each perceptual test allowing the student intern or practicing optometrist to review the norms, test validity and test reliability. We want the readers and test administrators to be aware of how accurate the test has been at diagnosing what it claims to diagnose. We encourage critical thinking, and hope that further studies can be done on these perceptual tests to further assess their validity and reliability.

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We believe the strength of this manual is in its simplicity and quick reference format. We feel that the "Purpose", "Indications", and "Administration" sections will allow the clinician or future vision therapist technician to brush-up on their administration skills prior to patient contact. One shortcoming we feel still exists with this manual is the thoroughness of the "Critique" sections. We would like to see more research data included
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by Karl Bakken and Melissa Severns
Pacific University College of Optometry
INTRODUCTION

The utilization of an extensive battery of visual perceptual tests is vital for evaluation and diagnosis of the learning-disabled or developmentally delayed child. Of the various testing instruments available to the optometrist, the perceptual tests tend to be poorly understood and, therefore, underutilized by optometrists. This is unfortunate, because the perceptual tests are diagnostically useful for uncovering problems not revealed by more traditional primary care oriented optometric tests. The PUCO Visual Perceptual Testing Manual has been organized into an easy reference format so that the optometric intern, practitioner or vision therapist can quickly find and choose an appropriate perceptual test to diagnose problems likely to be confronted in practice. Every effort has been made to present each test in a simple and straight-forward manner in order to minimize the preparation time required for administration, yet ensuring valid/proper administration.

The authors of the PUCO Visual Perceptual Testing Manual urge all clinicians to familiarize themselves with the subtle difference between perceptual testing and perceptual assessment. Perceptual testing reveals specific information on how the child visually perceives and acts on the environment around him/her. The optometrist’s diagnostic skills and keen insights are essential for perceptual assessment. Groffman and Solan present a list of necessary requirements for proper perceptual assessment.1

1. Medical, developmental, and educational history
2. Information from other professionals—psychological, educational, neurological, occupational therapists, etc.
3. Visual history, including previous vision therapy
4. Presenting complaint
5. Formal perceptual testing
6. Clinical Observation

Groffman and Solan describe three basic types of assessment which can be utilized by the optometrist: 1) formal standardized assessment, 2) informal observational assessment, and 3) dynamic assessment. Formal standardized assessment utilizes specific standardized tests (chosen by the optometrist) which provides data on isolated visual perceptual abilities of the child. The tests need to be valid and reliable so that results are reproducible even by other examiners. Informal observational assessment is a more process oriented method of assessment rather than product oriented. It requires the optometrist to observe and record behaviors of the child when under the stress of perceptual testing. Observational assessment places emphasis on discovering the nature of the child’s problem solving process. Many optometrists believe that direct observations are the most clinically useful of all assessment procedures. The drawback of observational assessment is that examiner observations do not allow for standardized scoring and is variable from examiner to examiner. Dynamic assessment is very similar to informal observational assessment in that it emphasizes looking at the processes utilized by the child to perform a task. Dynamic assessment differs from observational assessment because it includes some form of test-train-retest strategy. The child is taught how to perform certain skills tested by the instrument and then is retested. Learning potential and transferability of learning is assessed by the examiner and are used as a predictor of improvement with training. Groffman and Solan do not recommend dynamic assessment “as a basic evaluative device, but used judiciously, particularly for patients who have entered a vision therapy program.”1

The PUCO Visual Perceptual Testing Manual emphasizes the formal standardized assessment approach. As the examiner becomes more familiar with the testing protocol,
he/she will tend to incorporate more extensive observational assessment into patient management decisions.

The optometrist who wishes to implement a battery of perceptual tests into his/her practice must first be aware of all the factors (confounders) that can influence the child's performance on these tests. Once aware of these factors, the examiner must do everything possible to eliminate as many of these variables from the testing environment. The three main areas of influence are sensory or cognitive disability, physical environment, and psychological environment.

The sensory or cognitive disability can include a hearing or cognitive impairment as well as a visual impairment. Optometrists are at a distinct advantage at diagnosing and remediating the visual impairment but may need to rely on outside sources (speech/language pathologist, psychologist, occupational therapist, etc.) for assistance on hearing and cognitive deficits. If a sensory or cognitive deficit exists, the optometrist may need to adapt the testing administration and instructions to match the patient’s needs. Many times the test norms do not allow for this type of adjustment, therefore caution must be used when interpreting test results for these individuals.

The physical environment of the testing area can influence test results. It is best to conduct all perceptual testing in the same room on every patient to maximize standardization and reliability. The size of the testing room does not need to be large but large enough for the child and the examiner to not feel constricted. Configuration is more important than size; it should have four walls, be fairly soundproof, and away from “busy” areas within the office. The size of the furniture and ergonomics of the testing room should be set up for children (child-friendly environment). Avoid using too many posters or other visual distractions when decorating the room. Use task lighting to supplement the standard room illumination. Air temperature and ventilation must also be kept within a comfortable range during testing.

Psychological environment includes such variables as age, gender, race, religion, time of day, hunger/thirst, patient’s anxiety level, and test sequencing order. Psychological environment is significantly influenced by the doctor: prior contact with the doctor, authoritarianism, the doctor’s “white” coat, the doctor’s personal warmth, and perceived overall rapport with the patient. The experimenter’s expectancy (I’ll bet this patient has...) may also influence results. Often this is communicated through both verbal and non-verbal cues (facial expressions, postural changes, intonation and emphasis at key times during instructions. The patient will try to please the examiner by giving the “right” or expected response. The examiner should make all attempts to eliminate the disruptive psychological factors that are of his/her control.

Proper feedback or lack of feedback is crucial to keep test results valid and repeatable. Most standardized tests have example items in the beginning where the examiner may teach the task so that the subject understands the “rules” or what is required of them. The examiner should patiently instruct the patient about the sample items and not initiate formal testing until the task is fully comprehended. On the other hand, the examiner should never teach into the test beyond the sample items. The examiner should also record after each response made by the child whether the response is correct or incorrect so that the recording does not provide feedback about performance during testing. The examiner should never give away answers with non-verbal signals (smiles, frowns, changes in posture, etc.) or with changes in voice tone in response to correct or incorrect patient responses. During formal testing if a child directly asks whether their answer to a particular test item is right or wrong, the examiner should say: “that is a good answer”.

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How can the optometrist maximize the child’s visual-perceptual performance? The optometrist or examiner must develop a good rapport or relationship with the child. To establish a good rapport, the clinician should encourage the use of first names (avoid using the title “doctor” with young children). The optometrist should be natural, open, honest, and friendly when interacting with the child. It is important to use appropriate language when engaging in conversation or giving instructions, but one should avoid using condescending language when talking to the older children. Do not rush starting the evaluation and testing, instead take time to build rapport by talking about hobbies or interests. The examiner may also subtly find out the child’s perceptions regarding the reasons for extra testing and should attempt to correct the misperceptions (the examiner is an ally not the enemy). The optometrist should avoid suggesting that the upcoming tests will be an “ordeal” (“when we are done with the tests we’ll do something fun...”, etc.). Try to complete all testing without the parent in the room, and deal with separation anxiety kindly but firmly. If it is not possible to conduct testing without the parent nearby, politely ask the parent not to interrupt, clarify, or correct their child’s responses.

Maintain good rapport throughout the testing process. The examiner should continue using the child’s name often, maintain eye contact and be reassuring and supportive. The examiner should also demonstrate enthusiasm throughout the testing. The optometrist should praise effort not correctness of the response (“nice try...good, you’re working hard...that was a tough one”, etc.) The examiner should avoid using overworked expressions after each test item (“OK...good...fine”) The examiner should not be overly secretive when handling test materials, recording responses, or using a stopwatch. This behavior can erode trust and may arouse resistance, negativism and anxiety.

Be sensitive to each individual child’s “ceiling”. Once the child’s answers transition to predominantly incorrect and/or the child’s behavior changes to frustration, it is usually wise to discontinue the test. Mindlessly administering test items that are too difficult will only compound frustration, reduce self-esteem, and yield a child less willing to fully participate with subsequent tests. After discontinuing the test provide reassurance: “this test is intended for children older than you”, “you did well”, “no one is suppose to get all of the answers right.”

The best way to establish a good rapport with every patient is to become so familiar with test administration and scoring that more effort can be placed on interacting with the children. “Competent examiners follow the precise directions for administration and scoring, but also attends closely to the child and unobtrusively observes and records important behaviors”2

References:
AUDITORY-VISUAL INTEGRATION TEST (AVIT)
("Birch-Belmont Test")

Purpose: The purpose of the AVIT is to test the level of development of intersensory integration between audition and vision as an indicator of reading readiness. The hypothesis underlying the AVIT is that reading involves integration between auditory and visual sensory modalities. This integration is believed to develop after the individual sensory modalities have developed. Since poor intersensory integration has already been shown to correlate with poor reading ability when the senses of vision, touch, and kinesthesia were studied, it was hypothesized by Birch that poor auditory-visual integration would also be a reliable predictor of poor reading readiness.

Indications: The most meaningful results have been obtained when testing children in the first and second grades. Many kindergarten-aged children (15%) achieved scores equivalent to guessing. Norms have been established for kindergarten through 5th grade, but it shows the highest correlation to reading in the first and second grades. The AVIT can be useful as part of a battery of reading-readiness testing, or as part of a battery of tests to determine specific deficits contributing to poor reading.

Apparatus and Setup: The examiner utilizes a card on which 20 Stimulus Patterns are printed. The child is shown a series of 4" x 7" cards, each with three visual spatial patterns, one of which corresponds to each stimulus pattern. The examiner holds a pencil to tap out patterns and something to act as a visual screen behind which to hide the arm holding the pencil so the subject can not observe the examiner tapping.

Time Required: Approximately 5 minutes.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Auditory-Visual Integration Test. Proper use requires the purchase of the Auditory-Visual Integration Test and adherence to the protocol listed in the test manual.

Preset (Administration): The child and examiner face each other while seated on opposite sides on an exam table. The examiner holds a pencil with hand and forearm shielded from the view of the child. The examiner states, "I am going to tap out some patterns." The child is shown Response Card A. The examiner states, "Each pattern you hear is going to be like one of the dot patterns you see here. Let me show you." The examiner points to the first set of dots. "These are two dots close together. Listen to what they sound like." The examiner taps twice, with a pause of about one-half second between taps. "These are three dots close together." The examiner points to the third set of dots. "Listen to what they sound like." The examiner taps three times, with about one-half second intervals. "Now you are going to hear one of these. Listen and tell me which one it is." The examiner taps any one of the previous patterns. The examiner verifies or corrects the child's response.

The child is then shown Response Card B. The examiner states, "Listen again, and then show me what you hear." The examiner taps out Stimulus Pattern B and then verifies or corrects the child's response. This procedure is repeated with Response Card C.

Next, the examiner states, "Now we are going to do the same thing, except this time I won't show you the card until after you hear the dots. So listen carefully and try to remember." The examiner then taps out Stimulus Pattern 1 and shows the child Response Card 1. This is repeated for all ten Stimulus Patterns and Response Cards.
to show the Response Card until AFTER the stimulus is given. Do not correct the child's responses.

**What to Look For:** The examiner should look for correct responses. Spontaneously self-corrected responses may also be counted as correct.

**Scoring:** The total number of correct responses is the score. A perfect score is ten correct. For fourth and fifth grade children, twenty stimuli may be presented, making 20 a perfect score.

**Critique:** The AVIT has been criticized for 1) being based on faulty hypotheses, 2) not being a dependable tool at the Kindergarten level when a predictor of reading ability is needed, and 3) not being highly correlated with reading ability after 4th grade.

Birch's research failed to investigate three factors which provide alternative explanations for his findings:

- a. The possibility of earlier development of intersensory integration as ascertained by infant studies.
- b. The possibility that the same results could be obtained by intra-modal conditions, eliminating the need for an inter-modal explanation.
- c. Purely temporal-spatial ability was not measured independently of the inter-modal condition.

Although not conclusive, later research indicated that it is the temporal-spatial task which best correlates with reading age. It was found that learning-disabled children did not improve their temporal-spatial abilities, while normal children did improve with age. Even more recently, research has shown that both the temporal-spatial ability and inter-modal integration are related to reading ability and to each other. Auditory temporal stimuli are more easily decoded than visual temporal stimuli, probably because the auditory system is better adapted to temporally-distributed stimuli (such as language), while the visual system is better adapted to spatial pattern decoding (such as pictures).

At the Kindergarten level, a large number of children have difficulty conceptualizing the task they are asked to perform on the AVIT. By the end of Kindergarten, half of the children achieved a score of 5 or less. Only the upper 10% of children were able to achieve a score of 8.

The correlation of the AVIT with reading ability is strongest at the end of grade 1 and then declines gradually through grade 5, although it remains significant. It may be that the strong role played by phonics in reading (auditory-visual process) at the primary level explains the higher correlation in these grades. One author was surprised to find a correlation between the AVIT and both mental and written arithmetic in the intermediate (4th and 5th) grades.

In conclusion, the AVIT is a useful tool in testing for reading readiness. The highest degree of correlation with reading is obtained when a battery of readiness testing is administered, such as the AVIT, Grooved Pegboard, Visual Memory (Tachistoscope), and Six-Figure Divided Form Board. Such a combination may account for up to 50% of the variation in reading skills among a group of primary students. The AVIT is most useful in grades 1 and 2, although it maintains a significant correlation through at least grade 5.
Survey Results (1997):
How often used: 2.77. 29 optometrists of a total 91 used this test “frequently” or “all the time”. 28 optometrists marked it as “rarely” used or “don’t use”.

Usefulness: 3.10. 41 optometrists of a total 91 rated this test’s usefulness as “very” to “extremely” useful in their practice.

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References:
BEERY VISUAL-MOTOR INTEGRATION TEST (BEERY VMI)

Purpose: The Beery VMI is primarily designed to serve as a screening device to help determine the child’s ability to motorically copy geometric forms from visual stimuli alone. Keith Beery discovered that the child’s ability to copy geometric forms correlated significantly with their academic achievement. Therefore, the purpose of the Beery VMI is to determine which child is at risk for learning difficulties.

Indications: This test is designed for preschool and early grade school children, but may be utilized for anyone ranging from age two years through adulthood (norms are established from 2-11 through 18-0). The test can be administered for group or individual screenings.

Apparatus and Setup: The test utilizes an administration manual, student test booklet, blank paper, and a #2 pencil without eraser.

Time Required: Variable. This is not a timed test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Beery VMI. Proper use of the test requires the purchase of the Beery VMI and adherence to the protocol listed in the test manual.

Preset (Administration): The test booklet is turned over so the bound edge is toward the child. There are 24 geometric forms which are to be copied in order. Only one try on each form is allowed (no erasing). Make sure the test booklet and each child’s body remains “centered and squared” with the desk throughout testing. Since the test booklets are reused, place a sheet of paper on top so the child can draw the test figures directly below. Have the child open his booklet by turning from the top. Make sure the booklet is opened correctly and the child is seated properly. Point to Form 1 and say, “Can you make one line like that?” Point to the child’s sheet of paper, which is aligned directly below the first form, and say, “You make yours right here.” Encourage the child, but do not provide clues by tracing the stimulus. Continue prompting the child for as many forms as necessary. When the child understands, say, “Go right ahead and do the rest of them. You may turn to the next page when you have finished this one.” If the child does not understand a task or fails the first three forms, turn to the back of the first sheet and make repetitive vertical pencil marks. Invite the child to draw marks like yours. Repeat this procedure using horizontal lines and then circles. If the child succeeds on any of these forms, let him try again to copy the forms directly. Testing may be stopped after the child has “failed” on three consecutive forms.

What to look for: For each geometric form of the Beery VMI there is a page of scoring criteria in the test manual. Each page gives the age norm and the requirement for passing (or failing) each geometric form. The scoring criteria start on page 43 of the manual. If there is any doubt whether a form should be marked “passed” or “failed” after the criteria have been studied, mark “passed.” Inexperienced examiners sometimes tend to be too strict in their judgment of the forms.

Scoring: To determine the VMI age equivalent for a child, add up the number of forms answered correctly up to the three consecutive failures. This total is the child’s Raw Score. For example, if a child passed the first ten forms, failed the next three forms, and then passed the next one, his Raw Score would be 10. Refer to the table on page 93 of the manual to find the age equivalent that corresponds with the child’s raw score. Percentile
and standard score equivalent of raw scores for various ages will be found in the tables on pages 94-103.2,3

Beery VMI Raw Scores to Age Equivalents

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Age Equivalent</th>
<th>Raw Score</th>
<th>Age Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>18-0</td>
<td>25</td>
<td>9-3</td>
</tr>
<tr>
<td>49</td>
<td>17-5</td>
<td>24</td>
<td>9-0</td>
</tr>
<tr>
<td>48</td>
<td>16-11</td>
<td>23</td>
<td>8-9</td>
</tr>
<tr>
<td>47</td>
<td>16-4</td>
<td>22</td>
<td>8-7</td>
</tr>
<tr>
<td>46</td>
<td>15-11</td>
<td>21</td>
<td>8-4</td>
</tr>
<tr>
<td>45</td>
<td>15-7</td>
<td>20</td>
<td>8-1</td>
</tr>
<tr>
<td>44</td>
<td>15-2</td>
<td>19</td>
<td>7-11</td>
</tr>
<tr>
<td>43</td>
<td>14-9</td>
<td>18</td>
<td>7-8</td>
</tr>
<tr>
<td>42</td>
<td>14-5</td>
<td>17</td>
<td>7-5</td>
</tr>
<tr>
<td>41</td>
<td>14-0</td>
<td>16</td>
<td>7-2</td>
</tr>
<tr>
<td>40</td>
<td>13-8</td>
<td>15</td>
<td>6-11</td>
</tr>
<tr>
<td>39</td>
<td>13-5</td>
<td>14</td>
<td>6-8</td>
</tr>
<tr>
<td>38</td>
<td>13-1</td>
<td>13</td>
<td>6-6</td>
</tr>
<tr>
<td>37</td>
<td>12-9</td>
<td>12</td>
<td>6-3</td>
</tr>
<tr>
<td>36</td>
<td>12-5</td>
<td>11</td>
<td>6-0</td>
</tr>
<tr>
<td>35</td>
<td>12-0</td>
<td>10</td>
<td>5-10</td>
</tr>
<tr>
<td>34</td>
<td>11-8</td>
<td>09</td>
<td>5-6</td>
</tr>
<tr>
<td>33</td>
<td>11-5</td>
<td>08</td>
<td>5-2</td>
</tr>
<tr>
<td>32</td>
<td>11-2</td>
<td>07</td>
<td>4-10</td>
</tr>
<tr>
<td>31</td>
<td>10-10</td>
<td>06</td>
<td>4-7</td>
</tr>
<tr>
<td>30</td>
<td>10-7</td>
<td>05</td>
<td>4-3</td>
</tr>
<tr>
<td>29</td>
<td>10-4</td>
<td>04</td>
<td>3-11</td>
</tr>
<tr>
<td>28</td>
<td>10-0</td>
<td>03</td>
<td>3-6</td>
</tr>
<tr>
<td>27</td>
<td>9-9</td>
<td>02</td>
<td>3-2</td>
</tr>
<tr>
<td>26</td>
<td>9-6</td>
<td>01</td>
<td>2-11</td>
</tr>
</tbody>
</table>

Critique: The Beery VMI utilizes geometric forms and is relatively culture independent. This makes the test useful for children in the United States and many other countries. The test is particularly useful in screening preschool and elementary school-aged children with learning disabilities involving visual-motor integration. The Beery VMI is easy to administer and can be given individually or in groups. More than 50% of children aged 9 years 6 months passed form 18, but it is not until age 10 years 7 months that the average number of correct forms totals 18. This illustrates that the geometric forms do not progress from easiest to most difficult in perfect sequence. Generally speaking, the forms are arranged in order from simple to complex. Additionally, strengths and weaknesses within performances of individuals will be found. It has been found that the Beery VMI correlates with the TVAS ($r=0.815$, $p=0.002$) in a study by Wesson.4

In 1975, Koppitz theorized that visual-motor integration skills compare to IQ scores for children with average, but not superior intelligence. This hypothesis was testing in work done by Aylward and Schmidt in 1986. They found that the Beery VMI correlates with IQ in the same way Koppitz theorized with a correlation of 0.40 ($p<0.01$) for the average
group and with a correlation of 0.11 (not significant) for those children in the superior
group. In utilizing this test it is important to keep in mind that a child may have a high IQ
and perform very poorly if he has poor motor abilities. An example of this may be a bright
child with cerebral palsy.

The Beery VMI is well standardized, but has a limited geographic distribution. Scoring the
Beery VMI is fairly subjective. Reliability correlation for two or more scores have ranged
from .58 to .99. Reliability correlation for the same children taking the VMI test twice have
ranged from .63 to .92.

In terms of concurrent validity, correlation between the VMI and measures of handwriting
and reading have averaged from .58 to .50 respectively. Correlation with reading and other
academic achievement tests have tended to be higher for the primary grades than for the
upper grades. Brain injured, educable mentally retarded, and partially sighted children
have done less well on the VMI than their peers.

In terms of predictive validly, researchers have found the VMI to be valuable when used in
combination with other measures. In one study, the VMI was found to be particularly
sensitive in predicting high risk boys in kindergarten who subsequently had reading
difficulties. Comparison of achievement at the end of kindergarten and first grade indicated
that the VMI, in combination with an auditory-vocal association test, best predicted
achievement. However, predicative correlation declines as children move up the grade
levels.

Children exhibiting delays on the VMI (e.g., failing 6 months or below their chronological
age) will require further diagnostic testing to determine the nature of the problem.

In a retrospective study by Tassinari and Eastland they report that scores on the Beery
VMI improved by a statistically significant amount when comparing performance on the
VMI prior to an office and home-based therapy program to scores after completion of
vision therapy. 85% of the 46 tested improved from a failing score to a passing level (a
score of 93); while 72% of the subjects improved their standard score by two or more
Standard Errors of Measurement (SEM). In Tassinari and Eastland’s research, the 2 SEM
is equal to 11.62.

Survey Results (1997):
How often used: 3.84. 62 optometrists of a total 91 used this test “frequently” or “all the
time”.

Usefulness: 4.24. 61 optometrists of a total 91 rated this test’s usefulness as “very” to
“extremely” useful in their practice.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Keith E. Beery
ATTN: Modern Curriculum Press
13900 Prospect Road
Cleveland, OH 44136
References:
1. Applebaum SA, DeGandi GA. Sensory integration standardization test. Optometric
2. Beery KE. Developmental test of visual motor integration. Chicago: Follett
3. Beery KE. Revised administration, scoring and teaching manual for the developmental
4. Wesson MD. Diagnosis and management of reading dysfunction for the primary care
5. Aylward EH, Schmidt, S. An examination of three tests of visual motor integration.
6. Tassinari JD, Eastland RQ. Vision therapy for deficient visual-motor integration. Jour
DEVELOPMENTAL EYE MOVEMENT TEST (DEM)

Purpose: The DEM provides the clinician with an objective measure on a child’s eye movements and oculomotor ability. The author states that it can provide the practitioner feedback on “how the reader processes visual information during reading and non-reading tasks.”

indications: The DEM is normed for children ages 6 - 13. It should be administered to children whom the practitioner suspects decreased reading skills due to deficiencies in oculomotor skills.

Apparatus and Setup: DEM test booklet, test blank for recording performance, and a stop watch.

Time Required: Approximately five minutes for explanation and performance.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Developmental Eye Movement Test. Proper use of the test requires the purchase of the Developmental Eye Movement Test and adherence to the protocol listed in the test manual.

Preset (Administration): The DEM consists of three sub-tests (A, B and C). The three sub-tests must be given in specific order. Subtests A and B are the vertical components, sub-test C being the horizontal component.

Pre-test: The pre-test should be administered to all children 6 years of age. Say, "See this row of numbers? Please say these numbers out loud for me". The child should be able to read the row aloud in 12 seconds or less. The examiner should not provide any prompting. Finger pointing is allowed during the pre-test. It is a test of number knowledge and articulation and if the child is unable to perform this task, the DEM should not be administered.

Vertical Test: Place test plate A before the patient. Say, "I want you to carefully read the numbers down the two columns like this as quickly as you can". (Point to the top of the first column and motion with finger down the column. Repeat for the right column). Finger use is not permitted on this portion of the test. Tell the child, "Do not use your finger. Use only your eyes". Record the time it takes to complete Test A on the test blank.

Place test B before the patient. Administer exactly as test A. Record the time it takes to complete test B on the test blank.

Horizontal Test: Place test plate C before the patient. Say, "I want you to carefully read the numbers across the rows like this as quickly as you can". (Point to the first number of the top row. Motion with your finger along the line from left to right. At the end of the first line, motion finger to the beginning of the second line. Continue this for the next two lines). Make sure the child understands to continue the test upon completion of one row without interruption to the bottom of the page. Record the time it takes to complete test C on the test blank.

Scoring: Vertical time score is determined by adding the time to complete tests A and B. Record this time on the test blank. The vertical time score helps to determine the child’s automaticity of number calling ability.
Horizontal time score is determined by adjusting the time to complete test C by compensating for errors of omission and addition. The time is adjusted upward when numbers are omitted and downward when more than 80 numbers are read. The Horizontal Time is a measure of number calling ability in a horizontal spatial array. Several components may be contributing to performance on this task (short term visual memory, attention, spatial awareness). Therefore, it is important to differentially diagnose and assess other potential areas of possible deficiency. The formula for adjusting the Horizontal time score is as follows:

\[
\text{Adjusted Horizontal Time} = \frac{\text{Raw Score} \times 80}{80 - \text{Additions} + \text{Omissions}}
\]

The Ratio score is determined by dividing the adjusted Horizontal Time by the Vertical Time. Ratio scores which are higher than the expected normal values suggests number calling with horizontal eye movements are more difficult for the patient as compared to calling the same amount of numbers in a vertical array. From the Ratio score, four clinical response types have been identified:

Type I Behavior: Essentially normal performance in Horizontal Time, Vertical Time, and Ratio.

Type II Behavior: Characterized as abnormally increased time to complete the Horizontal Test in the presence of normal performance on the Vertical Test. The Ratio would be abnormally high in this case. Type II behavior is characteristic of oculomotor dysfunction.

Type III Behavior: Typified as an abnormal increase in both the Horizontal Test and Vertical Test times, but with a normal Ratio. In the presence of a normal Ratio, the Horizontal Test time is influenced and increased because of an abnormal baseline. This represents a case of difficulty in automaticity in number calling skills, not an ocular motility deficit.

Type IV Behavior: Increased Horizontal and Vertical Test times, and an abnormally high Ratio. This case is a combination of Type II and Type III behavior patterns. There are deficiencies in automaticity/oculomotor skills.

The normative analysis for the Developmental Eye Movement (DEM) test:

<table>
<thead>
<tr>
<th>Age</th>
<th>Vertical Time (seconds)</th>
<th>Mean (S.D.)</th>
<th>Horizontal Time (seconds)</th>
<th>Mean (S.D.)</th>
<th>Errors</th>
<th>Mean (S.D.)</th>
<th>Ratio (H/V)</th>
<th>Mean (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0 - 6.11</td>
<td>63.11 (16.59)</td>
<td>98.26 (32.61)</td>
<td>15.22 (11.49)</td>
<td>1.58 (0.45)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0 - 7.11</td>
<td>54.83 (9.20)</td>
<td>87.94 (28.18)</td>
<td>12.50 (12.91)</td>
<td>1.60 (0.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0 - 8.11</td>
<td>46.76 (7.89)</td>
<td>57.73 (12.32)</td>
<td>4.61 (6.91)</td>
<td>1.24 (0.18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 - 9.11</td>
<td>42.33 (8.20)</td>
<td>51.13 (13.30)</td>
<td>2.17 (4.10)</td>
<td>1.21 (0.19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 - 10.11</td>
<td>40.28 (7.43)</td>
<td>47.64 (10.11)</td>
<td>1.91 (2.68)</td>
<td>1.19 (0.17)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.0 - 11.11</td>
<td>37.14 (5.42)</td>
<td>42.62 (7.61)</td>
<td>1.68 (2.34)</td>
<td>1.15 (0.13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0 - 12.11</td>
<td>35.14 (5.87)</td>
<td>39.35 (8.11)</td>
<td>1.11 (1.17)</td>
<td>1.12 (0.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.0 - 13.11</td>
<td>33.75 (6.53)</td>
<td>37.56 (7.23)</td>
<td>1.61 (2.15)</td>
<td>1.12 (0.12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What to Look For: Substitutions, omissions, additions and transpositions. For the horizontal portion of the DEM, these errors are to be marked on the test blank. Errors need not be accounted for on the vertical portion of the test. If every entire line is skipped, count each number (5 omissions) when using the formula for adjusting Horizontal Time, but when recording “total errors”, the whole line omission only counts as ONE error.

Critique: Test-retest reliability as reported by the authors of the DEM was 0.89 for vertical time scores, 0.86 for horizontal time scores, and 0.57 for ratio scores. Interexaminer reliability was determined to be 0.81 for vertical time scores, 0.91 for horizontal time scores and 0.57 for the ratio score. Error coefficients on both test-retest and interexaminer were not significant, at 0.07 for each.

It has been theorized by Gilbert that the control used in making eye movements closely approximates that which is used in reading. Therefore, Gilbert states the DEM is a good test to use clinically to evaluate eye movements. In research conducted by Kulp and Schmidt, their findings suggest that the DEM is too difficult a test for most kindergartners. They also state the DEM is able to factor out the automaticity of number knowledge.

Rouse et al evaluated the test-retest reliability of the DEM in a population of thirty 3rd grade students. Results showed moderate correlation for vertical (r=0.65) and horizontal (r=0.58) times, while the ratio score’s reliability correlation (r=0.196) was very low.

Survey Results (1997):
How often used: 3.36. 46 of the total 91 responding optometrists reported using the DEM “all the time” or “frequently”.

Usefulness: 4.20. 50 of the responding optometrists indicate they feel the DEM is “extremely” or “very” useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Bernell Corporation
750 Lincoln Way East
South Bend, IN 46634

References:
DEVELOPMENTAL TEST OF VISUAL PERCEPTION (DTVP-2)

Developed by Hammill, Pearson and Voress

Purpose: The DTVP-2 is a battery of eight subtests that measure the different but interrelated visual perceptual and visual-motor abilities. The eight subtests are: Eye-hand Coordination, Positions in Space, Copying, Figure-ground, Spatial Relationships, Visual Closure, Visual-motor Speed, and Form Constancy. The purpose of this test is to document the presence and degree of visual perceptual deficits in children. The availability of quotients for both motor-reduced visual perceptual skills allows a comparison to be made between the two abilities, which contributes greatly to understanding any weakness a child might have.

Indications: The DTVP-2 is designed for use with children ages 4 through 10 years. The normative sample consists of 1,972 children in 12 states.

Apparatus and Setup: The complete setup includes one copy of the DTVP-2 response booklet, the child's habitual near lens prescription, a pencil and a stopwatch.

Time Required: The entire test takes 30 to 60 minutes to administer. To avoid needless delay, the examiner should encourage the patient to progress fairly rapidly through the test and not to spend too much time on specific items.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Developmental Test of Visual Perception. Proper use requires the purchase of the Developmental Test of Visual Perception and adherence to the protocol listed in the test manual.

Preset (Administration): Test paper is placed on a desktop that is appropriately high for a child's size and a pencil is placed next to it. It is important for the examiner to follow the exact instruction set detailed on pages 8-17 in the Examiner's manual.

What to Look for: Be alert to the child's level of fatigue and stop testing if s/he shows signs of tiring or losing interest. Consistently praise and encourage the patient, but don't prompt or otherwise deviate from the testing procedures.

Recording Responses: All observations should be documented directly on the Profile/Examiner Record Form. Notes should include: noise level, interruptions, distractions, light, temperature, energy level, rapport, perseverance and attitude toward the test to determine the validity of the evaluation.

Scoring: The DTVP-2 subtests should be administered in the following order: 1) Eye-Hand Coordination, 2) Position in Space, 3) Copying, 4) Figure-Ground, 5) Spatial Relations, 6) Visual Closure, 7) Visual-Motor Speed and 8) Form Constancy. All answers should be marked directly in the DTVP-2 Response Booklet by the patient and after all testing is complete the scoring transferred to the Profile/Examiner Record Form.

Critique: The DTVP-2 is a reliable, valid and nationally standardized visual perception test. The DTVP-2 yields five types of scores: raw scores, percentiles, subtest standard scores, age equivalent and composite quotients. Many evaluators feel this is the most accurate test of visual perception. However, it is also the most time-consuming and difficult test to administer of those optometrists currently use. In addition, it has a strong motor component that may lead to poor scores in children who have fine motor disturbances or difficulty in coordinating their hand movements to vision.
Survey Results (1997):
How often used: 1.78. 55 optometrists of a total 91 reported they “don’t use” the DTVP-2. Fifteen of the 91 reported using the test “frequently” or “all the time”.

Usefulness: 3.07. 15 optometrists of a total 91 marked the DTVP-2 as “very” or “extremely” useful. When calculating the average usefulness rank, we do not use “blank” responses (62 of the 91 surveys).

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Pro-Ed
8700 Shoal Creek Blvd.
Austin, TX 78758
(512) 451-3246

References:
GRiffin Dyslexia Tests

The Griffin dyslexia tests are designed to test specific language deficits: dyseidesia, dysphonesia, and dysnemkinesia. The Griffin Dyslexia tests are based upon the Boder model which subtypes deficits into eidetic, phonetic, nemkinetic, as well as combination deficits. Dyseidetic individuals will have poor sight-word recognition and instead will depend on phonetic skills to decode words. Typically reading is slow and difficult and spelling is very poor particularly with non-phonetic words. Dysphonetic individuals will have poor “word attack” skills or decreased phonetic ability (cannot break words into word parts) to decode unknown words. These individuals depend on contextual clues to identify words when decoding. Individuals with dysnemkinesia reverse numbers and letters when writing. Griffin et al. cautions the examiner by stating, “most young children have reversals but dysnemkinesia is indicated when there is an abnormally high frequency of reversals.”

The examiner should bear in mind that this family of tests are not reading tests, because only decoding and encoding is assessed. Comprehension and other important aspects of reading are not evaluated with these tests.

Adult Dyslexia Test (ADT): The ADT is designed to identify adults who exhibit specific eidetic and phonetic coding problems found in dyslexia. Similar to the Dyslexia Determination Test (DDT) and The Dyslexia Screener (TDS); however, the ADT utilizes a more advanced vocabulary to eliminate the ceiling effect caused by other tests.

Dyslexia Determination Test (DDT): The DDT is used to identify individuals who exhibit dyslexic patterns of response in the areas of reading, writing, and spelling. It is slightly longer and more comprehensive than The Dyslexia Screener (TDS) and is utilized when the practitioner wishes a more thorough search of the patient’s problematic areas. It is for grades 2 through 12.

The Dyslexia Screener (TDS): The TDS is used as a screening test when dyseidesia, dysphonesia, or dysnemkinesia may be suspected. It is a shortened version of the DDT. The TDS is for grades 2 through 9.

The Dyslexia Screener for First Graders (DSF): The DSF was designed for children younger than the recommended age for The Dyslexia Screener (TDS) and the Adult Dyslexia Test (ADT). The DSF utilizes the same testing strategies as the TDS and the ADT. It normed for grades 1.5 through 1.9.

References:
ADULT DYSLEXIA TEST (ADT)

Purpose: The ADT (fashioned off of the DDT) is used to identify adults who exhibit specific eidetic and phonetic coding problems found in dyslexia.

Indications: The test is indicated for any adult suspected of having reading problems or a learning difficulty. The authors of the ADT conservatively estimate the prevalence of dyslexia in the adult population as ten percent. The ADT might be able to better screen for dyslexic adults who might have otherwise passed the other Griffin dyslexia tests due to the "ceiling effect" found with them. The DDT and TDS are normed for primary and secondary students only.

As with all dyslexia suspects, factors such as lack of educational opportunity, sensory impairment, socioeconomic causes must be ruled out in all cases of learning disabilities. (Griffin, Christenson, and Walton 1990)

Apparatus and Setup: The Adult Dyslexia Test packet consists of test booklet which contains a list of "decoding" words, the decoding test form, the encoding test form, and an instruction manual.

Time Required: Total examination time is approximately 10-15 minutes.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Adult Dyslexia Test (ADT). Proper use of the test requires the purchase of the Adult Dyslexia Test and adherence to the protocol listed in the test manual.

Preset Administration:
Decoding Administration: The subject is asked to read aloud (decode) a list of words written on the test booklet. The word lists are arranged by grade levels with seven words for each grade. Griffin, et al. state that the test should begin with the 1st grade list, but the PUCO Visual Perceptual Testing Manual authors feel that the test can be sped up by adjusting the starting point to fit the subject (always remember to error on the side of underestimating their decoding potential).

The examiner scores the responses on the decoding form, marking the yes (Y) box when a word is correctly decoded within 2 seconds. If the word is unknown or decoded after 2 seconds or more, the no (N) box is marked. The examiner may wish to pace the subject by using a marker and exposing each word successively if the subject is reluctant to respond quickly.

The decoding grade level is determined when the subject last obtains four or more correct responses in a particular grade level (50% or greater being the cut-off criterion). Once the decoding level has been established, the subject continues decoding until there are seven no (N) tallies above the established decoding level. (This is necessary in order to obtain a sufficient number of no (N) words for phonetic encoding.)

The decoding grade level should be marked in the appropriate space at the bottom of the decoding form.

What to Look For: The examiner simply listens for correctly read words within a time limit of two seconds or less.
Eidetic Encoding Administration  The subject is given a pencil or pen and asked to write down (encode) the correct spelling of words dictated by the examiner. The last seven words from the list of known (Y) or eidetic words are dictated by the examiner to the patient.

Eidetic encoding is performed immediately following decoding assessment. The examiner dictates words starting with the last word successfully decoded (Y-word) at the established decoding grade level and works backwards until seven Y-words are dictated. The subject is instructed to write each of the seven dictated eidetic (Y) words being careful to spell each word correctly on the left-hand side of the encoding form.

Eidetic encoding is finished when the appropriate seven Y-words have been attempted by the subject.

What to Look For:  The examiner looks for correctly spelled words.

Phonetic Encoding Administration  The examiner explains to the subject that the words about to be dictated should be spelled phonetically ("just the way they sound"). It is helpful to provide the subject with examples such as shud for should, uv for of, and foren for foreign, etc.

The examiner begins dictating unknown (N) words with the first unknown word at a grade level above the established decoding level. (For example, if the patient has an established decoding level at grade seven, start dictating with the first unknown word in grade eight.)

The subject is finished when he/she has attempted to write all seven N-words (phonetically) on the right-hand side of the encoding form.

What to Look for:  The examiner judges each response to be correct if it is a good "phonetic equivalent" of the dictated unknown word. A list of phonetically correct spellings is included in the administration manual as a guide for scoring.

Scoring:  The examiner scores the encoding results to determine the percentage of correct eidetic and phonetic words. Divide the number of correct eidetic spellings and phonetic spellings by the number of words attempted. The percentages are based out of 7 questions so the values will be 0%, 14%, 29%, 43%, 57%, 71%, 86% and 100%.

Eidetic encoding correctness is simply determined by comparing the subject's spelling against the correct dictionary spelling for the word (as found on the Decoding Form and word lists).

Phonetic encoding correctness requires judgment on the part of the examiner. The judgment involves determining whether or not the spelling is a reasonably good phonetic equivalent of the word. Generally this is not difficult to discern as the examiner checks to see if the combination of letters could be pronounced to sound like the word.

Once percentage scores for encoding have been determined the examiner should refer to the table listed below for interpretation of encoding scores.
Critique: The dyslexia tests written by Griffin, Christenson, and Walton, although used by optometrists, may not be widely accepted by the educational/psychological community. The term "dyslexia" is an emotionally charged term with many people. There is no universally accepted definition for "dyslexia" at this time. The ADT like the other dyslexia tests written by the above authors, are designed to test specific language deficits: dyslexia, dysphonesia, and dysnemkinesia. The ADT tests for these deficits by directly assessing the patient's ability to correctly decode and encode (spell) specific words in characteristic patterns. The authors' viewpoint, in using their diagnostic approach, is that there are several subtypes of dyslexia and that it should no longer be viewed as a homogenous disorder.

No information regarding standardization or normative data is available from the authors at this time. The authors comment on the ADT's levels of validity: face, content, concurrent, construct, and predictive validity. The authors feel that the ADT provides acceptable face validity because it "appears to be a sensible approach to assess coding dysfunctions which cause reading and spelling problems in dyslexia." The authors assess their content validity with the same rationale. If "reading problems can be divided into two broad categories, coding problems and comprehension problems", then the ADT can adequately evaluate one part of the reading process (coding). Their view is that the individual who has a coding problem will struggle with reading and comprehension. Because the DDT and TDS showed concurrent validity with other coding tests (WRAT, PIAT, and Lindamood), they believed it was "reasonable to relate the ADT with the DDT and the TDS as to diagnostic coding results." The authors believe that the ADT reliably evaluates coding ability used in reading (or has good construct validity). Dyslexia is not completely predictive of having reading problems. However, a dyslexic is likely to be a poor reader,
even though comprehension may not be affected. It is for this reason the ADT has predictive validity. The authors believe that because the ADT has been shown to be a predictor of types of dyslexia, it may also be used as a predictor of poor reading skills.

Survey Results (1997):
How often used: 1.15. 72 of the responding 91 optometrists report they "don't use" the ADT.

Usefulness: 2.23. 3 of the responding optometrists report the ADT to be "extremely" or "very" useful. 5 report it to be "moderately" useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Reading and Perception Therapy Center
3840 Main Street
Culver City, CA 90232

References:
DYSEXIA DETERMINATION TEST (DDT)

**Purpose:** The DDT is used to identify individuals who exhibit dyslexic patterns of response in the areas of reading, writing, and spelling.

**Indications:** The test is indicated for any child suspected of having a learning disability.

**Apparatus and Setup:** The apparatus and setup includes an examiner’s instruction manual (52 pages), recording pages (2 pages), and a booklet of word lists (23 pages).

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Dyslexia Determination Test. Proper use requires the purchase of the Dyslexia Determination Test and adherence to the protocol listed in the test manual.

**Preset and Administration:** The DDT tests three basic types of dyslexia: 1) Dysnemkinesia (reversal problems), 2) Dysphonesia (phonetic problems in reading and spelling words), and 3) Dyseidesia (eidetic problems in reading and spelling words). It is administered as a one-on-one procedure. Part I of the DDT tests for Dysnemkinesia, while Part II tests both Dysphonesia and Dyseidesia.

**Part I - Dysnemkinesia**

Dysnemkinesia is assessed by requiring the patient to write the numbers 1-10 and to print the entire alphabet in upper- and then lower-case letters.

**What to Look For:** The examiner should look for handedness used in printing, reversed letters and numbers, omissions, poor posture, pencil grip irregularities, and any other observed problems.

**Recording Responses:** The examiner records impressions and observations on the front side of the Interpretation Recording Form.

**Scoring:** A score is obtained by counting the number of 1-10 reversals and adding to that the number of alphabet reversals, either upper- or lower-case, whichever is greater. Guidelines are given in the manual to identify the grade level equivalent of the patient’s letter and number formation skills.

<table>
<thead>
<tr>
<th>GRADE LEVEL</th>
<th>REVERSAL FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Grade</td>
<td>Nine</td>
</tr>
<tr>
<td>Second Grade</td>
<td>Seven</td>
</tr>
<tr>
<td>Third Grade</td>
<td>Five</td>
</tr>
<tr>
<td>Fourth Grade</td>
<td>Three</td>
</tr>
<tr>
<td>Fifth Grade</td>
<td>None expected, however an occasional one may be considered to be within normal limits</td>
</tr>
</tbody>
</table>

Comparison is then made to actual grade level placement to identify the patient as experiencing mild, moderate, marked, or no dysnemkinesia.
### SCORING DYSNEMKINESIA

| One grade level below placement | Mild       |
| Two grade levels below placement| Moderate   |
| Three grade levels below placement| Marked    |

**Part II - Dysphonesia and Dyseidesia**

Both Dysphonesia and Dyseidesia are assessed using a booklet of word lists ranging from the preprimary to college level, each containing 10 words.

**Subtest I:** The first subtest assesses the patient's ability to decode words. Start testing the patient with the word list that is two years below the reported reading level. The patient views the word list (Form A) at his usual reading distance while the examiner views the Decoding Patterns Form. The first part of this subtest assesses decoding by asking the patient to orally sight-read words. This is eidetic ability. The examiner places a check mark in the "E" (eidetic) column to signify words read correctly. The examiner must instruct the patient to "go on to the next word" if the patient lingers on a word for more than 2 seconds. If the patient correctly encodes at least 50% of the words on the list, they are allowed to proceed to the next reading level. When the patient cannot identify at least 50% of the words on the list, eidetic testing is stopped.

The patient is then required to attempt to read the words missed on the first part of the test, this time allowing 10 seconds of exposure. This tests their phonetic ability. The examiner puts a check mark in the "P" (phonetic) column on the score sheet if the word is read correctly in a 10 second time period. If the words are still not read correctly, a check mark is placed in the "U" (unknown) column. Decoding testing should continue until at least ten "U" words are recorded.

**What to Look For:** The examiner simply looks for correctly read words.

**Scoring:** To score, the test columns are totaled for each grade level. The highest grade level of 50% sight-word recognition is entered as the DDT grade level. A value judgment is made as to whether the patient uses a more phonetic or a more eidetic mode of processing.

**Subtest II:** The second subtest focuses on encoding, requiring the patient to spell words eidetically and phonetically. Starting with the patient's DDT Grade Level, the examiner calls out the odd-numbered words that were known eidetically by the patient (these are the words marked in the "E" column), working backward to lower grades, until a total of ten words are reached. Have the child use the back side of the interpretation form.

**What to Look For:** The examiner looks for correctly spelled words.

**Scoring:** The number of correctly spelled words is recorded as a ratio (e.g. 4/10 or 40%) on the front side of the Interpretation Recording Form. Table 1 shows this scoring procedure.
Table I: Taken from the Dyslexia Determination Test manual

<table>
<thead>
<tr>
<th>Score of Encoding of Flash-Known Words</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(100%) 10/10</td>
<td>Above normal</td>
</tr>
<tr>
<td>(80%) 8/10</td>
<td>Normal</td>
</tr>
<tr>
<td>(60%) 6/10</td>
<td>Borderline normal</td>
</tr>
<tr>
<td>(40%) 4/10</td>
<td>Mild Dyseidesia</td>
</tr>
<tr>
<td>(20%) 2/10</td>
<td>Moderate Dyseidesia</td>
</tr>
<tr>
<td>(0%) 0/10</td>
<td>Marked Dyseidesia</td>
</tr>
</tbody>
</table>

Next, the examiner reads aloud ten "U" words (words that are deemed unknown to the child). Again, the child attempts to spell these words, and uses the back side of the interpretation recording form to write his responses.

**What to Look For:** The examiner determines the responses to be correct if the patient recorded the "phonetic equivalent" of the list word (e.g. "caf" for "calf").

**Scoring:** The number of correctly spelled words is recorded as a ratio (e.g. 7/10 or 70%) on the front side of the Interpretation Recording Form. The following tables are used to determine where the child's decoding ability lies. To use these charts, first find the appropriate column by comparing the child's DDT decoding level to his actual grade placement. For example, if the child's decoding level was 2nd grade, and they were currently enrolled in 3rd grade, the appropriate column would be "decoding at one year below grade placement". Next, follow to column down until you reach the percentage of correctly spelled words for the section. The result will tell the practitioner if the child is decoding "greatly above normal, above normal, normal, etc..".

Both dysphonesia and dyseidesia levels can be obtained from the aforementioned tables. Table I is taken from the Dyslexia Determination Test Manual (DDT)\(^1\) and is to be used when decoding level is at or above grade placement. Table II is taken from the Supplement to the Examiner's Manual for the Dyslexia Determination Test (DDT)\(^2\) and is to be used when decoding level is below grade placement.

### Table I: Decoding at grade placement

<table>
<thead>
<tr>
<th></th>
<th>Decoding at grade placement</th>
<th>Decoding one year above grade placement</th>
<th>Decoding 2 or more years above grade placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greatly Above Normal</td>
<td>100%</td>
<td>80%</td>
<td>60 - 100%</td>
</tr>
<tr>
<td>Above Normal</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Normal</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>Borderline</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Mild</td>
<td>20%</td>
<td>0%</td>
<td>---</td>
</tr>
<tr>
<td>Moderate</td>
<td>0%</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

### Table II: Decoding below grade placement

<table>
<thead>
<tr>
<th></th>
<th>Decoding below grade placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Normal</td>
<td>100%</td>
</tr>
<tr>
<td>Normal</td>
<td>80%</td>
</tr>
<tr>
<td>Borderline</td>
<td>60%</td>
</tr>
<tr>
<td>Mild</td>
<td>40%</td>
</tr>
<tr>
<td>Moderate</td>
<td>20%</td>
</tr>
<tr>
<td>Marked</td>
<td>0%</td>
</tr>
</tbody>
</table>
Critique: The dyslexia tests written by Griffin, Christenson and Walton, although used by optometrists, are not widely accepted by the educational/psychological community. The term “dyslexia” invokes an emotional charge in many people within the circle, and there is no universal definition for “dyslexia” at this time. The DDT, like the other dyslexia tests written by the above authors, tests for specific language deficits: dysceidesia, dysphonesia and dysnemkinesia. The DDT tests for these deficits by directly assessing the patient’s ability to correctly decode and spell specific words in characteristic patterns. The author’s viewpoint in using their diagnostic approach, is that there are several types of dyslexia, and that it should no longer be viewed as a homogenous disorder.

No information regarding standardization or normative data is available from the authors at this time. The authors comment on the DDT’s level of validity: face, content, concurrent, construct and predictive. The authors feel that the DDT provides acceptable face validity because it “appears to be a sensible approach to assess coding dysfunctions which cause reading and spelling problems in dyslexia.” The author’s assess their content validity with the same rationale. If “reading problems can be divided into two broad categories, coding problems and comprehension problems”, then the DDT can adequately evaluate one part of the reading process (coding). Their view is that an individual who has a coding problem will struggle with reading and comprehension. The DDT showed concurrent validity when compared to coding tests such as WRAT, PIAT and Lindamood. Dyslexia is not completely predictive of having reading problems. However, a dyslexic person is likely to be a poor reader, even though comprehension may not be affected. It is for this reason the DDT has predictive validity. The authors believe that because the DDT has been shown to be a predictor of types of dyslexia, it may also be used as a predictor of poor reading skills.

Examiners are cautioned not to use the DDT in isolation, but only as a part of a battery of general ability and achievement tests. In some parts of the test, the examiner is instructed to make a qualitative value judgment, which would not be reliable for an inexperienced examiner.

Survey Results (1997): 33% of optometrists reported they use this test in their practice.
How often used: 1.80. 10 optometrists who use the DDT reported they use it “all the time” or “frequently”. 20 reported using it “occasionally” or “rarely”. 50 optometrists marked “don’t use”.

Usefulness: 3.08. 17 of the total 91 optometrists find the DDT “very” to “extremely” useful. 13 marked it “somewhat” or “not” useful. 55 survey responses for this test were left blank.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher:
Griffin & Walton
Reading and Perception Therapy Center
380 Main Street
Culver City, CA 90232
References:
THE DYSLEXIA SCREENER (TDS)

Purpose: The Dyslexia Screener (TDS) is a screening test for three types of dyslexic coding patterns: 1) Dyseidetic (poor sight-word recognition), 2) Dysphonetic (poor phonetic ability to decode unfamiliar words), and 3) Dysphoneidetic (mixed - a deficiency in both decoding and encoding).

Indications: The TDS screens the at-risk population to identify appropriately individuals with dyslexic problems and channel them to proper programs.

Apparatus and Setup: The apparatus and setup includes the examiner's instruction manual (50 pages), TDS Decoding Words (10 pages), recording page, and pencil.

Time Required: Approximately five minutes. The TDS is not a timed test, but Part I has time limitations in relationship to scoring.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for The Dyslexia Screener. Proper use of the test requires the purchase of The Dyslexia Screener and adherence to the protocol listed in the test manual.

Preset (Administration): The test is administered as a one-on-one procedure.

Part I - Decoding

Patient reads aloud the words from the TDS word list beginning with the pre-primer words. Not more than 2 seconds is allowed for reading each word. If the word is properly pronounced within one second mark the "Y" (yes) column on the record sheet (these are the known words). "N" (no) is marked if the patient is unable to read the word, mispronounces the word, or takes longer than 2 seconds. Continue through the grade levels until three or more "N's" are marked within a grade level. The decoding level is one grade level below the first grade level where there were more than three "N's". Circle this level on the TDS Decoding Words sheet. Continue to the next higher grade levels until there are five new "N" column marks above the established decoding level.

Part II - Encoding

Eidetic - Instructor dictates the "Y" column words (beginning with the last properly decoded word) and calls them out loud, starting with the higher level words and working backwards to the lower level words until five words are dictated. The patient is to write these words on the left side of the encoding form. Check for correct spelling and record the number of words that are spelled correctly out of five. Record this as a percentage (i.e., 0, 20, 40, 60, 80, 100). This is the eidetic encoding score.

Phonetic - Using the five newly marked unknown words ("N" words) call these aloud from the lower level words to the higher level words. The patient should write these words just the way the word sounds rather than by memorized spelling. Give them an example (e.g., "shud" for "should"). These are written on the right side of the encoding form. Check the patient's words for correct phonetic-equivalent spelling. Record the percentage of words correctly phonetically spelled. This is the phonetic encoding score.

Scoring: Refer to the interpretation chart in Table I, below. Locate the correct column on the top of the table for the Decoding Level of the patient from Part I above. For example, if
the child is in 3rd grade and has a 4th grade decoding level, you would use the column, "Decoding one year above grade placement". Locate the appropriate eidetic and phonetic percentages in the side rows and the corresponding evaluations (above normal, borderline normal, etc.). Check the appropriate boxes on the record forms.

Based upon the encoding evaluations (normal, mildly below normal, markedly below normal etc.) the possibility of dyslexia is determined and appropriate referral is made. Note that this screening method relies on both decoding and encoding results, even though it is the encoding only evaluation that determines the category in Table I. If the patient scores below normal for the eidetic portion of the test then the patient is suspect for dyseidesia. This is difficulties with perception of whole words or visual gestalts and the matching of these perceptions with auditory gestalts. A child with dyseidesia has a very poor sight word vocabulary and must labor through reading by sounding words out.

If the patient scores below normal for the phonetic portion of the test then the patient is suspect for dysphonesia. This is a difficulty with symbol-sound (grapheme-phoneme) integration. A child with dysphonesia will have difficulties sounding words out. They may have a good sight vocabulary but be unable to attack unfamiliar or new words.

If the patient scores below normal on both the eidetic and the phonetic portions of the test then the patient may be suspect for dysphoneidesia. This indicates difficulties in both the eidetic and phonetic areas described above.

Table I. Taken from "The Dyslexia Screener" by Griffin, Walton and Christenson. 1988.

<table>
<thead>
<tr>
<th></th>
<th>Decoding 2 or more years below grade placement</th>
<th>Decoding one year below grade placement</th>
<th>Decoding at grade placement</th>
<th>Decoding one year above grade placement</th>
<th>Decoding 2 or more years above grade placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Normal</td>
<td>---</td>
<td>100%</td>
<td>&gt;80%</td>
<td>&gt;60%</td>
<td>&gt;40%</td>
</tr>
<tr>
<td>Normal</td>
<td>100%</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>Borderline</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Mildly Below Normal</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
<td>---</td>
</tr>
<tr>
<td>Moderately Below Normal</td>
<td>40%</td>
<td>20%</td>
<td>0%</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Markedly Below Normal</td>
<td>20%</td>
<td>0%</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

What to Look For: Dialect of examiner and subject must match. The dictated pronunciation must be taken into account when judging the encoded word the subject attempted to spell phonetically.

Critique: It must be remembered that this is only a screening test and as such it does not determine or define the problem a child is having but rather gives the professional reason or not to investigate further the dyslexia possibility. For further investigation the professional may turn to a test such as the Dyslexia Determination Test (DDT) which is a more extensive test similar to the TDS.

The TDS has a slight tendency to underrate the degree of dyseidesia (one-quarter of a rating point) and shows a trend towards overrating the severity of dysphonesia when compared to the DDT. The correlation between the TDS and the DDT is high for dyseidesia (0.76) and
moderate for dysphonesia (0.62). In comparing the TDS to the DDT, there is not a statistically significant difference in the means for either dyseidesia or dysphonesia.

For test-retest results, there is no statistically significant difference for either dyseidesia (p=0.4349) or for dysphonesia (p=0.5042). Sensitivity of the TDS is rated at 87.5% while specificity is 70%. The TDS provides “high reliability, specificity and sensitivity” for diagnosis dyslexic patients and can be administered at the fundamental level.2

The TDS allows a quick screening procedure which can be used by optometrists, teachers or other professionals. The test should not be used in isolation, but should be a part of a full visual and perceptual work-up. However, this test was developed by optometrists and is not widely used outside the profession of optometry.

Survey Results:
How often used: 1.79. 14 optometrists of the total 91 report using this test “all the time” or “frequently”. 11 report using it “occasionally” or “rarely”, while 53 indicated they “don’t use” the TDS.

Usefulness: 3.11. 17 optometrists of the total 91 report the TDS to be “extremely” to “very” useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Reading and Perception Therapy Center
3840 Main Street
Culver City, CA 90232-2620

References:
DYSLEXIA SCREENER FOR FIRST GRADERS (DSF)

Purpose: The DSF was designed for children younger than the recommended age for The Dyslexia Screener (TDS) and the Adult Dyslexia Test (ADT). The DSF utilizes the same testing strategies as the TDS and the ADT. The DSF is normed and standardized for grade 1.5 up to 2.1. Most children in this age group can decode and encode reasonably well enough to determine whether or not a dysemic or dysphonetic coding pattern exists. The DSF will screen for three basic dyslexic patterns: dysnemkinetic, dyseidetic, and dysphonetic, as well as combinations of these three basic types.

Indications: Any first grade student who has a significant problem with letter reversals, who seems to have trouble with decoding either eidetically or phonetically, and/or who has obvious spelling errors in relation to average students should be tested.

Apparatus and Setup: Decoding Word List, DSF Encoding Form, pencil.

Time Required: Approximately five minutes, depending on the child. This is not a timed test, but some sections have time limitations in relationship to scoring.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Dyslexia Screener for First Graders. Proper use of the test requires the purchase of the Dyslexia Screener for First Graders and adherence to the protocol listed in the test manual.

Preset (Administration):

Part I - Dysnemkinesia

Tested by having the child write the numbers from 1 - 10 and the alphabet, upper case letters only, from A to Z as in the DDT. (The upper case letters are used because first graders typically have not learned lower-case letters as well as the upper case). This is done on the reverse side of the DSF Encoding form. All numbers must be written and at least 20 letters must be known.

Part II - Dyseidesia and Dysphonesia

Testing begins with the word list at the pre-primer level. Each word list contains 20 items. The child is asked to read each of the twenty words, "As quickly as you can". The child is allowed up to two seconds for eidetic coding. If the word was correctly pronounced a check mark is made in the appropriate space in the "E" (eidetic) column. If the word was decoded correctly but more than two seconds elapsed, a check mark is made in the appropriate space in the "P" (phonetic) column indicating phonetic decoding was correct. If an extended period of time elapses (more than 20 seconds) and the child fails to decode the word by pronouncing it, a check mark is made in the appropriate space in the "U" (unknown) column. If the child correctly decodes at least 50% of the words at a specific level, proceed to the next higher word list. This is continued for each successive grade level until the DSF decoding level is established - this is the highest level at which at least fifty percent of the "E" words are successfully decoded. However, testing continues until there are at least ten "U" (unknown) words.

At the established DSF level, the examiner begins dictation of eidetic words (words with in the "E" column). The child is asked to write each word after it is dictated. It is written on the designated line on the back side of the recording form. Dictated E words are written on the lines on the left half of the form. The examiner should start with the last word at the
established DSF decoding level and continue backward to lower grade levels until ten odd-numbered words have been written (encoded) by the subject.

When eidetic encoding is finished, testing for phonetic encoding begins. Starting at the DSF decoding level, the examiner dictates unknown words from the "U" column and proceeds forward (to higher levels) until ten "U" words have been written by the child on the lines on the right half of the paper. The child is instructed to "write the word "just as it sounds". Both odd- and even-numbered "U" words may be used for the phonetic encoding portion of the test. The child may use either upper or lower-case letters to write the words.

**Scoring:**

**Part I - Dysnemkinesia**

Up to 5 reversals are allowed for passing. Six errors (numbers and letters) or more is considered failing and dysnemkinesia is suspected.

**Part II - Dyseidesia and Dysphonesia**

The scoring for this portion of the test is based on the DSF sight word errors coordinated with the eidetic and phonetic spelling errors. First, find the established DSF level (the highest level at which fifty percent or more of the "E" words are successfully decoded) by locating it on the top row of Table I. Next, find the eidetic encoding score (in percentage) by moving down the appropriate column. Utilize this same method using the child's phonetic encoding score. For example, if the child's DSF level was Grade 1.7 (1st grade) and their eidetic encoding score is 30% (three correct spellings of the ten dictated words) the eidetic encoding rank would be "6". If this same child scored 70% on phonetic encoding, the rank assigned would be "2". See Table II to interpret these results.

Table I: Taken from Dyslexia Screener for First-Graders as quoted previously.

"Determination of Ranking of Severity from Encoding Results in Relation to Decoding Levels for Students in the First Grade. Percentages of correct spellings are shown."

<table>
<thead>
<tr>
<th>RANK</th>
<th>Grade 0.5 to 1.1 (pre-primer)</th>
<th>Grade 1.2 to 1.4 (primer)</th>
<th>Grade 1.5 to 2.1 (1st grade)</th>
<th>Grade 2.2 to 3.1 (2nd grade)</th>
<th>Grades 3.2 and higher (3rd or 4th grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>---</td>
<td>100</td>
<td>&gt;80</td>
<td>&gt;60</td>
<td>&gt;40</td>
</tr>
<tr>
<td>2</td>
<td>---</td>
<td>90</td>
<td>70</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>70</td>
<td>50</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
<td>60</td>
<td>40</td>
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</tr>
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<td>6</td>
<td>70</td>
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<td>10</td>
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<td>7</td>
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<td>40</td>
<td>20</td>
<td>0</td>
<td>---</td>
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<tr>
<td>8</td>
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<td>10</td>
<td>---</td>
<td>---</td>
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<tr>
<td>9</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>---</td>
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<td>10</td>
<td>30</td>
<td>10</td>
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<td>---</td>
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</tr>
<tr>
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<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
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<tr>
<td>13</td>
<td>0</td>
<td>---</td>
<td>---</td>
<td>---</td>
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</tr>
</tbody>
</table>
Table II: "Semantic Classification of Severity of Dyslexia According to Ranking of Results"

<table>
<thead>
<tr>
<th>RANK</th>
<th>SPECIFIC CATEGORY</th>
<th>GENERAL CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Above Normal</td>
<td>Above Normal</td>
</tr>
<tr>
<td>2</td>
<td>Above Normal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>High Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>Low Normal</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>High Borderline</td>
<td>Borderline dyslexia</td>
</tr>
<tr>
<td>6</td>
<td>Low Borderline</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mild (high)</td>
<td>Mild dyslexia</td>
</tr>
<tr>
<td>8</td>
<td>Mild (low)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Moderate (high)</td>
<td>Moderate dyslexia</td>
</tr>
<tr>
<td>10</td>
<td>Moderate (low)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Marked (high)</td>
<td>Marked dyslexia</td>
</tr>
<tr>
<td>12</td>
<td>Marked (low)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Marked (very low)</td>
<td></td>
</tr>
</tbody>
</table>

What to Look For: On the phonetic encoding portion of the test (words written on the right side of the encoding page), the examiner must determine if the child has written a reasonable phonetic equivalent. These words are from the "unknown" word list column and the child should not be able to spell them on an eidetic basis. For example, if the child wrote "could" instead of "cud", "kud", or "cuhd" the response is incorrect. Watch for reversals which are screened for in Part I of the DSF.

Critique: The dyslexia tests written by Griffin and Walton, although used by many optometrists, are not widely accepted by the psychological community. They believe the DSF to be a screener at this point in time. The DSF may be considered a test, rather than a screener, if and when validity and reliability studies indicate. The authors commented on the DSF's ability to predict a child's future reading skills by stating "nothing is completely predictable in this regard." However, they believe the DSF to be a good screening procedure for dyslexia. Since dyslexia tends to result in poor reading ability, the authors believe it gives their test good predictive power. No information regarding standardization or normative data is available at this time.

Survey Results: 8% of responding optometrists report using the DSF. How often used: 1.18. 3 optometrists of the total 91 reported using the DSF "frequently". 4 marked "occasionally" or "rarely", while 71 indicated they "don't use" this test.

Usefulness: 2.42. 4 optometrists reported the DSF to be "extremely" or "very" useful. 8 indicated it to be "moderately" or "somewhat" useful. 72 of the responses were left blank.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Reading and Perception Therapy Center
3840 Main Street
Culver City, CA 90232
References:
GARDNER REVERSAL FREQUENCY TEST

Purpose: The Gardner Reversal Frequency Test (GRFT) uses three different subtests to determine whether the child exhibits an unusual number of reversals. Gardner emphasizes that there are several types of single letter reversals (mirror image, inversions, inverted reversals, and rotations) and word reversals (sequence within, or entire word). Therefore, the clinician must be specific when addressing the pattern used by the patient. One must also address whether the errors occur with execution (writing) or recognition (reading, or hearing).

Indications: The test is normed for ages 5 years, zero months to 15 years and 7 months. It would be a valid test to use on anyone having difficulty in school (the "learning-disabled child") especially in the areas of reading and mathematics. The Gardner is a well normed, reliable, and widely used test within the optometric and educational community. Therefore, results obtained from the test will not only give the optometrist an objective method of assessing a child's reversals frequency, but also will allow the optometrist to easily convey this information to other health and educational professionals.

Apparatus and Setup: GRFT test sheets, pencil.

Time Required: Five to ten minutes. Testing time depends on the level of difficulty that the child has with the test. There are no time limits on any of the subtests.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Gardner Reversal Frequency Test. Proper use requires the purchase of the Gardner Reversal Frequency Test from Creative Therapeutics in Cresskill, N.J. and adherence to the protocol listed in the test manual.

Preset (Administration): The GRFT is divided into three subtests. The first will test execution as the child is asked to write a series of numbers and letters that the examiner says out loud. The second tests recognition as the child is asked to differentiate between correctly oriented letters and numbers from their mirror-images. The last subtest will evaluate the child's discrimination skills as he/she is asked to match a correctly oriented letter or number with one of four samples the is also correctly oriented.

SUBTEST I (Execution): The child should be seated in a room cleared of all written materials which may provide the subject clues to letter orientation. The child is given the exam sheet and a pencil with an eraser. There is no time limit and the child is allowed to erase or correct their response. The child is then told:

"This test tells me how well you can write numbers and letters. On each of these lines in Column I (examiner points to Column I) I want you to write a number. O.K., let's go. On this top line write the number 5."

The examiner proceeds with the numbers 2, 6, 3, 9, 4, and 7.

Upon completion of Column I, the examiner points to Column II and instructs the child, "On each of these lines here I want you to write a print letter, just like they have in books. I don't want you to write capital letters, only small letters. And I don't want you to write script or cursive letters...you know the kinds that connect to one another. O.K., let's go. On the top line write the letter h. Now on the second line, right under the h, I want you to write a g."
The examiner continues with the remaining letters: q, b, k, s, r, d, y, p, t, z, g, a, and e. The Gardner allows for examiner correction if the child writes a capital letter.
letter. The examiner may instruct the child to try to write a little or small case letter instead of the capital.

**SUBTEST II (Recognition):** The Subtest II examination sheet contains 6 rows of characters and it is divided up into four sections. The tests are presented from easiest to hardest with numbers presented before letters and matched pairs before isolated letter reversals. Rows 1-3 contain matched characters (one correct the other the mirror image of it). Row 1 contains numbers, while rows 2 and 3 contain letters. Rows 4-6 consist of isolated characters (reversals are randomly placed next to other properly oriented characters). Row 4 contains numbers, while rows 5 and 6 contain letters.

The examiner continues the testing immediately after Subtest I, by removing the Execution Subtest I form and handing the child the Recognition Subtest II form. Remember to keep the child free from clues on number/letter orientation. Once again, there is no time limit and the child is allowed to erase or correct their response.

The child is told: “In this first row (examiner runs his or her finger along the first row) are pairs of numbers, that is two numbers together. In each pair, one of the numbers is pointing the right direction and the other is pointing in the wrong direction. Draw a cross or “X” over the number that is pointing in the wrong direction.” The examiner gives similar instructions for the next two rows of letters.

The last three rows do not have the letters matched up. For these three rows the examiner gives these instructions. “In this row some of the numbers are pointing in the right direction and some in the wrong direction. Put a cross or an “X” over the number pointing in the wrong direction.” The examiner gives similar instructions for the letters in the fifth and sixth rows.

**SUBTEST III (Matching):**

The examiner continues the testing immediately after Subtest II, by removing the Recognition Subtest II form and presenting the child Matching Subtest III form. Remember to keep the child free from clues on number/letter orientation. Once again, there is no time limit to this test and the child is allowed to erase or correct their response.

After presenting the test form, the examiner points to the triangle in the upper left-hand corner and says, “Here is a picture. On the other side of the line are four pictures. (Examiner’s index finger sweeps across the four geometric figures to the right of the dividing line.) One of these four is the same as this one here (again pointing to the original triangle) and the other three are different. With your pencil put a circle around the one that is the same.” If the child understands and correctly responds, he/she is given the remainder of the test. However, if they are unable to respond correctly, do not continue testing.

The examiner continues, “On this side of the line, on your left (examiner points to the column to the left of the dividing line), is a number or letter. On the other side of the line, on your right, are four letters or numbers. One of the four is the same, and the other three are different, from the one on your left. Put a circle around the letter or number (examiner points to the series of four) that is the same as the letter or number here (examiner points to the isolated number or letter). You may take as much time as you like. If you change your mind and want to change your answer, you can do so by erasing the circle and putting another circle around your new answer.”
What to Look For: Reversals, recognition of reversals, and level of difficulty the child has with the test. Also watch for abnormal or unusual postures, twisting, excessive head tilting, and/or working distance.

Scoring: In an effort to establish usable norms, Gardner wanted to include to age groups where reversals are common. However, he did not want to "include children with only the most rudimentary knowledge of letters and numbers" which would result in "the inclusion of exam sheets with only one or two correct items". Therefore, he established cut-off criterion for Subtest I and Subtest II which would exclude children whose errors were viewed to be the result of improper letter and number knowledge.

SUBTEST I: The examiner scores two different types of errors: reversals and unknowns. The examiner marks the test with an "R" for reversals, and a "U" for unknowns. Gardner established 16 errors out of 24 as a cut-off point. "If the sum of the reversals errors and unknown errors exceeds 16 the child is not considered adequate for testing" and were not included in the norms for their study. If the child has at least 8 correct responses, the examiner adds up the number of R and U errors and compares the results to the norms established by Gardner. The norms contain statistics on the high, low and mean number of reversal errors (with a standard deviation) for each age group.

SUB TEST II: The examiner counts the number of reversal errors made on each line (written on the side), and then tallies up the number of errors on all 6 lines (written in bottom right hand corner). If the total number of reversal errors exceeds 42, "the child is not considered to have reached a degree of competency adequate for proper assessment" and was excluded from the test norms. The examiner compares the number of reversals the child made to Gardner's norms. The norms contain data on the high, low and mean number of errors for each age group. Subtest II also displays a percentile rank for each age group based on the number of errors made.

SUBTEST III: This tends to be an easy test for children. There is a significant drop off in the number of errors made after the age of 6. No normative data was collected on 9 year olds and above because 7 and 8 year olds hardly made any errors. To score, the examiner simply counts up the number of errors and compares it to other children their age. The normative data contains the mean number of errors per age group and the standard deviation.

The following tables are taken directly from the Gardner Reversal Frequency Test manual:

**Table I** Reversal error ranges, means, and standard deviations for normal boys and girls on the Execution subtest.

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Low</th>
<th>High</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-0 to 5-11</td>
<td>25</td>
<td>0</td>
<td>7</td>
<td>3.16</td>
<td>2.29</td>
</tr>
<tr>
<td>6-0 to 6-11</td>
<td>28</td>
<td>0</td>
<td>8</td>
<td>2.68</td>
<td>2.19</td>
</tr>
<tr>
<td>7-0 to 7-11</td>
<td>25</td>
<td>0</td>
<td>4</td>
<td>0.40</td>
<td>0.96</td>
</tr>
<tr>
<td>8-0 to 8-11</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>9-0 to 9-11</td>
<td>27</td>
<td>0</td>
<td>1</td>
<td>0.07</td>
<td>0.27</td>
</tr>
<tr>
<td>10-0 to 10-11</td>
<td>30</td>
<td>0</td>
<td>2</td>
<td>0.10</td>
<td>0.40</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>26</td>
<td>0</td>
<td>2</td>
<td>0.12</td>
<td>0.43</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>27</td>
<td>0</td>
<td>1</td>
<td>0.04</td>
<td>0.19</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
**Table 2** Reversals error ranges, means, and standard deviations for normal boys and girls on the Recognition subtest.

### NORMAL GIRLS

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Low</th>
<th>High</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-0 to 5-11</td>
<td>28</td>
<td>0</td>
<td>13</td>
<td>4.46</td>
<td>3.16</td>
</tr>
<tr>
<td>6-0 to 6-11</td>
<td>31</td>
<td>0</td>
<td>11</td>
<td>2.16</td>
<td>2.38</td>
</tr>
<tr>
<td>7-0 to 7-11</td>
<td>25</td>
<td>0</td>
<td>3</td>
<td>0.44</td>
<td>0.92</td>
</tr>
<tr>
<td>8-0 to 8-11</td>
<td>27</td>
<td>0</td>
<td>1</td>
<td>0.07</td>
<td>0.27</td>
</tr>
<tr>
<td>9-0 to 9-11</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>10-0 to 10-11</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>25</td>
<td>0</td>
<td>2</td>
<td>0.12</td>
<td>0.44</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### NORMAL BOYS

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Low</th>
<th>High</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-0 to 5-11</td>
<td>25</td>
<td>4</td>
<td>42</td>
<td>23.76</td>
<td>11.11</td>
</tr>
<tr>
<td>6-0 to 6-11</td>
<td>28</td>
<td>2</td>
<td>36</td>
<td>18.54</td>
<td>11.52</td>
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<td>7-0 to 7-11</td>
<td>25</td>
<td>1</td>
<td>22</td>
<td>8.16</td>
<td>5.31</td>
</tr>
<tr>
<td>8-0 to 8-11</td>
<td>26</td>
<td>0</td>
<td>19</td>
<td>3.73</td>
<td>4.07</td>
</tr>
<tr>
<td>9-0 to 9-11</td>
<td>27</td>
<td>0</td>
<td>13</td>
<td>3.15</td>
<td>3.03</td>
</tr>
<tr>
<td>10-0 to 10-11</td>
<td>30</td>
<td>0</td>
<td>14</td>
<td>2.07</td>
<td>2.73</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>26</td>
<td>0</td>
<td>11</td>
<td>2.81</td>
<td>3.12</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>25</td>
<td>0</td>
<td>7</td>
<td>1.56</td>
<td>1.66</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>27</td>
<td>0</td>
<td>8</td>
<td>1.96</td>
<td>2.24</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>12</td>
<td>0</td>
<td>7</td>
<td>2.42</td>
<td>2.06</td>
</tr>
</tbody>
</table>

### NORMAL GIRLS

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Low</th>
<th>High</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
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<td>3</td>
<td>39</td>
<td>21.20</td>
<td>10.25</td>
</tr>
<tr>
<td>6-0 to 6-11</td>
<td>31</td>
<td>0</td>
<td>34</td>
<td>13.00</td>
<td>9.49</td>
</tr>
<tr>
<td>7-0 to 7-11</td>
<td>25</td>
<td>0</td>
<td>29</td>
<td>5.64</td>
<td>6.48</td>
</tr>
<tr>
<td>8-0 to 8-11</td>
<td>27</td>
<td>0</td>
<td>9</td>
<td>2.63</td>
<td>2.80</td>
</tr>
<tr>
<td>9-0 to 9-11</td>
<td>25</td>
<td>0</td>
<td>9</td>
<td>2.24</td>
<td>2.22</td>
</tr>
<tr>
<td>10-0 to 10-11</td>
<td>27</td>
<td>0</td>
<td>7</td>
<td>1.74</td>
<td>1.68</td>
</tr>
<tr>
<td>11-0 to 11-11</td>
<td>25</td>
<td>0</td>
<td>10</td>
<td>2.36</td>
<td>2.78</td>
</tr>
<tr>
<td>12-0 to 12-11</td>
<td>25</td>
<td>0</td>
<td>6</td>
<td>1.36</td>
<td>1.68</td>
</tr>
<tr>
<td>13-0 to 13-11</td>
<td>25</td>
<td>0</td>
<td>5</td>
<td>1.08</td>
<td>1.35</td>
</tr>
<tr>
<td>14-0 to 14-11</td>
<td>11</td>
<td>0</td>
<td>5</td>
<td>1.20</td>
<td>1.60</td>
</tr>
</tbody>
</table>
Critique: The author comments that the Reversal Frequency Test “does not assess all types of reversals errors.” The author also acknowledges the Execution subtest is not a pure reversal test. Although it “assesses primarily long-term visual storage and/or retrieval of linguistic symbols”, it also requires proper auditory function and visual-motor skills. Gardner believes “the Recognition subtest is a ‘purer’ test of long-term visual storage and/or retrieval deficits because it does not rely on verbal instructions or writing of specific letters or numbers.” Gardner’s summary of the Matching subtest states that it appears to be more of a visual discrimination test rather than assessing visual memory.

Gardner’s first normative study was administered to 500 “normal” children (249 girls and 251 boys) ages 5-0 to 15-11 from public schools in Bergen County, New Jersey. The “normal” children consisted of those with average intelligence 90-110 IQ or “those whose scores on national tests of academic achievement were in the normal range (20th-80th percentile).” To do a comparative study, Gardner administered the Execution and Recognition subtests to 343 children with minimal brain dysfunction (MBD). The comparison norms and data are listed in the GRFT manual. Gardner believes that the new norms established on the MBD children will allow the examiner to compare their child’s score with “children known to have a neurologically based learning disability.”

The comparison results between “normal” children versus known MBD children were analyzed for three separate categories: (1) age effects; (2) group effects; and (3) gender effects. Within each category (age, group and gender) the study analyzed the reversal and unknown errors of the Execution subtest and the errors on the Recognition subtest. A summary of the results and statistical analysis can be found in the GRFT testing manual. For a more extensive analysis and comprehensive discussion the examiner can refer to Gardner’s study, The Objective Diagnosis of Minimal Brain Dysfunctions, Creative Therapeutics, 1979.

Survey Results (1997):
How often used: 2.80. 37 of the total 91 optometrists indicated they use this test “all the time” or “frequently”.

Usefulness: 3.58. 33 of the total 91 optometrists reported they find this test “extremely” or “very” useful. 12 optometrists find it “moderately” useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Creative Therapeutics
155 County Road
Cresskill, New Jersey 07626

References:
GETMAN VISUAL MANIPULATION TEST (VMT)

Purpose: The VMT assesses the skill of manipulating one’s visualizations and indirectly tests visualization itself. Visual manipulation is the skill an architect uses to draw the face of a building and then, in his mind’s eye, go inside the imaginary building and look back out so he can draw the interior view. The VMT is useful not only for diagnosis, but also to monitor the progress of a training program and to dramatically illustrate to parents and teachers the problems which the child is experiencing.

Indications: The VMT can be used as part of any developmental exam when the patient is of Kindergarten to primary age, and even older in extreme cases of learning disability. Young patients having difficulty in letter formation (especially when letter reversals are a problem), reading, or spelling are candidates for this test. The VMT can also be used to monitor progress in a vision training program aimed at developing visual manipulation skills.

Apparatus and Setup: The test utilizes four geometric forms, each on an 8-1/2” x 11” sheet of paper, or as a vinyl “stick-on” with Plexiglas replacing the paper. VMT-1 is a triangle, VMT-2 a half-circle, VMT-3 a sideways “T,” and VMT-4 an “L.” Orientation of these figures must be correct in order for scoring key to be valid. In addition, the test utilizes 4 worksheets (VMW-1 through -4), each displaying three rows of a geometric form in various orientations. The basic form is the same as the corresponding test form. For example, VMW-1 displays triangles in various orientations. Pencils for marking answers are also utilized.

Time Required: Less than 10 minutes, depending on the developmental level of the child.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Getman Visual Manipulation Test. Proper use requires the purchase of the German Visual Manipulation Test and adherence to the protocol listed in the test manual.

Preset (Administration): Examiner sits across the desk, facing the patient. Worksheet VMW-1 is placed in front of the patient on the desk. Test Form VMT-1 is held in a VERTICAL position in front of the patient, approximately 20 inches away, centered straight out from the patient’s nose. The dark-colored bar must be at the top of the card (or window).

Visual Manipulation Test Questions:

1. “Looking at the top row of shapes on the worksheet. Can you point to the one that looks like the shape on this window (test card)?”
2. “Can you pretend you are sitting where I (the examiner) am sitting? Now, mark the shape in the top row of the worksheet that would be like this shape if you were seeing it from my (the examiner’s) side.”
3. “Can you pretend that I (the examiner) have flipped this window from top to bottom so the black colored line on the top is now down instead of up? Now, mark the shape in the second row of the worksheet that this shape would be like after I (the examiner) flipped the window.”
4. “Can you pretend again that you are sitting where I (the examiner) am sitting and still pretend that I have flipped the window? Now, mark the shape in the third row of the worksheet that this flipped shape would be like if you were sitting in my (the examiner’s) chair.”
The same questions are repeated for Test Forms and Worksheets numbered VMT-2 & VMW-2, VMT-3 & VMW-3, and VMT-4 and VMW-4.

**What to Look For:** The first question in each series is not scored; it is only asked to be sure the patient fully understands the testing procedure on each change of shapes. Make sure the figure presented to the child is oriented as shown.

**Scoring the Test:** The first question in each series is not scored. One point is given for each correct choice on the last three questions in each series (each test form). The maximum score is 12 points. There are no half-points given because there is no “maybe” answer to any of the questions; the choice is either correct or it is not.

Score the number correct over the total possible correct. For instance, a perfect score would be recorded “VMT 12/12.” If only seven were correct, the score would be recorded “VMT 7/12.”

**Critique:** Not much literature is available on this test. The Getman Visual Manipulation Test was actually developed by Dr. Steven Marcus and Chris Henderson at the Pathway School in the mid-70’s, in consultation with Getman. It was reported by Getman in the OEP “Optometric Dialogue” February 1976, Vol. 48 of the Continuing Education Courses. In ongoing clinical application of the test, Dr. Marcus feels that it tests the visual skill most closely related to classroom performance. He feels there is almost a one-to-one relevance between this test and the child’s performance in spelling.

**Answer Key:**

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>W-1</th>
<th>W-2</th>
<th>W-3</th>
<th>W-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 (top row)</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No. 2 (top row)</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>No. 3 (2nd row)</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>No. 4 (3rd row)</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

Age norms were established for the Visual Manipulation Test by Dr. James L. Cox in a 1977 study of 717 primary-age children in California.

- Kindergarten = score of 4
- Grade 1 = score of 5
- Grade 2 = score of 6
- Grade 3 = score of 7
- Grade 4 = score of 8

**Survey Results (1997):** 26% of responding optometrists use the Getman Visual Manipulation Test.

- How often used: 1.67. 9 optometrists of the 91 reported they use this test “frequently” or “all the time”. 15 marked “occasionally” or rarely”.

- Usefulness: 2.77. 10 optometrists reported this test as “extremely” to “very” useful. 14 marked it as “somewhat” or “not” useful.

**PUCO VPTM Subsection Authors:**
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe
References:
GETMAN VISUAL RECALL TEST

Purpose: The Visual Recall Test assesses the Visualization skills of the patient. Visualization is a skill closely related to classroom performance, particularly in spelling. A word about to be written must be visualized by the writer, and then transmitted to the proprioceptive and motor systems for action. Visualization is essential to decoding information from graphic symbols on a page; it replaces earlier dependence on tactile, olfactory, auditory, gustatory, and direct visual experience. The primary purpose of our visual system (at least in the classroom) is the acquisition of knowledge from the symbolic contexts of our culture. Spelling and reading are visual-spatial phenomena. Every word has its own spatial organization.

The Visual Recall Test is similar in concept to the Monroe Visual 3, in that it presents a series of shapes to which little, if any, meaning can be attached. The Getman cards begin with fewer and/or simpler forms, thus avoiding the problem encountered with many children who would not attempt the Monroe second card because they were intimidated by the first card.

Indications: The Visual Recall Test can be used as part of any developmental exam when the patient is of Kindergarten through primary age. Young patients labeled as having learning disabilities, especially in spelling, writing, or letter reversals, are candidates for this test.

Apparatus and Setup: The test utilizes 9 pattern cards, three sheets of blank 8 1/2" by 11" paper ruled into 3 horizontal sections, and pencils for drawing.

Time Required: Approximately 10 minutes, depending on the developmental level of the child.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for The Visual Recall Test by Getman. Proper use requires the purchase of The Visual Recall Test and adherence to the protocol listed in the test manual.

Preset (Administration): Each of the first three cards (one form per card) are presented to the patient for five seconds of viewing. After each card is viewed, it is removed and the patient is instructed to draw what he saw. (Adequate time is allowed for drawing).

The second three cards (two forms per card) are presented for ten seconds each, and the last three cards (three forms per card) are presented for fifteen seconds each. (Adequate time is allowed for each card for drawing).

What to Look For: Assess the accuracy of form reproduction. Size matching is not necessary, but all parts of a form must be recognizable and correctly oriented to be given full credit.

Scoring: Each correctly drawn figure receives one point. If the form reproduced is recognizable, but partially incorrect, a score of 1/2 point is given (for example, rotations and reversals would be given 1/2 point).

Critique: Not much literature is available on this test. The Getman Visual Recall Test was actually not developed by Getman, but by Drs. Steven Marcus and Chris Henderson at the Pathway School in Audubon, Pennsylvania in the mid-70's. Getman merely
reported on it, and spoke of it very positively, in an OEP paper, Vol. 48, Optometric Dialogue series, January 1976. As mentioned earlier, it has the advantage of having a simpler beginning level than the Monroe Visual 3, which is beyond the ability of many adults, thus being much too difficult for primary-age children experiencing difficulties with visualization.

The Visual Recall Test was normed in a study of 717 primary-age children in Downy, CA, by Dr. James L. Cox in 1977. The normative scores, by grade, are:

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Expected Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten</td>
<td>8</td>
</tr>
<tr>
<td>Grade 1</td>
<td>9</td>
</tr>
<tr>
<td>Grade 2</td>
<td>10</td>
</tr>
<tr>
<td>Grade 3</td>
<td>11</td>
</tr>
<tr>
<td>Grade 4</td>
<td>12</td>
</tr>
</tbody>
</table>

Lack of specific scoring protocol and examiner subjectivity to whether a form is partially/fully correct may affect inter-examiner reliability of the test.

In research by Wesson, it is reported that the Getman Test of Visual Recall "has merit because, except for a few of the figures, verbal naming is a very difficult strategy for remembering the figures."² He also reports the Getman Visual Recall test significantly correlates with the TVAS (r=0.829), but not with the Beery VMI (r=0.522).

Survey Results (1997):
How often used: 1.71. 10 optometrists of the total 91 reported using this test "all the time" or frequently. 15 marked "occasionally" or "rarely", while 54 optometrists said they "don't use" this test.

Usefulness: 2.72. 9 optometrists of the total 91 reported this test as "extremely" or "very" useful. 16 marked "moderately" or somewhat useful.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Efficient Seeing Publications
7510 Soquel Drive
Aptos, CA 95003

References:
GROFFMAN VISUAL TRACING TEST - REVISED (VT-R)

Purpose: This test is designed to evaluate pursuit ability and probe simultaneous processing.

Indications: The VT-R is indicated for anyone who is experiencing or suspected of having difficulty in eye movement skills. It is typically utilized with students aged 7 to 12 years.

Apparatus: The test utilizes 2 demonstration plates and 5 testing plates. Recording is done on the visual tracing test record form. A stopwatch is used for timing.

Time Required: Usually less than 10 minutes to explain and administer, but dependent on the child’s ability.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Visual Tracing Test - Revised, by Groffman. Proper use of the test requires the purchase of the Visual Tracing Test - Revised and adherence to the protocol listed in the test manual.

Preset (Administration): The examiner hands the demonstration card to the student and says “This is a test to see how quickly and accurately you can follow a line using only your eyes. Look at the line that starts at the letter ‘A.’ Follow it with your eyes. When it reaches another line,...” (examiner points to the first intersection), “...follow it straight ahead and do not turn off onto a line which crosses the line you are traveling on. At the end of the line you trace will be a number. You will report this number to me. Do you understand?” When this is understood, continue. Repeat this process with the second demonstration plate.

Continue with the five test plates. On the VT-R, the child is asked to follow only Letter A on each plate (as compared to the original test where the child was asked to trace each of the five letters on the test plate). When the child has reported the number reached on Test Plate 1, continue with Test Plate 2, Test Plate 3, etc. Tell the child, “Your score will depend on accuracy and speed, so work quickly, but try not to make a mistake.” Be aware if the patient attempts to use his/her finger to trace the line, you must stop and start over. The patient should not handle the test card.

What to Look For: The examiner should watch for the following behaviors:

1. Attempting to use finger.
2. Excessive head movement.
3. Improper distance from the paper.
4. Unusual head posture.
5. Unusual body posture.
6. Unusual facial expression.
7. Unusual verbal comments.
8. Unusual body movement.
9. Any other unusual behavior.

Scoring: The correct answers for the five letter tracings (actual test plates) are:
If the correct answer is reached, the following table tells how many points are to be awarded, dependent upon the time it took to reach the answer. If the number reached is incorrect, a score of 0 is given.

<table>
<thead>
<tr>
<th>Time In Seconds</th>
<th>Points Given</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>10</td>
</tr>
<tr>
<td>11 - 15</td>
<td>9</td>
</tr>
<tr>
<td>16 - 20</td>
<td>8</td>
</tr>
<tr>
<td>21 - 25</td>
<td>7</td>
</tr>
<tr>
<td>26 - 30</td>
<td>6</td>
</tr>
<tr>
<td>31 - 35</td>
<td>5</td>
</tr>
<tr>
<td>36 - 40</td>
<td>4</td>
</tr>
<tr>
<td>41 - 45</td>
<td>3</td>
</tr>
<tr>
<td>46 - 50</td>
<td>2</td>
</tr>
<tr>
<td>51 - 60</td>
<td>1</td>
</tr>
<tr>
<td>&gt;60</td>
<td>0</td>
</tr>
</tbody>
</table>

**Critique:** The VT-R is a quick and easily administered test of visual tracing and eye-movement ability. In addition, it requires the subject to discriminate figure from ground. It can be used with a wide range of ages but is normed for ages 7 through 12 and over. It can be used as a device for screening and/or testing and it can also be used to evaluate progress in a vision training program. This test is not used outside the profession of optometry.

**Survey Results (1997):**
- **How often used:** 2.34. 21 of the total 91 optometrists use this test “all the time” or “frequently”.
- **Usefulness:** 3.05. 21 of the total 91 optometrists reported this test as “extremely” or “very” useful.

**PUCO VPTM Subsection Authors:**
- **Original Authors (1989):** Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe
- **Updated (1998):** Karl Bakken, Melissa Severns

**Publisher:** Keystone View Company
4673 Aircenter Circle
Reno, NV 89502

**References:**
KAUFMAN ASSESSMENT BATTERY for CHILDREN (K-ABC)

Adapted for the Optometrist by Hannu Laukkanen, O.D., M.Ed.

Purpose: The K-ABC is used to determine the intellectual ability and achievement of preschool and elementary school children, with well established norms for ages two and a half to twelve and a half. It was intended by its authors for: "psychological and clinical assessment, psychoeducational evaluation of learning disabled and other exceptional children, educational planning and placement, minority group assessment, preschool assessment, neuropsychological assessment, and research." The K-ABC consists of 16 subtests which are grouped into two sections: Achievement test (ACH) and Mental Processing Composite (MPC). Mental Processing is further broken up into Sequential Processing (SEQ) and Simultaneous Processing (SIM). The Achievement section of the K-ABC is designed to sample acquired factual knowledge learned in schools and at home. The Mental Processing section seeks to discover how the child extrapolates information and tests problem solving ability. The Sequential Processing section consists of three subtests while the Simultaneous Processing section consists of seven subtests. Both the SEQ and the SIM yield a separate global score. The combination of the SEQ and SIM global scores provides the global Mental Processing Composite. "The MPC subtests include a predominance of spatial and perceptual tasks, not unlike those found with a variety of perceptual tests currently used by clinical optometrists." Due to the rigorous testing and standardization procedures performed on the K-ABC, the optometrist can benefit from knowing that the validity and reliability of the test is strong. Due to time constraints often placed on clinical optometrists and the need for specific perceptual information on how the child processes information (visually or a Gestalt approach versus auditory or sequential manner), Hannu Laukkanen, O.D. of Pacific University College of Optometry recommends using the abbreviated Mental Processing test battery introduced by Applegate and Kaufman.

Indications: The abbreviated Mental Processing test battery consists of four subtests from the original K-ABC. These subtests represent the tests which best differentiated simultaneous processing versus sequential processing. The authors stress that the subtests are "process-oriented, they focus on whether the stimuli are manipulated one at a time or simultaneously, regardless of item content." The abbreviated MPC test battery is indicated when the optometrist wants to determine how the child extrapolates information from the world around him/her. Does the child assimilate the information in simultaneous Gestalt-like approach or do they process information sequentially.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the Administration and Scoring Manual for the K-ABC and from the tabbed title pages preceding each subtest of the K-ABC. Proper use requires the purchase of the K-ABC test available from American Guidance Service and adherence to the protocol listed in the test manual.

Materials: The K-ABC testing kit contains the interpretive manual, the administration and scoring manual, three easels (easels 1 and 2 contain the MPC subtests, easel 3 contains the ACH subtests), 25 recording forms, 9 triangles, 118 photo series cards, the magic window disk, and other testing amenities. Administration of the abbreviated Mental Processing test battery also requires a stopwatch or watch with a second hand.

Preset and Administration: The abbreviated Mental Processing test battery of the K-ABC consists of four subtests (two from the SEQ subset and two from the SIM subset). The SEQ subtests are Number Recall and Word Order. The SIM subtests are Gestalt
Closure and Triangles. Administration time averages about 45 minutes for preschool children and about 70-75 minutes for school age children.

Number Recall: Sequential Processing Subtest (auditory-vocal)
Ages 2-6 through 12-5

The general procedure has the examiner say a sequence of numbers to the child and then asks the child to repeat the numbers in the same order. The authors state to make sure that the child is attending before saying each item. The numbers are to be read at a steady rate of one word per second. Try to avoid grouping the numbers rhythmically and do not drop your voice when reading the last number of the sequence. If the child begins to respond before the examiner finishes the sequence, the authors indicate the use of non-verbal gestures (e.g., putting out your palm to indicate "stop", putting your index finger to your lips) to silence the child.

The test consists of nine questions for the 2.5-3 year olds, twelve questions for the 2.5-4 year olds, twelve questions for the 5-7 year olds, and 16 questions for the 8-12.5 year olds. The authors have allowed for teaching on the sample question as well as the first two items given to each child (however, record the child's first response). If the child responds incorrectly or does not respond, demonstrate and explain the correct response (e.g., say, I said "two--three," so you should say "two--three" just as I did...etc.)

Test verbage written for the sample question for Number Recall includes:

"I am going to say some numbers. Try to say them just as I do. Two--three"

Throughout the remainder of the test, the authors allow for prompting the next item with the words:

"Say these numbers just as I do."

Word Order: Sequential Processing Subtest (auditory-motor)
Ages 4-0 through 12-5

The general procedure has the examiner say a series of words (names of common objects), then asks the child point to the silhouettes of the objects in the same sequence that it was called out by the examiner. Once again the authors urge the examiner to make sure the child is attending before administering each item. The words are to be read at a steady rate of one word per second. Try to avoid grouping the words rhythmically and do not drop your voice when reading the last word of the sequence. If the child says the words instead of touching the pictures, say "Touch the pictures." The examiner is only to give credit if the child touches the pictures in the correct sequence.

The test starts with item one for the 4-5 year olds and stops after item ten for the 4 year olds, after item thirteen for 5 year olds. The test begins with item four for the 6-7 year olds and stops after item eighteen, and for 8-12.5 year olds it begins with item seven and ends with item twenty. The authors allow for teaching on the unscored sample question and the first two items given to each child (however, record the child's first response). The examiner is allowed to demonstrate and explain the correct response, then repeat the item.

Exact test verbage written for the administration of Word Order includes:

"See these pictures?" (Point to the pictures) "I want you to name them." For each picture, ask, "What is this?" Correct the child as necessary and repeat until the child associates the appropriate term with each picture. Then proceed to the sample question.
Sample: "I am going to say the names of some pictures. When I am done, I want you to touch the pictures that I named. Do it just the way I say them. House--cup."
Immediately turn the page for the child's response. "Now touch the pictures that I named."

Testing continues in a similar manner through test item nine. Beginning with test item ten, a new series of pictures (seven pictures instead of five and with increasing complexity) are used for the rest of the subtest. The child is asked to name these objects just like he/she did at the beginning of the test.

Beginning with test item fourteen, the test increases in difficulty with addition of time delayed "noise" task between the auditory list and the motor sequential recall. The child is asked to name off some colors presented in the test booklet in front of them. This naming task should last for only five seconds.

Exact test verbage written for the administration of Word Order starting with item 14:
Say, "Now I'm going to make it a little harder. Before you touch the pictures, you have to name some colors. Let's practice. Start here (point to top left, from child's point of view) and say these colors as fast as you can. The authors suggest accepting any name the child gives to the color; name the color only if the child says "I don't know."
"Let's do one. First, I name the pictures. Then, you name some colors. After that, you try to touch the pictures I named. Do you understand? The authors recommend administering item 14 even if they don't understand because often the child won't until they try. The test continues in a similar manner through item 20.

Gestalt Closure: Simultaneous Processing Subtest (visual-vocal)
Ages 2-6 through 12-5

The general procedure has the examiner expose a partially completed "inkblot" drawing, and asks the child to name the object pictured. The authors allow for more than one specific answer "as long as understanding of the concept is obviously conveyed. Examples: 'you cook with it' for Item 17 (stove), 'girl on her hands' for Item 19 (gymnast)." If the child names only a part of the picture, the examiner is allowed to probe further and say "Yes, but tell me the name of the whole thing."

The test begins with item one for 2.5-6 year olds, item six for 7-9 year olds, and item ten for 10-12.5 year olds. Three year olds are finished with administration after item 14. Four to seven year olds finish with item 20, and ten to twelve and half year old kids finish with item 25. The authors allow for teaching on the unscored sample question and the first two items given to each child (however, record the child's first response).

Exact test verbage for the administration of Gestalt Closure:
"What is this?" If the child gives an incorrect or no response, demonstrate and explain the correct response with "This is a bird. See, here are the wings. Here is the bird's head...etc. Continue on to the next items using only the cue "What is this?" whenever necessary.

Triangles: Simultaneous Processing Subtest (visual-motor)
Ages 4-0 through 12-5

Additional Materials: Stopwatch or watch with a second hand, and nine blue and yellow triangles provided with the K-ABC test package.

The general procedure has the examiner supply the child with the appropriate number of triangles, then asks the child to use those triangles to make a design which matches the
picture. All test items have a two limit time limit. No credit or partial credit is to be given if the child completes the form correctly in more than two minutes. Give encouragement whenever needed if the child is struggling or making little effort to solve the problem. The authors urge the examiner to only give the exact number of triangles required to complete the test and to keep the remaining triangles out of reach. Do not allow the child to hold the triangles against the picture or stand the triangles on end when replicating the design. If the child uses fewer than the allotted triangles to complete the design, the authors want the examiner to tell the child to use all of the triangles.

Scoring the design: Triangles must be no more than 1/4 inch apart and no more than 1/4 inch out of alignment for the item to be scored a 1. There is no penalty for rotations if the design is assembled correctly.

The test begins with item one (two triangles) for 4-5 year olds, item four (three triangles) for 6 year olds, item seven (four triangles) for 7 year olds, and item ten (four triangles) for 8-12.5 year olds. Four to five year olds are finished with administration after item 9. Six year olds finish with item 12, seven year olds finish with item 15, and eight to twelve and a half year olds are finished with the test after item 18. Starting with item 13, the number of triangles jumps up to eight total, and the ninth and final triangle is added for item 15. The authors allow for teaching on the unscored sample question and the first two items given to each child (however, record the child’s first response).

Exact test verbage for the administration of Triangles:

"Put these together (point to the triangles) to make this (point to the model). Begin timing. Allow two minutes. If there is an incorrect response, demonstrate and explain the correct response with “Watch me. The yellow triangle goes here just like the picture, and the blue triangle goes here...etc.) Continue on to the next items using only the cue “Now try to make one like this” whenever necessary.

Scoring: The Administration and Scoring Manual of the K-ABC clearly states that “every item on the K-ABC is dichotomous: correct responses are scored 1 and incorrect responses are scored 0.” The raw score for each subtest is equal to number of items answered correctly. The Administration and Scoring manual contains tables with which to convert the raw scores into scaled scores, grade equivalents and national or sociocultural percentile ranks.

The Administration and Scoring Manual of the K-ABC also contains a few sections on maintaining patient rapport, and methods of keeping the administration procedures consistent and reproducible. The writers of the K-ABC stress that the examiners using the K-ABC should be at a post-graduate level preferably within the field of psychology or schooled the areas of observing behavior.

Probably the greatest asset that optometrist can bring to the administration of the K-ABC is a remarkable ability to observe behavior. Kamphaus believes that fully half, if not more of the important information obtained from intelligence tests comes from observing the child’s reaction to novel problems, stress, frustration, and success. With one on one contact, the examiner can observe the child’s problem-solving approach, attention span, language usage, fine and gross motor control, and activity level.

Critique: The K-ABC is a well normed, validated, and reliable tool for assessing the cognitive abilities of children. The 1981 standardization represents a sample of 2000 children, age 2.5 to 12.5, from 34 test sites in 25 states. Census Bureau data were used to stratify within half-year groups for sex, geography, parental education, community size,
and ethnic group. Nearly 7% of the sample was drawn from children placed in special
education as well as gifted and talented programs. The test-retest reliability for the 16
subtests of the K-ABC ranged from .59 to .98 with the ACH subtests generally being more
reliable than the MPC subtests. The global scores show excellent reliability, with
coefficients between .77 and .97. The test-retest reliability's for the four subtests we
recommend are: Number Recall .83, .84, .81; Word Order .85, .76, .73; Gestalt Closure
.74, .84, .86; and Triangles .76, .70, .83 (depending on three different age groups: ages 2-
6 through 4-11, 5-0 through 8-11, and 9-0 through 12-5, respectively).

The K-ABC has been rigorously tested since its inauguration in 1981, and although many
have found subtle differences in its reliability and construct, predictive, and concurrent
validities, it has withstood its antagonists and the test of time.

Survey Results (1997):
How often used: 1.32. 67 of the total 91 responding optometrists reported they "don't
use" the K-ABC.

Usefulness: 2.43. 7 of the responding optometrists report the K-ABC to be "extremely"
or "very" useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: American Guidance Service
Circle Pines, MN 55014

References:
3. Applegate B, Kaufman AS. Short form of K-ABC sequential and simultaneous
processing for research and screening. Journal of Clinical Child Psychology,
6. Kamphaus RW, Reynolds CR. Clinical and research applications of the K-ABC. Circle
KING-DEVICK SACCADE TEST (KD)

Purpose: The clinical assessment of eye movement functioning of school-aged children is an integral part of a complete vision examination. Poorer readers, as a group, read more slowly than normal readers and exhibit smaller and more numerous fixations and regressions. The King-Devick is one test for the measurement of oculomotor behavior. It is a timed test of saccadic eye movement ability and visual-verbal automaticity. It is a modification of the Pierce Saccade Test. It is a convenient screening device to identify children whose visual performance is below the expected norm on a task that resembles the eye movement motor activity of reading. It is a three-part, norm referenced test in which the child is asked to “call out” a series of forty numbers on each part as rapidly as possible. Randomly spaced numbers are utilized on each line, hence, the ocular fixations required to perform the test are much like those used in the reading process.

Indications: The K-D can be utilized with children primarily aged 6 to 14 years of age. It can be used to screen eye movement abilities or as a test to measure improvement in skills before and after a structured therapy program.

Apparatus and Setup: The test consists of one demonstration card and three test cards (KD-1, KD-2, and KD-3). Each of these cards is composed of eight rows, with each row having five 20/100 (at 40cm) reduced Snellen equivalent numbers. The three parts of the test increase in complexity from KD-1 to KD-3. Subtest 1 consists of randomly spaced numbers connected by horizontal lines while subtests 2 and 3 do not have any horizontal lines. The vertical separation between rows is reduced in subtest 3 to 3/8 of an inch, whereas in the first two parts it is 1/4 of an inch.

Time Required: The time for administration varies from an average of 2 minutes for 6-year-olds to an average of 50 seconds for 14-year-olds.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the NYOSA-KD test. Proper use of this test requires the purchase of the NYOSA-KD test and adherence to the protocol listed in the test manual.

Preset (Administration): The demonstration card is presented to the child. He/she is told to call out the numbers, in order, as fast as possible following the arrows. If the child successfully completes the demonstration card, Tests 1, 2, and 3 are subsequently serially presented.

What To Look For: The administrator of the test should look for the ease of performance by the child. Watch for other types of motor involvement during the testing, such as using fingers as a guide, extensive head movement, and obvious under and overshoots of eye movements. The examiner should also make note of any episodes of losing his/her place during test performance.

Scoring: Scores are evaluated in terms of time in seconds to complete each part of the test with a correction factor allowed for omissions or additions. There is an individual score for each part as well as a total score, KD-T, representing the sum of the three components (KD-T = KD-1 + KD-2 + KD-3).

Critique: The test requires minimum time to administer and interpret making it practical for use by non-optometrists and ideal for visual screening. Since it is also standardized, it can be used as part of a pre- and post-visual therapy evaluation. Visual attention, accommodation, fusion, visual verbal matching, etc. are all involved when performing this
test. Therefore, the optometrist should use a sequence of tests to probe isolated areas to make a differential diagnosis. The K-D is more useful when used in conjunction with a complete visual analysis.

There appears to have been some critical assumptions regarding the child's developmental abilities in other areas related to reading development that could significantly affect the clinical interpretation of the KD test results. One assumption is the child’s ability to automatically recall and “name the number” seen during the fixations. Studies show the “naming” efficiency becomes more automatic with age and rapidly develops in the primary grades. Normal readers have been shown to be generally faster (i.e., more automatic) than poorer readers in naming digits. The KD Test (or any other similar one with a visual-verbal format) may not be solely assessing oculomotor function but automaticity as well. Therefore, it would appear that lateral eye movements, as measured with the KD Test, cannot simply be presumed to be deficient if a child performs poorly on these tests, especially in the lower grades. It is very possible in some learning and reading disabled children that poor performance on the KD results from deficits in automaticity and not oculomotor dysfunction. This further emphasizes the need to incorporate the use of other optometric tests along with the KD to better assess the visual skills of the individual.

In research by Kulp and Schmidt, they found that for 5 and 6-year olds, the performance on the NYOSA KD was related to reading performance. They also evaluated the test-retest reliability of the KD in a population of 52 kindergartners and first graders over three test administrations. It was found that "test times with repeated testing was found to be moderately high for kindergartners, first graders, and the group as a whole." However, in the first graders a trend towards decreased completion times was found upon retest and errors were not found to be reliable in kindergartners. The authors conclude that "the NYOSA K-D test is not a reliable test for kindergartners and first graders."

Survey Results (1997):
How often used: 3.10. 42 of the total 91 optometrists responding to our survey use this test “all the time” or frequently”.

Usefulness: 4.08. 43 optometrists of the total 91 find this test “extremely” or “very” useful.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Bernell Corporation
750 Lincoln Way East
South Bend, IN 46634

References:

MKM MONOCULAR AND BINOCULAR READING TEST

Purpose: The MKM is used to detect children who may experience reading problems which may be associated with poor binocular coordination and macular suppression. The test can be utilized to determine monocular and binocular reading ability and can give an indication as to the student's basic sight word inventory.

Indications: The test is designed to be utilized with first and second grade children. The MKM Preschool Test can be used with children who experience difficulty reading the words in the regular version of the MKM.

Apparatus and Setup: The MKM contains six stereoscopic cards which are divided into two sets. Set II contains 3 cards. Set II, card #1 presents 110 Dolch basic sight words to the left eye alone. Set II, card #2 presents the same 110 basic sight words in reverse order to the right eye alone. Set II, card #3 contains the same words but some of the words are common to both eyes while some are presented just to the right or left eye alone. Set II, card #3 investigates the student's binocular reading ability while #1 and #2 investigate the student's monocular reading ability.

Time Required: Variable, depending on the student's age and reading ability, however, administration is generally less than 10 minutes.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the MKM Monocular and Binocular Reading Test. Proper use requires the purchase of the MKM Monocular and Binocular Reading Test and adherence to the protocol listed in the test manual.

Preset (Administration): Set I of the MKM Monocular and Binocular Reading Test should be used on first and second graders, since most students are expected to be familiar with these words by the end of the first grade. Set II contains basic sight words that most children are expected to know by the end of the second grade and is administered in the same manner as Set I. The preschool version is similar to the binocular reading card except that basic geometric forms are used instead of words.

The following procedure is utilized for the MKM: Set I, card #1 is inserted into the card holder of a Brewster stereoscope at the near position. The following instructions are then given to the student: "Here is a group of words. They do not make a story so do not try to make any sense out of them. I would like you to keep both eyes open and read these words for me the best you can. If you do not know a word, I will help you, but please try to read every word. I will say...ready, begin...and then I would like you to start reading. Ready, begin."

The procedure is then repeated with card #2. The words on card #2 are printed (and therefore read) in reverse order of card #1. This is to avoid any memorization of order by the child.

Next, the binocular test card, Set I, card #3, is placed at the near setting in the stereoscope. The instructions are repeated emphasizing..."keep both eyes open."

Scoring: As the student reads the words, the clinician records any errors to the left of the test word in the space provided on the score sheet. Reading time is also recorded. For card #2 the words will be read in reverse order, so the clinician should record errors proceeding from the lower right on the score sheet. Again, the reading time should be recorded.
The words marked (L) on the score sheet are presented to the left eye alone, and those marked (R) are presented to the right eye alone. Every other line is common to both sides and presented to both eyes. Suppressed words should be circled, while errors should be written above the test word on the score sheet. By analyzing the score sheet, the clinician can determine which errors were common to both eyes or which errors were made with the right or left eye alone. The presence of word reversals (was for saw, no for on, etc.), vertical reversals (but for put), internal reversals (there for three, how for who, etc.), improper vowel sounds (run for ran, come for came, etc.), and other errors can be noted.

Normally, the reading time and the number of errors is expected to be approximately the same for each eye. If the reading time of one eye exceeds the other by 20%, this indicates the presence of a binocular visual problem.

**Norms by Grade:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Time In Seconds</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>111</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>94</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>84</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>74</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>6</td>
</tr>
</tbody>
</table>

**What to Look For:** If suppression is constant, generally the right or left eye will be completely suppressed throughout the test. If no suppressions are noted the reading time can be compared to the monocular portion of the test. If the time is appreciably longer under binocular conditions the presence of a binocular visual problem would be suggested. If suppressions are noted the time cannot be compared to the monocular cards, as fewer words would have been read.

Some students will note that certain words tend to "float out" toward them. This is due to a binocular luster effect and should be considered normal.

In cases of suppression not related to strabismus and amblyopia, improved performance is often made possible immediately with the application of plus at near (generally from +.50 to +1.50). You may gradually increase the amount of plus until a good binocular performance is obtained. The weakest amount of plus that will eliminate the suppression could be considered as a tentative add.

**Critique:** The MKM Monocular and Binocular Reading Test is a tool which is easily administered and can give valuable information regarding ability, monocular and binocular visual performance, sight word vocabulary, and suppression. The test can also be helpful in evaluating the progress of visual training. It can also be used as a dramatic demonstration of how lenses can improve binocular reading performance.

A reliability study was conducted in 1965 to determine if the MKM was reliable on a test re-test basis. The results of the study indicated that it was reliable. In 1966 a study was conducted by the authors of the test to determine if the MKM could be used as a predictor of a child's academic and reading achievement level. The MKM was administered to all students in grades one through six at the Zion Lutheran School in Rapid City, South Dakota. The students were also administered the Gates-McKillop Oral Reading Test. There was also a significant relationship between passing the MKM and the teacher's subjective evaluation of the student's scholastic ability.
Additional investigations by the authors suggested that students in the upper third of the class in elementary school show a good binocular performance and do not, in general, suppress. Children in the lower third of the class in elementary school tend to show marked suppressions. Children in the middle third of the class tend to show moderate suppressions. If it is true that the MKM can yield information which helps identify children likely to have reading problems related to suppression and poor binocular coordination, then it is suggested that this test might be useful as a supplement to a routine visual examination and as a screening device for schools and reading clinics.

In research by Jech and Coffey report an age-related developmental trend when evaluating performance on the MKM. Both time and errors show a significant improvement with age with regard to monocular data. For binocular data, time scores show a significant improvement with increasing age; however, the comparison for errors with the binocular data was not significant. "In all cases means and their standard deviations show a decrease with increasing grade level, indicating better and more consistent performance among older children." 

Survey Results (1997): 35% of optometrists reported using this test. How often used: 1.95. 15 of the total 91 optometrists use this test "frequently" or "all the time". 17 use it "occasionally" or "rarely". 51 survey responses were left blank.

Usefulness: 3.19. 17 optometrists indicated they find this test "extremely" to "very" useful. 54 optometrists left this category blank.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Monocular and Binocular Reading Test
809 Kansas City Street
Rapid City, SD 57701-2689

References:
MOTOR FREE VISUAL PERCEPTION TEST (MVPT)

Developed by Colrusso and Hammill

Purpose: This is a test of visual perception which avoids motor involvement and which is practical for screening, diagnostic and research purposes. This test has five subtests: Spatial Relationships, Visual Discrimination, Figure-ground, Visual Closure and Visual Memory.

Indications: The MVPT is 36-item, individually administered multiple choice test of visual perception. The only response required from the subject is that he/she point to one of the four alternatives that he/she feels is the correct response. This test has been normed on 863 subjects ranging in age from 4 years, 11 months to 8 years, 11 months.

Apparatus and Setup: The complete setup includes one copy of the MVPT test plates, and the child’s habitual near lenses if needed.

Time Required: Usually less than 10 minutes are required to complete the test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Motor Free Visual Perception Test. Proper use requires the purchase of the Motor Free Visual Perception Test and adherence to the protocol listed in the test manual.

Preset (Administration): Since the test is not a timed test, the subject should be allowed a reasonable amount of time (approximately 15 seconds) to make a selection. Each subtest has an example to facilitate proper understanding.

Test Plates 1-8: Present the item to the subject and point to the stimulus figure, saying "Look at this". Point to the four alternative figures, saying "Find it here".

Test Plates 9-13: Present the item to the subject and point to the stimulus figure, saying "Look at this". Point to the four alternatives, saying "Find one here. It might be smaller, bigger, darker or turned on its side".

Test Plates 14-21: Present the stimulus page to the subject for five seconds, saying "Look at this". Turn the page exposing the four alternative figures, saying "Now find it here".

Test Plates 22-32: The examiner points to the four alternative figures, saying "If we finished drawing these figures, which one would look just like this one"? (pointing to stimulus figure).

Test plates 33-46: Present the item to the subject and point to the four alternative figures, saying "Which one is different from all the others?" or "Which one is not the same as the others"?

Scoring: The MVPT has been normed on 863 subjects for perceptual age and perceptual quotients.

Remember to:

1. Keep scoring sheet out of child’s view.
2. Circle each answer given by the child.
3. Tally the correct responses for a raw score.
4. Do not include the examples when you score.
**MVPT PERCEPTUAL AGES**

<table>
<thead>
<tr>
<th>Raw Scores</th>
<th>Perceptual Age (years-months)</th>
<th>Standard Deviation (years-months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>&gt;9.0</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>8-8</td>
<td>7-11 to &gt;9.0</td>
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<tr>
<td>28</td>
<td>8-2</td>
<td>7.5 to &gt;9.0</td>
</tr>
<tr>
<td>27</td>
<td>7-11</td>
<td>6-11 to 8-8</td>
</tr>
<tr>
<td>26</td>
<td>7-5</td>
<td>6-8 to 8-2</td>
</tr>
<tr>
<td>25</td>
<td>6-11</td>
<td>6-2 to 7-11</td>
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<td>24</td>
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<td>23</td>
<td>6-2</td>
<td>5-10 to 6-11</td>
</tr>
<tr>
<td>22</td>
<td>6-0</td>
<td>5-8 to 6-8</td>
</tr>
<tr>
<td>21</td>
<td>5-10</td>
<td>5-5 to 6-2</td>
</tr>
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<td>5-0 to 5-10</td>
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<td>18</td>
<td>5-2</td>
<td>4-9 to 5-9</td>
</tr>
<tr>
<td>17</td>
<td>5-0</td>
<td>4-6 to 5-5</td>
</tr>
<tr>
<td>16</td>
<td>4-9</td>
<td>4-3 to 5-2</td>
</tr>
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<td>15</td>
<td>4-6</td>
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<td>&lt;4.0 to 4.9</td>
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<tr>
<td>13</td>
<td>4-0</td>
<td>&lt;4.0 to 4-6</td>
</tr>
</tbody>
</table>

**Critique:** The MVPT is a quick and reasonably reliable way to assess a child's level of visual maturity. The MVPT has the advantage of being fast to administer. If a more thorough battery is needed, the Developmental Test of Visual Perception (DTVP-2) would be the test of choice. As with other tests, MVPT scores are affected by guessing and subject motivation. Scores below 10 cannot be interpreted with confidence.

**Survey Results (1997):**
- **How often used:** 2.86. 34 out of the total 91 reported using this test “all the time” or “frequently”.
- **Usefulness:** 3.34. 33 optometrists reported the MVPT to be “extremely” to “very” useful.

**PUCO VPTM Subsection Authors:**
- Original Authors (1989):
  - Daniel Kosterman, Marcus Morben, Terry Rudenskey, Samuel Soesbe
- Updated (1998):
  - Karl Bakken, Melissa Severns

**Publisher:** Academic Therapy Publications
- 20 Commercial Blvd.
- Novato, CA 94947
References:
THE NSUCO OCULOMOTOR TEST

Purpose: To assess the quality of both saccadic and pursuit eye movements.

Indications: Allows clinician to provide a quick, inexpensive analysis of the patient's eye movements with minimal patient cooperation.

Apparatus and Setup: Two small (approximately 1/2 cm in diameter) colored, reflective spheres (balls) mounted on dowel sticks. One target is used for pursuits, two for saccades. For those unwilling or unable to be tested with the colored ball targets, use animated toy targets on pencils (one for pursuits, two for saccades).

Time Required: Minimal time is required, under two minutes.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the NSUCO Oculomotor Test. Proper use of the test and norming of results requires the purchase of the NSUCO Oculomotor Test and adherence to the protocol listed in the test manual.

Preset (Administration): The protocol for proper administration is given as shown in the NSUCO Oculomotor Test manual written by W. C. Maples, O.D.

I. Posture:
   The patient stands with feet a shoulder-width apart, arms hanging naturally at their side, directly in front of the examiner.

II. Head:
   Do not give instructions on head movement. Scoring of the test is based on whether or not the patient chooses to use their head for assistance.

III. Target characteristics:
   As seen above in "Apparatus and Setup".

IV. Movement of the target:
   A. Directional:
      1. Saccades are performed in the horizontal meridian only (five round trips).
      2. Pursuits are performed rotationally, both clockwise (two rotations) and counterclockwise (two rotations).
   B. Extent:
      1. Saccade extent should be no more than 10 cm on each side of the patient's mid-line (20 cm total).
      2. Pursuit path should be no more than 20 cm in diameter. The upper and lower extent of the circular path should coincide with the patient's mid-line.

V. Test distance from the patient:
   Testing is done no more than 40 cm and no less than the Harmon distance, i.e., the distance from the subject's middle knuckle to his elbow.

VI. Ocular condition:
   Testing is done binocularly.

VII. Age of the patient:
   The manual states that the test can be performed on anyone two years old to adult, however, the norms are calculated for 5 years old to 14 years old and above.

VIII. Instructions:
   A. Saccades:
      "When I say red, look at the red ball (dog toy). When I say green, look at the green ball (dinosaur toy). Remember, don't look until I tell you to."
B. Pursuits:
"Watch the ball (dog) as it goes around. Try to see yourself in the ball 
(watch the dog's eyes). Don't ever take your eyes off the ball (dog)."

Scoring: The scoring of the NSUCO involves giving point values to the observations 
made by the clinician. The clinician will score the test for both the pursuits and saccades 
based on the same four factors: ability, accuracy, head movement and body movement. 
The manual stresses the point that the clinician should be cautioned: DO NOT ATTEMPT 
at first to record the performance on this by recording the number that is associated with the 
observed performance. Instead, record the observed performance in written form and 
assign numerical values later. There are two types of observations to be scored: qualitative 
(based on the clinicians qualitative judgment of performance) and quantitative (requires the 
clinician to count the number of times that he/she observes a particular type of behavior).

Qualitative Testing: The five qualitative aspects to be graded include:
1. Head movement of pursuits
2. Head movement of saccades
3. Body movement of pursuits
4. Body movement of saccades
5. Accuracy of saccades (amount of over- and undershooting)

Based on a five point scale (five being the highest and one the lowest), the clinician makes 
an assessment as to how much of the time the patient showed motor overload type 
behaviors.

Quantitative Testing: There are three aspects to be counted:
1. Pursuit ability (the number of rotations made on pursuits)
2. Saccadic ability (the number of successful round trips made on saccades)
3. Accuracy of pursuits (the number of target losses or refixations on pursuits)

Once again, the scoring is based on a five point scale with five being the highest. The 
ability of pursuits is judged by the number of rotations the patient can complete without 
losing attention. The manual cautions that "it should be emphasized that if the subject loses 
fixation, but then spontaneously recovers, this is not considered to be a loss of ability or 
attention", but instead will be "scored as an accuracy factor".1 (41) The saccadic ability is 
assessed by counting the number of successful round trips completed before total loss of 
attention is observed.

The NSUCO Method of Scoring Saccades and Pursuits Ability
Qualitative Testing
HEAD AND BODY MOVEMENTS
1. Large movement of the head (body) at any time
2. Moderate movement of the head (body) at any time
3. Consistent slight movement of the head (body) (greater than 50% of the time)
4. Intermittent slight movement of the head (body) (less than 50% of the time)
5. No movement of the head (body)

Quantitative Testing
SACCADE ABILITY
1. Completes less than two round trips
2. Completes two round trips
3. Completes three round trips
4. Completes four round trips
5. Completes five round trips
Pursuit Ability
1. Cannot complete 1/2 rotation in either the clockwise or counterclockwise direction
2. Completes 1/2 rotation in either direction
3. Completes one rotation in either direction but not two rotations
4. Completes two rotations in one direction but less than two rotations in the other direction
5. Completes two rotations in each direction

Saccade Accuracy
1. Large over- or undershooting is noted one or more times
2. Moderate over- or undershooting noted one or more times
3. Constant slight over- or undershooting noted (greater than 50% of the time)
4. Intermittent slight over- or undershooting noted (less than 50% of the time)
5. No over- or undershooting noted

Pursuit Accuracy
1. Refixations more than 10 times
2. Refixations five to 10 times
3. Refixations three or four times
4. Refixations two times or less
5. No refixations

When finished scoring, the examiner can compare their results to the norms established by Maples over a number of years on school screenings with a total of 1,714 children (878 males, 836 females). The norms are established for children 5 to 14 years old. Maples determined the minimal acceptable scores by age and sex for both saccades and pursuits (listed below in the following two tables). Failure of the NSUCO Oculomotor Test occurs when the child scores below these values for their sex and age group.

NSUCO Saccade Test Minimal Acceptable Score by Age and Sex

<table>
<thead>
<tr>
<th>AGE</th>
<th>ABILITY</th>
<th>ACCURACY</th>
<th>HEAD MVMT</th>
<th>BODY MVMT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
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<td>5</td>
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<td>11</td>
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<td>12</td>
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<td>3</td>
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<tr>
<td>13</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>14=&gt;</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Critique: The NSUCO Oculomotor Test appears to be a reliable, inexpensive, and quick diagnostic test of oculomotor skills. The test also appears to demonstrate good predictive validity of children's reading skills.

Three types of reliability were tested on the NSUCO Oculomotor Test: test-retest reliability (subject performance reliability), intrarater reliability (observer reliability based on how consistent the same observer scores the subject's behavior on two different occasions), and interrater reliability (observer reliability based on how closely the two clinicians grade the same behavior). The NSUCO Oculomotor Test demonstrated acceptable test-retest, inter- and intrarater reliability. Due to the use of ordinal level data, they used the Wilcoxon Matched Pairs Signed-Rank Test to calculate the reliability of their data. The Wilcoxon takes into account the magnitude of difference between the two ranked scores if they were not identical. However, for their statistical analysis, they only considered exact agreement as agreement.

The average intrarater reliability findings also demonstrated good reliability values for both the quantitative and qualitative scores on pursuits and saccades. The reliability values for the four variables tested with pursuits: "ability" showed 95%, "accuracy" showed 90%, "head movement" showed 76%, while "body movement" showed 100% reliability. The four variables tested with saccades: "ability" showed 90%, "accuracy" showed 62%, "head movement" showed 86%, and "body movement" showed 95% intrarater reliability.

The average interrater reliability findings demonstrated good reliability values for both the quantitative and qualitative scores on pursuits and saccades. The interrater reliability values for the four variables tested with pursuits: "ability" showed 88.1%, "accuracy" showed 68.6%, "head movement" showed 63.7%, while "body movement" showed 73.5% reliability. The four variables tested with saccades: "ability" showed 98.0%, "accuracy" showed 55.5%, "head movement" showed 68.4%, and "body movement" showed 78.2% interrater reliability.

The test-retest reliability findings for the NSUCO Oculomotor test showed that although the child did not perform exactly the same, their differences were not statistically significant between testing. Only "head movements" on the saccade subtest showed a statistically significant improvement in skills. The test-retest reliability values for the four variables tested with pursuits include: "ability" showed 97.9% agreement, "accuracy" showed 64.9% exact agreement, "head movement" showed 56.7% exact agreement (23% increased while 19% decreased), and "body movement" showed 74.2% exact agreement. The four
variables tested with saccades include: “ability” showed 100% exact agreement, “accuracy” showed 25.8% exact agreement (42% increased while 30% decreased), “head movement” showed 43.8% exact agreement (37% increased while only 18% decreased), and “body movement” showed 74.2% exact agreement.

The validity of the NSUCO Oculomotor Test was tested by administering the test to three groups of individuals: gifted students, normal students, and learning disabled students. They established a score of a three or below as a failure criterion, while passing anyone who scored a four or a five. Two different studies were conducted. One small study on only gifted students and learning-disabled (LD) students with only one observer. They found the LD to be poorer in every aspect of the oculomotor testing with a statistical significant difference in five of the eight categories. The second study was conducted on a group of “normal” students at a local school with the additional knowledge of the good and poor readers provided by previous school testing. This study contained 24 observers and all of them were masked from the knowledge of reading skills. They found “the failure rate for the poor readers to be twice that of the good readers.”¹ (51) Both the Mann-Whitney U Test and the student t-test found the NSUCO Oculomotor Test could statistically predict these two groups of good and poor readers.

**Survey results (1997):**
How often used: 1.97. Fifty one of the 91 optometrists did not use the NSUCO Oculomotor Test. Twenty one optometrists responded that they use the test “frequently” or "all the time”.

Usefulness: 3.26. Nineteen responders found the test either "very" or "extremely" useful. However, 56 of the 91 left the question blank, thereby skewing the results.

**PUCO VPTM Subsection Authors:**
Original Authors (1998):
Karl Bakken, Melissa Severns

**Publisher:** NSUCO Oculomotor Test
W.C. Maples, O.D.
Optometric Extension Program
1921 East Carnegie Avenue, Suite 3-L
Santa Ana, CA 92705-5510

**References:**
PEABODY PICTURE VOCABULARY TEST - REVISED (PPVT-R)

**Purpose:** The PPVT was initially designed to provide an estimate of an individual's verbal intelligence potential by measuring receptive language. Since the test's development in 1959, twenty years of use and research with the original version yielded many valuable suggestions for improving the test. The revised version is a more sophisticated test, but still contains many of the best features of the original. New features include: standardization on a nationwide basis, inclusion of adult norms, re-done drawings for better racial, ethnic and sex balance, and the number of test plates increased from 150 items to 175. The revised version also contains fewer "very hard" and "very easy" items with an increased number of items at the middle-aged level.

**Indications:** The PPVT-R provides a direct measure of receptive vocabulary, verbal-visual integration, and indirect measures of intelligence, mental age, and scholastic aptitude. The test may be given to any English speaking resident of the United States between 2 years 6 months and 18 years who is able to hear words, view drawings, and able to respond either "yes" or "no" in any manner.

**Apparatus and Setup:** The PPVT-R test kit includes a two spiral-bound books (Form L and Form M) each containing 175 numbered plates preceded by five example plates, an instruction manual, and Individual Test Records recording sheets which list stimulus words and keys to correct responses. It is important for the examiner to use the correct pronunciation of each of the test plate words (a "Guide to Pronouncing the Stimulus Words" is located in Appendix B of the testing manual).

**Time Required:** Administration takes approximately 10 - 15 minutes. The PPVT-R is not a timed test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Peabody Picture Vocabulary Test - Revised. Proper use of the test requires the purchase of the Peabody Picture Vocabulary Test - Revised and adherence to the protocol listed in the test manual.

**Preset (Administration):** Either Test Form L or Test Form M may be used. The important rules of administration of the PPVT-R as listed in the administration guide are:

1. The test should be given in a quiet room away from others.
2. The examiner should be business-like, pleasant, and encouraging.
3. Praise should be given generously (but not overdone) to motivate the subject. Effective comments are: "Good! You are doing well" etc.
4. Encouragement should be given even if an incorrect response is made. If the subject says, "Did I get that one right?" say: "That was a good answer."
5. Directions to the subject should be read verbatim, rather than from memory.
6. It is not permissible to show the subject the printed stimulus words, to use them in sentences, to define, or to spell them.
7. Stimulus words may be pronounced more than once by the examiner. If two pronunciations are listed in the dictionary, both are given.
8. Singular stimulus words should not be converted to the plural.
9. Stimulus words should never be preceded by an article (a, an, the).
10. The subject may take any reasonable amount of time per item to make his choice. However, after about one minute, he should be encouraged to decide. Say: "Try one. Point to one of them." A response should always be secured.
11. Record the final response if a subject changes his choice.
Introduce the test to children below 8 years of age by saying: "I want to play a picture game with you." Turn to Example A and say: "See all the pictures on this page." (Point to each.) "I will say a word, then I want you to put your finger on the picture of the word I have said. Let us try one. Put your finger on 'bed'." When the child makes the desired response turn to Example B saying: "That's fine. Now put your finger on 'fish'." Then turn to Example C saying: "Good! Show me 'butterfly'." Then say: "Fine! Now I am going to show you some other pictures. Each time I say a word, you find the picture of it. When we get along further in the book you may not be sure you know the word, but I want you to look carefully at all the pictures anyway and choose the one you think is right. Point to ______________." (See the instructions below for starting points).

Introduce the test to children 8 years of age and above by saying: "I have some pictures to show you." (With mature subjects, say: "I want to find out how large your vocabulary is.") Turn to Example A and say: "See, there are four pictures on this page. Each of them is numbered." (Point to each.) "I will say a word, then I want you to tell me the number of (or point to) the picture which best tells me the meaning of the word. Let us try one. Tell me the number of (or point to) the picture which best tells the meaning of 'crib'." When a subject makes the desired response, turn to Example B saying: "That's fine. Now, what number is 'fin'?" Then turn to Example C saying: "Good! What number is 'butterfly'?" Then say: "Fine! Now I am going to show you some other pictures. Each time I say a word, you tell the number of (or point to) the picture which best tells the meaning of the word. As we advance through the book you may not be sure you know the meaning of some of the words, but I want you to look carefully at all of the pictures anyway and choose the one you think is right. What number is ______________?" (See the starting point instructions below).

Special instructions are given in the manual to introduce the test to very young children, mentally challenged children, or very immature children.

Starting Points: For children of estimated average learning ability or above begin the test with the recommended starting point which is coded to the left of the item numbers on the Individual Test Record. Subjects suspected of subnormal learning ability may be started below the recommended place in keeping with best estimates of their mental age.

From the starting point work forward until the subject makes his first error. In the event he has not made 8 consecutive correct responses prior to this first error, drop back immediately to the starting point and work backward consecutively until a total of 8 consecutive correct responses has been made by the subject. Responses above the starting point, as well as below, are to be counted for purposes of establishing this basal of 8 consecutively correct answers. Continue testing forward from the point of the first error until the subject makes 6 errors in any 8 consecutive presentations; count the last item presented as his ceiling. If the examiner tests the subject at a too difficult level, the subject will immediately make errors. If this happens, the examiner should drop back 15, 20, or the necessary number of plates to a new starting point where the subject is successful even though it is below that which the subject's chronological age would suggest. The examiner should then proceed, as described above to establish a basal and a ceiling. The test is discontinued when a basal and ceiling have been established. By using this method the test is administered only over the critical range for a particular subject.

Scoring: The examiner records the number (1, 2, 3 or 4) of the child's response next to the test item (correct responses are printed on the form). Draw a line through the numeral or geometric figures of incorrect responses. The Raw Score is determined by first adding up all correct responses (all items below the basal point are assumed correct; all items above the ceiling item are assumed incorrect). To get the total Raw Score, subtract the errors
(count errors between the highest basal and lowest ceiling only) from the number of the last item presented, or ceiling item.

The Raw Scores must then be converted to Derived Scores (norms) to allow comparison of performance to reference groups. The derived score norm may be converted to standard score equivalents and percentile ranks. Raw score conversion tables are located in the Appendix of the PPVT-R manual and are quick and easy to use. Remember to use the correct table for the form that you are using (L or M).

What to Look For: The examiner simply looks for correct or incorrect responses.

Critique: To determine the PPVT-R's reliability, analyses was performed two different ways. First, the split-half procedure was used. This is done by comparing performance on the odd versus even items on one form of the PPVT-R. For ages 2.5 through 18, the split-half coefficients ranged from 0.67 to 0.88 on Form L, and from 0.61 to 0.86 on Form M. The second analyses performed was alternate form reliability. Immediate re-test reliability ranged from 0.73 to 0.91. Delayed re-test reliability (a minimum of 9 days and a maximum of 31 days between administration) ranged from 0.52 to 0.90. The authors of the PPVT-R report the revised version to be a slightly more reliable test than the original. Several independent studies have reported alternate form reliability ranges from 0.79 to 0.86 for raw scores and that most comparison studies are supportive of the publisher's claim of equivalency of forms.3

The validity data for the PPVT-R was supportive of content, construct and concurrent validity.4 No predictive validity data are available for the PPVT-R.

The PPVT-R provides a well standardized, norm-referenced test of standard receptive American English vocabulary.3 McCallum reports the PPVT-R is an attractive, easy to use test of receptive language. The PPVT-R has a number of advantages, including the following: 1) It is quickly given in 10 to 15 minutes; 2) Scoring is objective and easy; 3) No oral response is needed; 4) The test covers a wide range of vocabulary; 5) Alternate forms of the test are provided to facilitate repeated measures.

The PPVT-R can be administered to individuals with motor and/or communication dysfunctions by employing a binary response method developed by Wagner.6 The PPVT-R was administered and evaluated using this method and the results "strongly suggest that the present binary response adaptation of the PPVT-R is a viable alternative to the standard administration".7

The PPVT-R has also been compared to other intelligence and achievement tests. In the study by Smith et al. the PPVT-R showed significant correlation with the reading and spelling portions of the WRAT-R (Wide Range Achievement Test-Revised).8

Survey Results:
How often used: 1.33. 6 of the total 91 optometrists responding to the survey reported using the PPVT "all the time" or "frequently". 66 of those responding indicated they "don't use" the PPVT.

Usefulness: 2.19. 5 optometrists indicated the PPVT was "extremely" to "very" useful. 13 reported it to be "somewhat" or "not" useful.
PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: American Guidance Service
Circle Pines, MN 55014-1796

References:
PIAGET LEFT-RIGHT AWARENESS TEST

Purpose: The purpose of this test is to determine a person's ability to differentiate between left and right.

Indications: Norms for the Piaget have been established for ages 5 through 11 years of age.

Apparatus and Setup: The Piaget utilizes an instruction set, pencil, key or coin, and a watch or bracelet to be worn on the examiner's left arm.

Time Required: This is not a timed test. Generally this test requires less than 10 minutes to administer.

Preset (Administration):

Section A: It is important to make sure the subject is paying attention. The following questions should be asked serially, noting the subject's response (gesture) each time: "Show me your right hand... show me your left hand... touch your left ear... raise your right hand... show me your right leg... show me your left hand... point to your right eye."

Section B: The examiner should sit opposite the subject and ask the following questions successively. Once again, the response (gesture) of the subject should be noted: "Show me my right hand... now show me my left hand show me my left leg... now show me my right leg."

Section C: Next the examiner is to place a penny on the table to the left of a pencil in relation to the subject. Ask the following questions successively: "Is the pencil to the right or the left? And the penny - is it to the right or the left?" The subject now goes around to the opposite side of the table. "Is the pencil to the right or the left? And the penny - is it to the right or the left?"

Section D: The examiner sits opposite the subject with a coin in his/her right hand and a watch or bracelet on his/her left arm. The following questions are asked: "See this penny? Do I have it in my right hand or in my left hand? And the bracelet (watch) - Is it on my left arm or my right arm?"

Section E: The examiner places three objects in front of the subject: a pencil is placed to the left; a key in the middle; and a coin to the right. The following questions are asked: "Is the pencil to the left or to the right of the key? Is the pencil to the left or the right of the penny? Is the key to the left or the right of the pencil? Is the penny to the left or the right of the key? Is the key to the left or the right of the penny? Is the penny to the left or the right of the pencil? Is the penny to the left or the right of the key?"

What to Look For: It is necessary that the subject answer all questions in a particular section correctly in order to receive credit for that section.

Scoring: The examiner compares the sections which are passed by the subject to the normative information to establish an age score for the subject.
Critique: The Piaget Left-Right Awareness Test is a quick and simple method to screen children for laterality difficulties. Many children with learning disorders demonstrate an inability to differentiate between left and right, either on themselves or in the mirror position. This difficulty is more common for girls than boys and more common among left handed individuals than among right handed people. Difficulty differentiating between left and right is also more common among children with arithmetic problems. The test cannot differentiate between 5 and 6 year olds or 8-10 year olds. It is not arranged from easiest to most difficult (section C is easier than B). The Piaget is not norm referenced or quantified by ordinal raw score. It is useful only as a screening device.

Survey Results (1997):
How often used: 3.31. 39 optometrists of the total 91 use this test “all the time” or “frequently”. 28 marked the Piaget as using it “occasionally”.

Usefulness: 3.61. 40 optometrists find this test to be “extremely” to “very” useful. 32 find it “moderately” or “somewhat” useful.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher:

References:
PIERCES SACCADIE TEST

Purpose: This test is designed to determine saccadic eye movement ability.

Indications: The test is designed to be utilized with persons ages 6 through adulthood. It may be used as a screening test for saccadic ability or as a performance test during evaluation. It may be possible to utilize the Pierce as a test to determine the immediate effect of lenses and prisms used to aid binocularity, however the test does lack suppression control.

Apparatus and Setup: The Pierce is composed of four test cards, with the first being a demonstration plate and the following three making up the actual test. Each card has 15 rows of 2 numbers each. The demonstration card has arrows from left to right to simulate the type of eye movements the subject is to make. The first test card has lines between the numbers and the second and third cards have open spaces between the numbers. The test also utilizes recording forms and a stopwatch.

Time Required: Variable, generally less than 5 minutes to complete tests I, II, and III.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Pierce Saccade Test. Proper use requires the purchase of the Pierce Saccade Test and adherence to the protocol listed in the test manual.

Preset (Administration): The patient is instructed to hold the test cards in the fronto-parallel plane at his normal reading distance. The tests have been standardized on the basis of presenting the tests in the following order: Demonstration card, Test I, Test II, and Test III. If the patient moves his head during the saccades on the demonstration card he is instructed to try to not move his head on the following test cards.

The patient should be instructed to, “Call out all the numbers on the card as rapidly and as accurately as possible,” in the manner indicated. The examiner should point to the upper left-hand number, then the upper right-hand number, then the second left-hand number, the second right-hand number and so on. The patient is asked if he/she understands and is ready. The examiner says “Ready, start,” and begins timing him. The timing is stopped when he/she has completed calling out all of the numbers.

What to Look For: The examiner should observe the patient during testing and rate his/her head movements according to the following scale:

- No head movement
- Slight head movement
- Exaggerated head movements

Other signs to watch for include abnormal working distance, posture, head tilt, frowning, or squinting.

Recording Responses: The patient is timed in seconds during each of tests I, II, and III. The recording forms have the numbers printed on them to allow the examiner to follow along as the patient calls out the numbers. Errors are recorded as omissions or addition errors. Omission errors are recorded by marking a slash through the number omitted. Addition errors are recorded by circling the number that was repeated.
Scoring: The time in seconds and the errors for each test (I, II, and III) are added together to give the total time and the total errors. These are then compared to a graph to give "Age Equivalent" performance. There is also a graph showing the percent of subjects with exaggerated head movements versus chronological age. The test also has normative data that can be used to judge whether a subject's performance is normal or abnormal. An abnormal performance is indicated by scores 1 SD below the mean for the subject's age.

Norms by Age:

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Time in sec (SD)</th>
<th>Errors (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>127 (20)</td>
<td>18 (10)</td>
</tr>
<tr>
<td>7</td>
<td>114 (26)</td>
<td>14 (11)</td>
</tr>
<tr>
<td>8</td>
<td>92 (17)</td>
<td>7 (7)</td>
</tr>
<tr>
<td>9</td>
<td>77 (12)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>10</td>
<td>71 (15)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>11</td>
<td>67 (13)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>12</td>
<td>57 (8)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>13</td>
<td>54 (8)</td>
<td>---</td>
</tr>
<tr>
<td>14</td>
<td>54 (6)</td>
<td>---</td>
</tr>
<tr>
<td>15</td>
<td>50 (6)</td>
<td>---</td>
</tr>
</tbody>
</table>

Critique: The Pierce Saccade Test is a test for determining saccadic ability, which may also aid in determining the immediate effects of lenses and prisms used to aid binocularity. Statistical analysis has shown the Pierce to have poor repeatability, with subject's showing a significant improvement in test scores on the retest. Data has suggested the subjects became more familiar or have learned to take the test, thus improving their scores on retest. Studies have concluded that the Pierce test may be a questionable test for evaluating whether improvements are due solely to oculomotor therapy. Any test with a visual-verbal format may not be solely assessing oculomotor function but automaticity, as well. Therefore, it would appear that lateral eye movements as measured with the Pierce cannot simply be presumed deficient if a child performs poorly on this test.

The graphs of total errors and total times start leveling off between the ages of 10 and 14 years. This implies there are very small differences between a 10- and a 14-year-old age equivalent where the test tops out. Therefore, this test has limited usefulness for the average adult patient, but may be helpful in identification of an adult who is experiencing difficulty with saccadic ability.

Survey Results (1997): The Pierce Saccade Test was not included in our survey.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: John R. Pierce, O.D., Ph. D.
University of Alabama at Birmingham
School of Optometry
References:
SPACHE BINOCULAR READING TEST

Developed by George Spache, Ph.D.

Purpose: The Spache Binocular Reading Test tests how well the patient uses each eye individually during reading tasks.

Indications: The Spache Binocular Reading Test can be used for ages 6 to adult.

Apparatus and Setup: Stereoscopic reading card and a stereoscopic viewer. The words of the story are arranged so that when viewed through the stereoscope the words on the card are presented either to the right or left eye only. The stereoscope should be on a table so the child can comfortably look in the oculars with their habitual reading correction, if any.

Time Required: Usually less than 5 minutes are required to complete the test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Spache Binocular Reading Test. Proper use of the test requires the purchase of the Spache Binocular Reading Test and adherence to the protocol listed in the test manual.

Preset (Administration): First have the patient look at several ordinary stereograms or picture stereographs to determine the point at which the holder should be set for easy fusion. Use the age appropriate testing card.

Recording Responses: Use the Binocular Reading Test Record for all recording and scoring of this test. It has the paragraph written out and notation of which eye is able to see the word. The examiner should count the number of key words read (not those omitted) by each eye. Enter these figures as the numerator of the fractions. Add these same figures for the total number of key words read. Write this number as the denominator of each fraction.

Scoring: The average patient shows little preference for either eye in the Binocular Reading Test. Expected results should be within 7% of the items read by the right and left eyes. If there is a larger discrepancy, then the patient requires a thorough binocular vision evaluation.

Critique: This test is a good basic tool to use for evaluating the level of binocularity of a child. The test is easy to administer and a child is not penalized for poor sight vocabulary since only right and left eye comparisons are used. Visual acuity demands of this test might cause a child with less than 20/30 near acuity to do poorly.

Survey Results (1997): The Spache Binocular Reading Test was not included in our survey.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Keystone View Company
4673 Aircenter Circle
References:
SUNY DEVELOPMENTAL TEST BATTERY

Purpose: The SUNY Developmental Test Battery consists of six tests that assess visual-perceptual development and maturity. These tests can provide valuable information about how the patient's developmental/perceptual status may be affecting school performance. The SUNY Test Battery is concerned with three general areas of visual development: 1) the invariant, 2) bilaterality, and 3) spatial organization and manipulation.

The invariant refers to a zero point, or point of origin, around which human beings organize space. Since there is no absolute reference point in physical space, the human child uses the only non-variant item in his environment, his own body, for a zero point. In order to assess the integrity of this "invariant," or zero point, the developers of the SUNY Test Battery hypothesize that the better the knowledge and control of the body (self), the better the invariant. The invariant is important because it is the base from which all visual behavior proceeds. The tests in the SUNY battery that evaluate body knowledge and control (and thus the invariant) include Standing Angels-in-the-Snow, Chalkboard Circles, and the 3:3 Alternate Hop.

Bilaterality, the second major area that the SUNY Test Battery assesses, is the awareness of oneself as a two sided being (left and right) and the knowledge of the difference between the two sides. Bilaterality is important because one has to know what is right and left on the body before these are developed in space. The SUNY Test Battery developers hypothesize that the state of manual dominance and the ability of the child to manually cross the mid-line reflect the maturity of this phase. The SUNY tests that evaluate bi-manual integration (bilaterality) include the Circus Puzzle, the Pegboard Test, and the Winterhaven Copy Forms Test.

Spatial organization and manipulation is the third major area tested. It represents the projection of bilaterality out into space. The child imposes on the environment a set of coordinates that have been developed within his own body. The developers of the SUNY Test Battery hypothesize that the relative maturity of this phase is the degree to which the child must relate visual or spatial phenomenon back to his body organization. In other words, as a child matures he depends less on motor activity and more on vision. At the mature level the child is able to handle spatial phenomena in a purely visual manner without using body tilts, paper rotations, etc.

Besides this visual-motor hierarchy, the SUNY Test Battery evaluates the maturity of spatial organization and manipulation in terms of three other factors. These factors are form matching/reproduction, visualized reversals, and visual organization. Visualized reversals refer to the ability to visually manipulate space from another viewpoint. Visual organization means the ability to visually plan out a task in a defined spatial area. The SUNY tests that evaluate visual-motor hierarchy are the Circus Puzzle, the Pegboard Test, and the Winterhaven Copy Forms. The Pegboard Test is used to evaluate visualized reversals and the Winterhaven Copy Forms Test is used to evaluate visual organization.

Indications: The SUNY Tests are indicated for any child 2 years of age or older who is suspected of having learning or developmental/perceptual difficulties. The skills tested in the SUNY battery are assumed to normalize (or maximize) between six and nine years of age. This makes the battery particularly useful in evaluating spatial organization and manipulation for children from Kindergarten to Grades 3 or 4. However, it is useful with developmentally delayed older children—up to ages 12 or 13, particularly those with learning difficulties.
In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Suny Developmental Test Battery.

TEST #1: STANDING ANGELS-IN-THE-SNOW

Purpose: The purpose of the test is to assess body knowledge and control.

Apparatus and Setup: The examiner is seated in front of the child so that his face is level with the child's. The examiner's legs are separated so that the child is standing midway between them, with a separation distance of one foot on each side between the examiner's foot and the child's foot.

Time Required: Less than five minutes.

Preset (Administration): The examiner tells the child, "We are going to play a game called 'touch and go.' If I touch your arm, you must move only that arm until it is even with your shoulder." The examiner touches one of the child's arms, extends the child's arm and guides it to shoulder level. The examiner then tells the child, "If I touch your leg, you must move your leg so that your foot slides on the floor until it just touches mine." The examiner demonstrates this. "If I touch more than one thing at the same time, you must move both things I touch at the same time. Remember, you must move only the parts that I touch. While we are playing this game, try to keep looking at my face all the time." The examiner proceeds in the following order:

1. Both arms (homologous)
2. Right arm (monolateral)
3. Left arm (monolateral)
4. Right leg (monolateral)
5. Left leg (monolateral)
6. Right arm and right leg (ipsilateral)
7. Left arm and left leg (ipsilateral)
8. Right arm and left leg (contralateral)
9. Left arm and right leg (contralateral)

What to Look For: The examiner evaluates the child's ability to perform the specified movements, including homologous, monolateral, ipsilateral, and contralateral limb movements. The examiner also looks for motor overflow, such as movement of non-touched body parts. The examiner also assesses segmentation, which occurs when touched limbs are not moved simultaneously.

Recording Responses: The age that is most characteristic of performance is circled according to the SUNY Developmental Test Battery Chart. Next, the appropriate age square on the SUNY Profile Sheet is checked for Factor A: Body Knowledge and Control.

Scoring: Standing Angels-in-the-Snow, like other SUNY tests, has been age normed. The child's performance of it can be compared to his chronological age.

TEST #2: CHALKBOARD CIRCLES

Purpose: The purpose of the test is to assess body knowledge and control. This test also provides a measure of bilateral integration and hand dominance.
Apparatus and Setup: The examiner tells the child: "Here are two pieces of chalk, one for this hand, and one for that hand. I want you to make two circles at the same time, one with each hand. Keep going over and over the circles that you make. I don't want the two circles to touch. I will tell you when to stop. I want you to make the two circles like this." The examiner takes the child's arms and simulates the circles in the air. He should simulate circles of about one foot in diameter, staring with both hands at the top of each circle, first symmetrical circles both going toward the mid-line, then symmetrical circles, both going away from the mid-line. Between the two types of simulation he says: "You can do them this way or this way." The examiner then lets the child produce the circles on the blackboard. After five complete revolutions, the child is told to stop. The produced circles are then erased. The examiner then says: "Now I'd like you to make two circles again at the same time one with each hand. Again, try not to let the two circles touch each other. This time I want you to make them this way." He then demonstrates reciprocal circles with both hands moving to the child's right from the top of each circle (the right and left hands both moving clockwise). The examiner then lets the child produce the circles on the blackboard. After five complete revolutions, (attempted or completed) the examiner says: "Now make them go the other, opposite way." This is the "reversed" portion of the test.

What to Look For: The examiner first evaluates the child's ability to use both arms at the same time. Next, the examiner assesses the child's ability to perform symmetrical circles, in which both hands go toward the mid-line at the same time or both go away from the mid-line at the same time. Third, the examiner evaluates the child's ability to perform reciprocal circles, in which one hand moves toward the body mid-line while the other moves simultaneously away from the body mid-line. In other words, both hands move clockwise at the same time. Fourth, the examiner assesses whether the child can sustain the required task over time. Fifth, the examiner looks for any phase difference between the two hands, which occur when the two hands are out of sync. Finally, the examiner evaluates the quality of the child's circles including size, spacing, and proportion.

Recording Responses: The age that is most characteristic of performance is circled according to the SUNY Developmental Test Battery Chart. Next, the appropriate age square on the SUNY Profile Sheet is checked for Factor A: Body Knowledge and Control.

Scoring the Test: Chalkboard Circles, like the other SUNY tests, has been age normed. The child's performance can be compared to his chronological age.

TEST #3: 3:3 ALTERNATE HOPPING

Purpose: The purpose of the test is to evaluate body knowledge and control. This includes motor planning and the ability to perform integrated motor movements.

Apparatus and Setup: No specific apparatus is required.

Time Required: Less than five minutes.

Preset (Administration): The examiner tells the child: "I'd like you to hop in place, three times." After the child has done this, he is told: "Now, I'd like you to hop in place, three times on the other foot." The examiner then says: "This time I'd like you to hop in place three times on that foot..." (examiner points to right foot), "...then three times on this foot..." (examiner points to the left foot), "...and keep doing it until I tell you to stop. I'd like you to try to do it like this." The examiner then demonstrates one cycle of the 3:3 Alternate Hop. He then asks the child to do it. If the child has difficulty, the examiner lets him try while he holds the child's hands.
What to Look For: The examiner evaluates the child's ability to perform the specified movements, including hopping the correct number of times. The examiner also looks at the child's transition in going from one side to the other (e.g. smooth or jerky, pause or no pause). Finally, the examiner assesses whether the child can sustain the task over time.

Recording Responses: The age that is most characteristic of performance is circled according to the SUNY Developmental Test Battery Chart. Next, the appropriate age square on the SUNY Profile Sheet is checked for Factor A: Body Knowledge and Control.

Scoring: 3:3 Alternate Hopping, like other SUNY tests, has been age normed. The child's performance can be compared to his chronological age.

TEST #4: CIRCUS PUZZLE

Purpose: Circus Puzzle tests three factors: 1) Bi-manual integration, including the ability to cross the mid-line which indicates how well developed the child's sense of bilaterality is; 2) Form matching/reproduction - an aspect of spatial organization and manipulation; and 3) Visual-motor hierarchy which is a measure of how dependent the child is on body involvement to organize and manipulate visual space. The more vision operates without motor involvement, the higher the developmental level of the child.

Apparatus and Setup: Initially, the examiner should number the back of each piece of Circus Puzzle in the following manner:

1. Rope Climber
2. Trapeze Man
3. Bar Bell Lifter
4. Trapeze Lady
5. Lady and Whit Dogs
8. Seal
9. Elephant
10. Clown with White Collar
11. Lady and Bear
12. Lady on White Horse

The examiner sits at a desk with the child sitting opposite him. The examiner places a completed Circus Puzzle flatly on the desk so that it is oriented properly in an up-down direction with reference to the child. The puzzle is placed so that its geometrical center is coincident with the geometrical center of the desk. The left and right sides of the puzzle should be parallel to the corresponding sides of the desk.

Time Required: Usually less than 10 minutes, depending on the developmental level of the child.

Preset (Administration): The examiner tells the child, "Here is a puzzle." The examiner then takes the pieces out of the puzzle board by raising the puzzle from the desk and pushing each piece out through the cloth that lines the back of the puzzle board. The numbers on the backs of the pieces should be visible to the examiner but not to the child. All pieces with even numbers should be placed between the right edge of the desk (child's view) and all pieces with odd numbers should be placed between the left border of the puzzle and the left edge of the desk (child's view). All pieces are placed picture side up. When all pieces are so arranged the examiner says, "Now you put all the pieces of the puzzle in the places they belong. Take your time and do the best you can."
child begins, the examiner should ensure that the child is seated so that his body mid-line is aligned with the geometric center of the puzzle. The examiner carefully watches the child's performance but does not comment about it.

**What to Look For:** Circus Puzzle evaluates three factors: Factor B: Bi-manual Integration, Factor C: Form Matching, and Factor E: Visual Motor Hierarchy. In terms of Factor B: Bi-manual Integration, the examiner looks for 1) body tilt toward the side where the piece is to be placed; 2) which hand(s) picks up pieces on right, which hand picks up pieces on left; 3) which hand places pieces picked on right, and pieces picked on left; 4) transfer of pieces from one hand to the other for placement; and 5) crossing the mid-line.

In terms of Factor C: Form Matching, the examiner assesses 1) the number of form errors, which is the inability to fit a piece into the proper place and 2) the number of false starts, which is putting a piece in the wrong place initially and then correcting. In terms of Factor E: Visual Motor Hierarchy, the examiner determines whether the child relies on tactual judgment or visual judgment in completing the task. In other words, does the child put each piece on the board and then try to force it into place (tactual mode) or does the child visually orient each piece first before placing it on the board (visual mode)?

**Recording Responses:** The age that is most characteristic of performance is circled according to the SUNY Developmental Test Battery Chart. Next, the appropriate age squares on the SUNY Profile Sheet are checked for Factors B, C, and E and are compared to his chronological age.

**TEST #5: WINTERHAVEN COPY FORMS**

**Purpose of Test:** Copy Forms tests four factors. The first factor evaluated is biannual integration, including the ability to cross the mid-line. This indicates how well developed the child's sense of bilaterality is. Form matching/reproduction, the second factor assessed, is the aspect of spatial organization and manipulation. The third factor, visual organization, is a measure of the child's ability to visually plan out a task in a defined spatial area. Visual-motor hierarchy, the fourth factor that Copy Forms evaluates, is a measure of how dependent the child is on body involvement to organize and manipulate visual space. The more that vision operates without motor involvement, the higher the developmental level of the child.

**Apparatus and Setup:** Winterhaven Copy Forms consists of a set of seven cards, on each of which is drawn a geometric figure. The child sits at a desk with the examiner sitting opposite. A piece of 8" x 11" white, unlined paper is placed in front of the child with the 11" side parallel to the front and back of the desk. The examiner has the cards in a pile in front of him and each card is placed so that the figure will be properly oriented to the child.

**Time Required:** Usually less than 10 minutes, depending on the developmental level of the child.

**Preset (Administration):** The examiner tells the child: "Look, picture number one is a circle, picture number two is a cross." He then shows the child each card, which is flat on the desk, in the following order while verbally identifying each one: circle, cross, square, triangle, divided rectangle, horizontal diamond, vertical diamond. After this presentation, the examiner says: "Now I will show you the pictures again, one at a time. Each time I show you a picture, I want you to make one just like it on the paper. Do the best you can and take your time. I want you to get all seven pictures on this side of the paper." The
examiner then hands the child a pencil and begins the presentation of the cards again. The picture is available to the child until he shows that he is finished with the particular figure.

**What to Look For:** Winterhaven Copy Forms test four factors: Factor B: Bi-manual Integration, Factor C: Form Matching/Reproduction, Factor D: Visual Organization, and Factor E: Visual Motor Hierarchy. In terms of Factor B: Bi-manual Integration, the examiner evaluates 1) hand preference for writing and 2) support from the non-writing hand holding or orienting the paper. In terms of Factor C: Form reproduction, the examiner looks for 1) the ability to accurately reproduce figures; 2) segmentation of rectangle, meaning that the inner vertical line is drawn first and the rest of the lines are drawn as unrelated on either side; and 3) the proportionality of the drawn figures. In terms of Factor D: Visual Organization, the examiner evaluates the placement of the figures. Are the figures superimposed on one another, randomly placed on the page, placed around the central circle, or consistently placed in horizontal or vertical order? In terms of Factor E: Visual Motor Hierarchy, the examiner assesses 1) body involvement, i.e., whether the trunk, head, or tongue is involved in completing the task and 2) tilt of the body or paper (especially when reproducing oblique lines).

**Recording Responses:** The age that is most characteristic of performance is circled according to the SUNY Developmental Test Battery Chart. Next, the appropriate age squares are checked on the SUNY Profile Sheet for Factors B, C, D, and E.

**Scoring the Test:** The Winterhaven Copy Forms Test, like other SUNY tests, has been age normed. The child’s performance in terms of Factors B, C, D, and E are compared to his chronological age.

**Publisher:**
Teacher’s Test Manual  
Perceptual Copy Forms  
PO Box 111  
Winter Haven, FL 33880

**TEST #6: PEGBOARD TEST**

**Purpose:** The Pegboard Test tests four factors. These factors include bi-manual integration (bilaterality), form matching/reproduction, visual-motor hierarchy, and visualized reversals (the ability to visually manipulate space from another viewpoint).

**Apparatus and Setup:** Two pegboards measuring 10” x 10” and red and yellow pegs are recommended for this test. The examiner sits at a desk with the child sitting opposite him. The pegboards are placed touching each other and even with each other so that the center of the line joining them is coincident with the geometric center of the desk. The bottom border of the joined pegboards should be about 6” higher than the lower edge of the desk and the sides of the pegboards should be parallel to the corresponding sides of the desk. The line joining the two boards should also be aligned with the child’s mid-line.

**Time Required:** Usually less than 10 minutes, depending on the developmental level of the child.

**Preset (Administration):** The child is shown the two sets of pegs: five red and five yellow. The examiner says, “Which color pegs would you like?” After the child chooses, he is handed those pegs. The examiner then says, “Now I’d like you to close your eyes and shake the pegs in both your hands at the same time. Keep your eyes closed and keep shaking until I say, ‘open’.” As the child does this, the examiner produces model No. 1, as shown on page 54 of Dr. Suchoff’s manual. After this is done, he tells the child to open
his eyes and stop shaking the pegs. He then says, "I want you to make the same exact picture with your pegs that I have made with mine. I want it so that, if we cut your picture out of the puzzle with a saw, it would fit right on top of mine. Make your picture on this side." The examiner indicates the pegboard on which there are no pegs. "Take your time and do the best you can." After the child has completed the first pattern, the examiner takes his pegs out and the child is told to remove his pegs. He is then told to close his eyes and shake the pegs in his hands once again. When the examiner has placed model No. 2 on the second board (not the one showing model No. 1), the child is told to open his eyes again and to stop shaking the pegs. The child is again directed to: "Make the same exact picture that I have made with my pegs," and is shown that it should be made on the empty board. In a similar manner, the patterns are shown by the examiner and produced by the child until all five patterns are shown. The examiner alternates the placement of the model pattern on the boards each time so that model pattern No. 1 is on the child's right, model pattern No. 2 is on the child's left, model pattern No. 3 is on the child's right, etc.

The second phase of this test is performed in the same way as described above. The same figures are used and the model patterns are alternated between the boards as previously described. The examiner has the child close his eyes and shake the pegs as he constructs model pattern No. 1. He then tells the child to open his eyes and says, "Let's make believe that this is a flag on a flagpole." The examiner indicates each part. "I want you to make yours so that the flag flies the other way - the opposite way. Remember, I don't want you to make it upside-down, just opposite." The examiner determines whether the child understands the directions and explains further, if necessary. The child then constructs the "opposite" pattern and the examiner proceeds with the model patterns previously described.

What to Look For: The Pegboard Test evaluates four factors: Factor B: Bi-manual Integration, Factor C: Form Reproduction, Factor E: Visual Motor Hierarchy, and Factor C1: Visualized Reversals. In terms of Factor B: Bi-manual Integration, the examiner observes 1) which hand holds the pegs and which places them, 2) body tilt (to prevent crossing the mid-line), and 3) motor control. In terms of Factor C: Form Reproduction, the examiner assesses 1) which patterns are accurately reproduced, 2) lateral reversals of patterns, and 3) the ability to reproduce oblique elements. In terms of Factor E: Visual Motor Hierarchy, the examiner looks for 1) "central to peripheral attack," meaning that the peg forming the center of the pattern is placed first and the other pegs are placed around it, and 2) body, head, or board tilt. In terms of Factor C1: Visualized Reversals, the examiner evaluates 1) which patterns are accurately reversed, and 2) the ability to reverse oblique elements.

Recording Responses: The age that is most characteristic of performance is circled according to the SUNY Development Test Battery Chart. Next, the appropriate age squares are checked on the SUNY Profile Sheet for Factors B, C, C1, and E.

Scoring: The Pegboard Test, like other SUNY tests, has been age normed. The child’s performance in terms of Factors B, C, C1, and E can be compared to his chronological age.

Critique of SUNY Developmental Test Battery: The theoretical basis of the SUNY Developmental Test Battery is the belief that visual-spatial development involves a sequence of learning stages through which the maturing child progresses. Researchers such as Gessell and Piaget have shown in their work that learning is an adaptive process in which the initial stages serve as a foundation for the more complex stages of learning which follow. Thus, the rationale for the SUNY tests seems solidly based. The actual evaluation used in the SUNY Developmental Test Battery has its roots in several sources, including the Developmental Visual Evaluation of the Optometric Center of New
York, the Purdue Perceptual Motor Survey, the Rosner Perceptual Survey, and the works of Getman and Gessell. The SUNY Test Battery has several advantages over the batteries mentioned above. First, the SUNY Test Battery has a very clearly defined model. All of the SUNY tests relate specifically back to this model. Second, the SUNY Test Battery describes performance in a specific age related manner.

The norms for the SUNY Test Battery come from several sources, including Gessell’s work (Copy Forms), the Optometric Center of New York’s Red School House Study, and “over 100 years” of clinical experience. The primary author of the SUNY Test Battery, Dr. Suchoff, admits that many of these normed behaviors lack formal research and “should be the first to be considered as formal research becomes possible.”

Survey Results (1997): 30% of responding optometrists reported using the Suny Battery.

How often used: 1.86. 13 of the total 91 optometrists use this test “all the time” or “frequently”. 14 use it “occasionally” or “rarely”, and 51 stated they “don’t use” this test.

Usefulness: 19 of the total 91 optometrists find this test to be “very” to “moderately” useful. 10 optometrists find it “somewhat” or “not” useful. We do not use the blank responses (54 of the total 91) when calculating the usefulness rank.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

References:
TEST OF AUDITORY ANALYSIS SKILLS

Purpose: To provide a way for testing a child's auditory perceptual skills. Auditory processing skills are used when the child learns to read because he must learn to attach certain specific spoken sounds to printed letters or combination of letters. If these skills are not developed, the probability of the child understanding the concept of the letters standing for sounds is low. It helps to detect if language problems are auditory-based. The test starts at a simple level, where the child is asked to analyze a two syllable, compound word into this task, he is asked to analyze phonemes, or single sounds. This test, like the Test of Visual Analysis Skills, can be used to identify goals in teaching auditory perceptual skills.

Indications: For children with reading/language problems; to determine if cause may be auditory. Ages 4 and up; normed for grades K - 3.

Apparatus and Setup: TAAS test sheet, pencil.

Time Required: Approximately five minutes. This is not a timed test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the TAAS testing procedure by Jerome Rosner. Proper use requires the purchase of the Test of Auditory Analysis Skills and adherence to the protocol listed in the test manual.

Preset (Administration): The test starts with two demonstration items to show what is expected. Example: Instructor: "Say cowboy". Pause and allow the child to respond. "Now say it again, but don't say boy". Child: "cow". If the child does not answer the demonstration items correctly, try to explain to him what you want. If he still answers incorrectly, do not administer any more items. If the child answers correctly, go on to the test items. Continue through the entire list, or until the child makes two consecutive errors. When you get to the items that ask the child to say the word, but don't say /.../, (a single sound), you are to sound out the letter; do not say the letter name. Example: Instructor: "Say stale". Now say it again, but don't say /tl/. Child: "sale".

Do not give the child hints with your lips. Speak distinctly, but do not stress any particular sounds.

Scoring: Stop testing after two successive errors and record the number of the last correct item before these two errors. This number is the TAAS score.

<table>
<thead>
<tr>
<th>SCORE</th>
<th>USUAL GRADE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>Kindergarten</td>
</tr>
<tr>
<td>4 - 9</td>
<td>First Grade</td>
</tr>
<tr>
<td>10 - 11</td>
<td>Second Grade</td>
</tr>
<tr>
<td>12 - 13</td>
<td>Third Grade</td>
</tr>
</tbody>
</table>

What to Look For: The examiner simply looks (listens) for correct verbal responses from the child.
Critique: The child can be taught to pass the test and the effects of the teaching will be apparent elsewhere, namely in his reading and spelling. The TAAS is easy to administer and score, and can be completed in a short amount of time.

The TAAS is highly effective when used as a screening test. The TAAS can also be used in conjunction with the TVAS, results of which can be indicative of further diagnostic testing and remediation. If more complex test results are desired, it is recommended that tests such as the Test for Auditory Perceptual Skills (TAPS) be used. Hearing should always be checked by an audiologist before beginning a program for auditory-perceptual skills improvement.

Wesson also reports a significant correlation between the TAAS and reading skills ($r=0.676; p=0.046$). He reports the TAAS to be a “unique test” which may be able to predict reading success. These conclusions must be interpreted with caution, however, because only 13 children were involved in the case study. Wesson states that the TAAS may prove differently if a larger number of subject are used.

Survey Results: The TAAS was not included in our survey.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Found in: 
Helping Children Overcome Learning Difficulties
by Jerome Rosner, O.D.
Walker & Company
720 Fifth Avenue
New York, NY 10019

References:
TEST OF VISUAL ANALYSIS SKILLS (TVAS)

Purpose: The TVAS is a test of a child’s ability to understand the relationship of parts to wholes. More specifically, it is a visual perceptual test that examines a child’s ability to analyze a geometric pattern in an organized fashion and copy it. The author of the test also claims that teaching the child to pass the test will teach him perceptual skills.

Indications: The TVAS is suitable for any child between the ages of 4 and 8 who is experiencing learning difficulties.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Test of Visual Analysis Skills. Proper use of the test requires the purchase of the Test of Visual Analysis Skills and adherence to the protocol listed in the test manual.

Apparatus and Setup: The test patterns are printed on 2-3/4” x 2-3/3” reusable laminated cards and the child copies the respective designs on smaller maps that are contained within 2” squares.

Preset (Administration): Give the child a pencil (or crayon, depending on the size of the response spaces) and say, “Make your side look like mine.” Point first to “his” side and then to the side with the pattern. “Draw the lines on yours so that it looks just like mine.” Continue in this manner until the child either fails two items in succession or completes the first nine items, whichever comes first. (An item is passed if the child draws the correct number of lines and locates them on the dots accurately.) If the child reaches item 10, change the instructions slightly to: “Some of the dots are missing from your side. Don’t draw in the dots, just pretend they are there and draw the lines as though they were there.” Continue in this manner until either all 18 items have been completed or two successive items are failed, whichever comes first. The child should be encouraged to draw his lines neatly, although this is not a critical factor. Do not coach the child — he must copy the designs without assistance. Be noncommittal about the child’s performance. Use words such as “okay,” rather than “right” or “wrong.” Children may erase if they wish. The test is not timed.

What to Look For: The examiner should look for correct or incorrect responses. An incorrect number of lines or an incorrect placement on the dots constitutes an error (a failed item).

Recording Responses: Since the TVAS is stopped when the child makes two successive errors, monitoring the test is important. For each item to be scored correct, the drawing must have the right number of lines and they must be located on the proper dots. Touching the dots, however, is not critical for a correct score. If lines are omitted or added, or if lines are located on the wrong dots, the item is scored as incorrect.

Scoring: The TVAS score is the number of the last successfully completed item before the two consecutive errors. The significance of the score is as follows:

<table>
<thead>
<tr>
<th>TVAS Score</th>
<th>Usual Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Preschool</td>
</tr>
<tr>
<td>3-7</td>
<td>Kindergarten</td>
</tr>
<tr>
<td>8-10</td>
<td>First Grade</td>
</tr>
<tr>
<td>11-16</td>
<td>Second Grade</td>
</tr>
</tbody>
</table>
The author states that, if the score is below the child's school grade level, the examiner can assume the child's perceptual skills are below the expected level and are contributing to his school learning problem.

**Critique:** A 1983 study compared two versions of the TVAS (given to 184 students at two different schools) with each other and with the Developmental Test of Visual-Motor Integration (VMI). No significant between-school, within-age-group differences were found in any of the age categories between the two versions of the TVAS. Pearson product moment correlation between the VMI and the TVAS scores of Schools #1 and #2 were .83 and .79 respectively, which is significant to \( P < .0005 \). The outcome of this study indicates that the TVAS provides a valid measure of at least one aspect of visual perceptual skills development, regardless of which version of the test is used.

**Survey Results (1997):**
How often used: 2.14. 22 of the total optometrists use this test “occasionally” or “frequently”. 56 of the total reported using this test “rarely” or that they “don’t use” the TVAS.

Usefulness: 2.89. 20 of the total 91 optometrists find this test “extremely” to “very” useful.

**PUCO VPTM Subsection Authors:**
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

**Publisher:**
Academic Therapy Publications
PO Box 899
San Rafael, CA 94901

**References:**
TEST OF VISUAL PERCEPTUAL SKILLS - REVISED (TVPS-R)

Purpose: The TVPS-R is a non-motor visual-perceptual test designed to determine a child's strengths and weaknesses in the areas of visual discrimination, visual memory, visual-spatial relationship, visual form constancy, visual sequential memory, visual figure-ground, and visual closure.

Indications: Children ages 4 through 12 years.

Apparatus and Setup: The TVPS-R uses an examiner's manual, test booklet, and recording forms. Due to the length of administration, it is essential to give this test in an environment that will allow the child to focus on the task at hand.

Time Required: The time involved depends primarily on the age of the child. The time varies from 7 minutes for young children to 15 minutes or more for older children. A limited amount of time is allowed for a child to make a choice. If a child hesitates in making a selection, he should be encouraged to make a decision. Allow approximately 10 seconds for this process.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Test of Visual Perceptual Skills. Proper use of the test requires the purchase of the Test of Visual Perceptual Skills and adherence to the protocol listed in the test manual.

Preset (Administration):

1) Visual discrimination

State to the child, "Look at this form," while pointing to the single form above the five forms on Plate A. Then say to the child, "Find it among the five forms below," pointing to the five forms below. If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child fails four out of five consecutive items.

2) Visual memory

State to the child, "Look at this form and remember it so that you can find it on another page," while pointing to this form, which is a single plate; Plate A. Then say to the child (after you have turned the page), "Find it among these forms." If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child misses four out of five consecutive items.

3) Visual-spatial relationships

State to the child (pointing to the forms on Plate A), "Here are some forms that are the same, but one form is going a different way or part of one of the forms is going a different way." If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child fails four out of five consecutive items.

4) Visual Form Constancy

State to the child, "Look at this form," while pointing to the single form above the other five forms on Plate A. Then say to the child, "Find this form from among these five
forms, even though it might be smaller, bigger, darker, turned, or upside-down.” If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child misses four out of five consecutive items.

5) Visual Sequential Memory

State to the child, “Look at this form very closely,” while pointing to the form on Plate A. Emphasize to the child, “Remember it so that you can find it among other forms.” Then turn the page and say to the child, “Find it among these forms.” (After the child has determined the correct form, say to him that these forms are going to get longer, further encouraging him to remember the exact sequence.) If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child misses three out of four consecutive items. Based on the time limits used in the development of this subtest, examiners can allow an increase of time as the sequence of forms increases.

<table>
<thead>
<tr>
<th>Number of Forms in Sequence</th>
<th>Time allowed (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 3</td>
<td>5</td>
</tr>
<tr>
<td>4 to 5</td>
<td>9</td>
</tr>
<tr>
<td>6 to 7</td>
<td>12</td>
</tr>
<tr>
<td>8 to 9</td>
<td>14</td>
</tr>
</tbody>
</table>

6) Visual figure-ground

State to the child, “Look at this form,” while pointing to it on Plate A. Then say to the child, “Look at the forms below,” saying further, “Find the exact (or same) form from among these forms below,” while emphasizing to the child that the form is hidden and that he or she will have to look very closely. If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child misses three out of four consecutive items.

7) Visual closure

State to the child, “Look at this form” while pointing to the completed form on Plate A. Then say to the child, “Look at the figures below which are incomplete,” while pointing to these forms. Ask the child to point to the one form that would be like the form above if completed. If the child determines the correct response, continue with this subtest until the ceiling is reached. The ceiling is reached when the child misses three out of four consecutive items.

For each subtest, let the child know that he may not be able to answer all the questions correctly. He should be encouraged to answer all items and guess when necessary.

What to Look For: During testing, be sure the child points to only one selection or identifies a response by number. The child should be allowed to answer each sample question preceding each subtest. If the sample item is answered incorrectly, the examiner should identify the correct response and explain why it is the correct answer. During testing do not let the child know whether or not he has answered correctly.

Behavioral characteristics of the child should be noted by the examiner. These characteristics may include distractibility, short attention span, difficulty in concentration, fear of failure, hypo- or hyper-activity, impassivity, withdrawn behavior, and difficulty
understanding directions. These characteristics will aid the examiner in determining the validity of the test results.

**Recording Responses:** Record the child’s birth date, age (years and months), and the exam date on the recording form. Record the number corresponding to the child’s response for each test item. The correct response is already printed on the form for easy comparison. The recording form should be placed so the child cannot see whether the response is marked “correct” or “incorrect.” Behavioral characteristics should be recorded in the space provided on the recording form.

**Scoring the Test:** Add up the number of correct responses and record it in the space below each subtest. Transfer subtest scores to the front page of the recording form. These raw scores can be converted to scaled scores and visual-perceptual ages using the tables in the instruction manual. The sum of the scaled scores can be converted to perceptual quotients and percentile ranks using the table in the manual. The percentile quotient represents the child’s overall performance.

The median visual-perceptual age from all seven subtests may be used to represent the child’s average TVPS-R performance.

**Critique:** The original TVPS was first published in 1982, and has since been updated in 1996 with the revised (TVPS-R) version. Much of the data incorporated into this critique utilizes information regarding research on the original TVPS version.

**Critique of the original 1982 TVPS:**
The TVPS has several advantages as a perceptual test. The test figures are in no way language related and answers are given by the child pointing, therefore many language and cultural factors are eliminated. All children are given an equal chance. The TVPS is quick to administer and score. Administration of the TVPS does not require any advanced training, which allows its use by a wide range of professionals. Speed is not a factor in the child’s performance, as the test is not timed.

Test-retest reliability for intraclass correlation for the total original TVPS score was 0.81. When broken into subtests, the reliability ranged from 0.33 (Sequential Memory) to 0.78 (Form Constancy). Because of low reliability of the subtests of the original TVPS, extreme caution is indicated when evaluating subtest scores.

Research by Griffin, et al showed that a child’s degree of dyscidesia (measured by the DDT) does not affect performance on the TVPS.

One weakness of the TVPS is that the rationale for the development of the test is not presented, which leaves justification for its use up to the examiner. The TVPS tests the child in many areas, including visual discrimination, visual memory, visual-spatial relationships, visual form constancy, visual sequential memory, visual figure-ground, and visual closure, but there have been no factor analytic studies done to support these factors’ inclusion as separate subtests. Another problem with the TVPS is that no comparisons were made between the normative sample and a criterion group of children with visual perceptual deficits. Therefore, the examiner should be cautious in classifying a child as delayed in visual perception based on this test.

While the TVPS is well standardized, it has a limited geographic distribution. The major problem with the TVPS lies in its weak validity, especially in the areas of diagnostic and predictive validity. The predictive validity of the test for achievement scores in reading and
spelling is not strong and the rationale for this prediction is not discussed. Further studies are needed in the areas of diagnostic and predictive validity.

Research by Cron et al. questions the concurrent validity of the TVPS “because of the lack of agreement between TVPS scores and other valued tests of similar characteristics.” The data showed that only the Visual Discrimination subtest of the TVPS correlated significantly with age (r=0.344). This was also the only subtest to correlate with the standard discrimination test, the error score of the Matching Familiar Figures Test (MFFT) (r=-0.43, p<0.01).

The TVPS also has some problems in terms of reliability. Reliability included only measures of internal consistency, and these were poor to fair for four of the seven subtests, with poorer reliability for the 10- to 12-year-olds. The total test reliability coefficients were good and reliabilities were fair to good for three subtests.

Despite its shortcomings, the TVPS can be a useful tool to learn how a child visually perceives and interprets various forms. The test is best interpreted as a total test and in conjunction with a battery of other perceptual tests.

**Critique of the 1996 TVPS-Revised:**
The purpose and format of the TVPS remains unchanged; however, the revised version contains new, refined norms and standardization data. The TVPS-R includes new test items, has rearranged items, and has excluded some of the original test items. The format of the Individual Record Form remains the same, however, it is not interchangeable between the original TVPS and TVPS-R due to the aforementioned changes.

Total score reliability coefficients for the revised version range from 0.83 to 0.91; while total group reliability ranged from 0.74 to 0.85. For individual subtests, the reliability ranged from 0.27 to 0.80. The author states the low reliabilities on individual subtests “are due to a relatively small number of dichotomous items; however, the median and total sample reliability values indicate acceptable internal consistency”.

In terms of construct validity, the TVPS-R coefficients ranged from 0.38 to 0.73. Data on current validity was obtained by comparing scores on the TVPS-R to performance on tests such as TAAS, the WISC-III, the WPPSI-R and the WRAT. The author states, “subtest intercorrelations are generally in the low to moderate range, indicating that these subtests, while related, are each measuring a different aspect of visual-perceptual skill.”

To evaluate diagnostic validity, 42 known learning-disabled subjects were administered the TVPS-R. Scores for the learning handicapped group were well below the non-learning handicapped group. The total of the scaled scores for the learning-disabled group was 53 (mean), while the total score of the non-learning disable group was 70 (mean).

The TVPS-R incorporates new tables for converting raw scores to scaled scores; therefore, the practitioner must access the correct manual, according to which test version used, when evaluating performance. The original TVPS conversion tables do not correlate with this updated information.

**Survey Results (1997):**
**How often used:** 3.39. 46 optometrists of a total 91 use this test “all the time” or “frequently”.

-93-
Usefulness: 3.80. 50 of the total 91 optometrists rank the TVPS as “extremely” or “very” useful.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: Psychological and Educational Publications, Inc.
Post Office Box 520
Hydesville, CA 95547-0520
1-800-523-5775

References:
VISAGRAPH II EYE MOVEMENT RECORDING SYSTEM

**Purpose:** To objectively determine and quantify the reading ability of the patient by evaluating eye movements made during a "real world" reading task (compared to old methods of computerized recordings). The Visagraph system records and analyzes eye movements and allows for objective evaluation of a reader's visual efficiency and an indirect judgment about his/her effectiveness. The components of reading efficiency measured with the Visagraph II include: Fixations (number of eye pauses/100 words), regressions (number of reverse eye movements/100 words), average span of recognition (the word or word-parts perceived during a fixation), average duration of fixation (the length of time of eye pause to perceive), rate with comprehension (words read in relation to time), and directional attack (the tendency to read in a left-to-right manner).

The Visagraph II can also be used in conjunction with the DEM and King-Devick to evaluate the quality of eye movements. Due to the subjective nature of the DEM and K-D (eye-movement ability is inferred from the amount of time it takes a person to call out a number printed on a page), "it is not possible to determine whether a poor score results from vergence instability, unsteady fixations, insufficient perceptual span, inaccurate saccades (overshoots, undershoots, etc.) or other factors." The Visagraph II measures eye movement performance during the high cognitive demand task of reading which differs significantly from the low cognitive demand task of calling out numbers. Therefore, one could argue that the Visagraph II is a better predictor of eye movement performance during "real world" activities.

**Indications:** The Visagraph II is indicated on any patient who complains of troubles with reading or demonstrates poor performance at school. An individual's eye movements or oculo-motor patterns reflect an acquired reading performance which represents his/her visual/function, perceptual, and cognitive adaptations and development over a period of time. The Visagraph system can be an important diagnostic tool used in conjunction with any reading improvement program. It can also be used to evaluate learning disability adaptation behavior, text tactics such as skimming and scanning, and work adaptation behavior to CRT operations.

**Apparatus and Setup:** IBM or compatible computer system with 9 pin female D-Sub connector marked COM (CPU 286 or higher, 20 MB hard drive minimum / 1MB available for installation, VGA color monitor required, 3.5" hard drive, recordings require an additional 1 MB), ober2:Visagraph Program 2.13 version, Visagraph infrared goggles with cable and connector, the ober2:Visagraph Reading Test Booklet, and a printer.

The most recent version of the software (2.13) is very reliable and incorporates several new features. Noteworthy is the cross-correlation value which expresses quantitative eye movement differences between the left and right eye. It is designed to be sensitive measure of binocular function. Potential eye movement differences between the two eyes during reading is controversial. According to Laukkalan, eye movement differences between the two eyes can stem from a number of sources: misalignment of the goggles, improperly set pupillary distance, infrared reflection differences between eyes, z-axis head movement during examination, or instrument/software artifacts.

The reading selections utilized are composed of 6 levels (preprimary through grade 6), with two additional levels, one through grade 7, and the other through grade 10. The test selection should be one that can be read easily, therefore it should be at the subject's reading level or lower. If there is any doubt as to reading ability, an oral pretest contained in the Visagraph Test Selection Booklet is utilized to determine the proper reading level. A
A comprehension test covering the reading material is administered at the end of the reading sample. The questions are designed to be administered orally. A comprehension level of 70% or better will qualify the reading performance.

To start-up the program, type VISA at the C:\> prompt and press ENTER. This will place you in the main menu. There are 10 options available within the main menu, entering a number between 0 and 9 will get you into the one you desire. The options available are as follows:

0 - **Setup Standards**: Includes all information which will be held standard for each examination. Once entered into the computer, this information does not need to be adjusted for each exam.

1 - **Input Subject and Text Data**: The essential information is required for patient identification and proper scoring with norms. The essentials include last name, first name, class, and level of test selection. There are 97 test selections to choose from with 11 tests for each age level and an additional 3 tests for levels one through three allowing for adults reading at that age level. Sex, date of birth, notes, and experiment are optional.

2 - **Start Reading Test**: Make sure to give proper instructions and follow the preset administration as found in the testing manual or found below.

3 - **Display Reading Profile**: The computer program will automatically calculate and quantify the reading performance. A plot of the subject's performance, based on the most active eye (greater number of fixations or regressions), will be displayed and compared to the national norms found by Stanford Taylor.

4 - **Display Reading Graphs**: There are four types of reading graphs that can be viewed or printed out:
   1. Fixation (Model) Graph: "A realigned plot which compensates for head sway and makes fixations and all other characteristics more easily discernible."  
   2. Fixation (Descriptors) Graph: "A fixation (model) graph with line numbers, fixation numbers, durations, etc. in numerical form (on other eye)."  
   3. Fixation (Text) Graph: "A fixation (model) graph with the lines of print from the test selection appearing next to each line of print."  
   4. Fixation/Raw Data Graph: A combination of a fixation (model) graph for one eye and a Raw Data (original data) recording for the other eye.

5 - **Simulation**: A graphic simulation of the subject's eye movements in relation to the lines being read. A dot will hop along to each place that the subject made a fixation, thereby showing the length of saccades and duration of fixations. The simulation feature is primarily an option that may be used to orient viewers to the nature of eye movements used when reading.

6 - **Extended Information**: "A report on the Text information read, Recording/Analysis Information, and the Reading Performance Information (for right or left eye)."

7 - **Select File**: At any time the examiner can retrieve previous recordings done on the patient or any other patient. The files are automatically saved after each recording. To retrieve the file, use the ARROWS to move to the patient's file you wish to retrieve and press ENTER.

8 - **Normative Performance**: Taylor National Norms.
9 - Comments and Notes: The examiner is allowed some space to write comments about the patient or the patient's performance. A helpful option to use in times when other factors might be affecting their performance.

Time Required: The Visagraph II takes approximately 10 minutes to administer.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the ober2: Visagraph Eye Movement Recording System. Proper use of the test requires the purchase of the Visagraph II Eye Movement Recording System available from Taylor Associates in Huntington Station, NY and adherence to the protocol listed in the test manual.

Preset (Administration): The testing sequence is adapted from the Taylor Associates ober2: Visagraph manual:

Step 1: At the time of testing, enter subject information (name, class, and test selection).
Step 2: Subject puts on goggles and they are adjusted. They are adjusted for pupillary distance at near by centering the pupils through the apertures. The goggles are placed over the near prescription if they have any.
Step 3: Subject reads the chosen selection in the test booklet. Be sure to tell the subjects to read as fast as they without rereading the text and to read for comprehension. Let them know ahead of time that there will be ten yes/no questions to answer immediately afterwards.

- The test begins with these instructions:
  "Look at the 'o' (circle) above the selection"
  "Start reading when you hear a beep"
  "Close your eyes when you are finished reading"
- PRESS ANY KEY TO START RECORDING
- Upon completion of the test, PRESS ANY KEY TO STOP RECORDING, and the comprehension questions will appear.

Step 4: Ten Yes/No comprehension questions are asked and a score is entered.
Step 5: A reading profile of the patient's performance will automatically be displayed on the screen to allow for a quick analysis of the results with the patient.

What to Look For: Make sure that there are two reading traces (one for each eye) appearing on the screen while the subject is reading the text. "If both traces do not appear to move from left-to-right", PRESS ANY KEY and the recording will stop. Readjust the goggles, and delete that patient's performance. Re-enter the patient data, and chose a different test selection.

Scoring:
A. Interpreting recorded information: The following describes the considerations observed in both the recording and calculations with the Visagraph:

1. Sampling: Fifty samples per second are collected of the fixation positions of both the left and right eyes. (Available for display in "Raw Data Graph" form.)

2. Countable lines: The data is then analyzed on all "countable" lines. The performance of the first and last lines of each reading display are eliminated as atypical. The net result is 8 "countable" lines for levels 1-3 and 15 lines for levels 4 and up (unless re-reading occurs).

3. Analysis/calculations: The sampling of fixation positions is analyzed for significant changes in eye-movement positions, significant duration of fixation, and return sweeps. Using these parameters, all significant eye movements are plotted in fixation "buckets"
across lines of print, and this information is then used for all “Calculations” and for the “Fixation Graph” display. This information is also used for the “Simulation” option available in management whereby a reader’s eye movements are presented on the computer screen in relation to each line of print.

B. Results of Calculations:

1. Fixations:
   a. Nature of fixations: The fixation refers the pause used when reading between saccades during which time the eye is "held relatively stationary for a short time and during which perception takes place." Following each fixation, the eye moves (saccades) to a new fixation position. The efficient reader will require fewer fixations and longer saccades per line compared to the inefficient reader. An individual might employ a comparatively large number of fixations for any of the following reasons:
      i. Difficulty with visual acuity or binocular coordination.
      ii. Conditioning of early reading experiences.
      iii. Perceptual inaccuracy.
      iv. Comprehension difficulties.
   b. "Raw Data Graph"/Counting Fixations: An examiner might choose to use the Raw Data Graph of the Visagraph to additionally study and count fixations. Each vertical line on the graph indicates a fixation. The horizontal lines connecting fixations are inter fixation movements.
   c. "Raw Data Graph" Observations: It is also possible to study the Raw Data Graph to note individual variations in the number of fixations per line and the location of these fixations.

2. Regressions: Regressions are a type of fixation that occurs following a right-to-left saccade rather than the normal left-to-right, and can be thought of as a reverse fixation. As with fixations, the Visagraph will automatically calculate the number of regressions for each subject. The examiner can also study the Fixation/Raw Data Graph to count the number of regressions or to note the consistency of regressions per line. Regressions are classified into two types:
   a. Habitual regressions can be caused by an "inadequate formation of directional attack when learning to read" or because of a "lack of confidence and an ingrained need to double check".
   b. Sporadic regressions occur "principally from difficulty with the content". When the reading material is difficult for the patient, their lack of experience makes them spend more energy towards interpreting the written words. This effort also disrupts their ability to organize the written words into cohesive thoughts, and creates the need to recheck.

3. Directional Attack: "The term 'directional attack' refers to the characteristic tendency of the reader to perceive and organize content in a left-to-right manner". Generally, if the percentage of regressions is 10-15% or less, a reader’s directional attack can be judged efficient; if 25% or more, the reader is employing poor directional attack. The Visagraph will also calculate Raw Data Graph information on directional attack.

4. Span of Recognition: "The span of recognition refers to the amount of words or word parts perceived during a fixation or eye pause during reading". The span of recognition refers to the amount of word information the reader deals with perceptually, not the amount of material optically forming an image on the eye. However, the Visagraph calculates the span of recognition only by determining the number of fixations required to read a certain number of words, and makes no claims towards determining the word parts perceived. The authors believe this measurement to be a significant finding when determining the
readers efficiency. The fewer the number of fixations (the larger span of recognition) and
the more regular the fixation pattern across each line of print, the more accomplished the
reader.

5. Duration of Fixation: "The duration of fixation refers to the length of time a reader’s
eyes pause during a fixation." In the past, the Visagraph’s calculations of the average
duration of fixation included the length of time required for saccades and return sweeps.
However, because saccades occupies such a slight amount of time, the past values "did not
detract from the usefulness of the average duration of fixation". The Visagraph II now
calculates the actual duration of each fixation as well as the average duration of fixation.
The actual duration of fixation is presented on the Fixation (Model) Graph.

Results from the Taylor National Norms show that the duration of fixation tends to
shorten as the reader matures. However the change the average duration of fixation
changes very little after the reader reaches 4th grade or about ten or eleven years of age.

6. Rate With Comprehension: This "refers to the time required by a reader to read through
a given selection with adequate comprehension". Many persons assume that rate is a
highly variable factor and that we can alter our rate to suit the situation for our purposes. In
actuality, the vast majority of people vary their rate but slightly on material that could be
classified as easy to fairly difficult." When comprehension is the goal, a person relies
upon a characteristic manner of reading. The Visagraph II calculates the rate with
comprehension by taking the number of words read times 60, and dividing that value by
the number of seconds needed to read the countable lines. Their calculations exclude the
first and last line of print.

"The rate of reading regarding its use with the Visagraph is based on the following
conditions:

- The level of test material read is such that it permits a reasonable degree of fluency to be
demonstrated.
- The test selections are structured so that they are reasonably complete in themselves,
  with their facts and ideas presented in a sequential manner."

7. Determining the Relative Reading Efficiency/Grade Level Performance: "Relative
Efficiency is a calculation that provides an objective numerical indication of the grade level
of a subject’s reading performance. It is based on the following considerations:

- It presupposes that fixations, regressions, and rate are the most important components.
- It presupposes that a person who makes more regressions is generally less effective
  perceptually, and that regressions therefore should be given additional weight in the
  calculations."

The Relative Efficiency (R.E.) value is then compared with grade level averages on the
R.E. Scale chart in the Visagraph II manual (page 64) to determine the patients grade level
performance. This value is automatically calculated by the Visagraph II program and
displayed on the Reading Profile.

Critique: A study done by Colby, Laukkanan, and Yolton found the Visagraph to
be a reliable diagnostic tool with rare errors in recording which were due only to operators
mistakes. They conducted their study on a group of optometry students and therefore
developed norms only for the Taylor Level 10 paragraphs. They determined the Visagraph
II to be quite reliable between paragraphs and reliable between sessions (with split-half
reliabilities between 0.69 and 0.88 on all values tested). Their study considered two types of validity:
1. do the Visagraph II eye movement numbers represent the actual eye movements made;
2. does the derived score for grade equivalent on the Visagraph II represent the true reading abilities of the subjects. Because there is no "gold-standard eye-movement data" to compare with, they were unable to judge the validity of the first part. To determine if the Visagraph II grade equivalent matches reading ability they compared their numbers to the subjects results on the reading comprehension subtest of the Optometry Admissions Test. They found a lack of correlation between OAT comprehension scores and Visagraph II scores (except duration of fixations). Colby et al. determined that this lack of correlation results from the OAT subtest measures only comprehension skills and not overall reading efficiency. 21

Compared to the earlier version of the Visagraph, they have corrected for their weaknesses by taking the subject out of the head constraints and placing them in goggles thereby allowing for normal reading posture and removing errors created by head movements. They have also improved the reading selection format by using a book rather than a computer screen and by having black letters on a white background as compared to the reverse.

The Visagraph Eye-Movement Recording System has proven to be a very effective device for evaluation and diagnosis of reading and/or eye-movement problems. It is a versatile instrument which can graphically show the types of eye movements that the patient is utilizing. The Visagraph demonstrates how the patients eye movements affect reading and comprehension, and also shows progress after structured training has taken place. The norms found in the Colby et al. study further verify the tests reliability on optometry students.

Survey Results (1997):
How often used: 1.23. 68 of the responding 91 optometrists report they "don't use" this test.

Usefulness: 2.85. 9 of the responding optometrists report the Visagraph to be "extremely" or "very" useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Taylor Associates
200-2 E. 2nd Street
Huntington Station, NY 11746

References:
VISUAL-AURAL DIGIT SPAN (VADS)

Purpose: The VADS is a brief assessment of intersensory integration and recall, which are necessary to perform reading, spelling, and arithmetic tasks. The four subtests focus on Aural-oral, Visual-oral, Aural-written, and Visual-written integration.

Indications: It can be used as a test of reading readiness or as a diagnostic tool to identify symbol-sound association and sequencing problems in a child with normal visual and auditory perception skills.

Apparatus and Setup: The examiner and child sit facing each other with the set of number sequence cards and a copy of the VADS score sheet before the examiner, but screened from the child.

Time Required: Generally, the test takes about 10 minutes to administer, depending on the age and ability of the child.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Visual-Aural Digit Span. Proper use of the test requires the purchase of the Visual-Aural Digit Span and adherence to the protocol listed in the test manual.

Preset (Administration): The VADS Test consists of four subtests in which the examiner presents series of digits, either visually or aurally, to the child who is then instructed to recall these series in either written or oral form. The subtests are the Aural-Oral, in which the child is instructed to repeat orally a series of digits read by the examiner; the Visual-Oral, in which the child is instructed to repeat orally a series of digits after viewing each printed sequence for 10 seconds; the Aural-Written, in which the child is asked to write a series of digits following oral presentation; and the Visual-Written, in which the child is asked to write a series of digits after they have been viewed on printed cards. Two different digit spans of equal length, each successively increasing in length, are presented until the child fails to correctly recall at least one of each series.

In each category, start with three digit series first and, if successful, go directly to the next higher series without doing the other of the same length. When the subject errs, give him the other sequence of the same length. If he gets that right, go to the next longer sequence. Testing stops when two errors are made in the same category length. Administration of the specific tests are as follows:

Aural-Oral: Tell the child that you are going to read aloud some numbers and that, when you are through reading he is to repeat them all. Read the digits at the rate of one per second.

Visual-Oral: Have the child read the first card (number) aloud to you if there is any doubt of his being able to read numbers. Present each sequence-bearing card, one at a time, for about ten seconds, instructing him not to repeat any of them until the card is hidden. At that time the child is to orally repeat the correct sequence.

Aural-Written: As in Aural-Oral, the child is read the sequence and writes the numbers down on paper after the examiner has finished reading the digits.

Visual-Written: The child is shown the number card for ten seconds and is asked to write the numbers down after the card is concealed.
What to Look For: Attention should be given to the response style of the child in order to detect indications of attention span, maturity, effort expended, confidence, and perception.

Recording Responses: Record the longest sequence the child was able to repeat correctly on either the first or second trial in each test.

Scoring the Test: The numerical score given to each category is simply the number of digits in the longest sequence the subject was able to correctly repeat. In addition to a score for each subtest, six "Combination Scores," involving various combinations of the subtest scores and a total test score are computed. The six Combination Scores are described as follows:

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Combination Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aural input</td>
<td>The sum of the Aural-Oral and Aural-Written.</td>
</tr>
<tr>
<td>Written expression</td>
<td>The sum of the Aural-Written and Visual-Written.</td>
</tr>
<tr>
<td>Intrasensory integration</td>
<td>The sum of the Aural-Oral and Visual-Written.</td>
</tr>
<tr>
<td>Intersensory integration</td>
<td>The sum of the Visual-Oral and Aural-Written.</td>
</tr>
</tbody>
</table>

Notice whether any group or subgroup is strikingly higher or lower than others. Compare performance to age norms for each group. Look for patterns of organizational immaturity, form reproduction problems, or other trends. Together, these can give a picture of the subject’s integrative and recall abilities. The total VADS Test score, according to the manual, "measures the entire process of perceptual-motor integration, sequencing, and recall." Two chapters on the clinical interpretations of children’s performance are provided in the test manual.

Critique: Normative data on VADS performance and age equivalency was derived from data provided by 810 normal public school pupils, ranging from 5-1/2 to 12 years, 11 months in age. None of the children had serious mental or physical handicaps. An equal number of boys and girls were tested. Racial breakdown was 81% Caucasian, 13% African America, 6% Hispanic, and less than 1% Asian. All testing was done by licensed psychologists.

As already mentioned, VADS scores in kindergarten had a high degree of correlation to third-grade reading and slightly less, but still significant, correlation to third-grade arithmetic skill as measured by the CTBS. A number of studies have also found significant correlations between VADS Test scores and current performance on other achievement measures, such as the PIAT and CAT. Again, the relationships appear uniformly stronger in the lower, rather than upper grades.

In comparisons between VADS Test performance of learning disabled and average pupils at three different grade levels, all 11 scores were found to differ significantly. The test has also been shown to discriminate between learning disable, mentally challenged, and average pupils.

Although the VADS percentile scores have been shown to differentiate well between levels of performance of younger children, the test does not appear to discriminate as well between high average and outstanding performance of children above age 10, since many obtain perfect scores.

The VADS author does a good job of substantiating the useability of the test. The author provides a sound clinical rationale for the test, delineates case examples for further clinical
interpretation, provides a moderate research link between the VADS Test and achievement, indicates the test limitations as a means for subgrouping children by mental ability, delineates the diagnostic efficiency of the test with other measures, and places the test in perspective as a possible “tool” in an overall screening battery for elementary children.

The major weakness of the test is its construct validity. The tasks employed in this test rely heavily upon attention and memory factors that are independent of intersensory integration. For example, visual presentation requires a 10-second presentation of all digits, while oral presentations are presented one digit per second. Torgesen et al.’s results suggest that the memory difference between good and poor readers is not due to modality presentation, but to simultaneous vs. sequential processing.

Another serious limitation of the VADS Test is the lack of evidence on the reliability of the test for the normed sample. Most critically, the estimates for the standard error of measurement are missing for every score, subscore, and combination of scores.

The VADS Test should help diagnosticians pinpoint the underlying nature of some children’s learning problems, predict later academic performance, and discriminate between children with and without learning problems. The examiner must be careful to note the construct validity problems of the test and to avoid intersensory interpretations of child performance.

Survey Results (1997):
How often used: 1.74. 9 optometrists of the total 91 use this test “all the time” to “frequently”. 17 optometrists report using it “occasionally” or “rarely”.

Usefulness: 2.72. 16 optometrists marked the VADS as “very” or “moderately” useful. 55 of the survey responses for this category were left blank.

PUCO VPTM Subsection Authors:
Original Authors (1989):
Daniel Kosterman, Marcus Morben, Terry Rudensey, Samuel Soesbe

Updated (1998):
Karl Bakken, Melissa Severns

Publisher: The Visual Aural Digit Span Test
Grune and Stralton, Inc.
New York, NY

References:
   1977.
WEPMAN AUDITORY DISCRIMINATION TEST

Purpose: This test is designed to provide a measure of determining a child's ability to be able to discriminate phonemes that are used in English speech. The Wepman is solely an auditory test. It has been suggested by the author that relationships exist between auditory discrimination and intelligence, hearing, speaking and reading.

Indications: The Wepman is normed for children ages 5 - 8 years.

Apparatus and Setup: Two testing lists which are also used as the recording forms.

Time Required: The Wepman is administered individually and requires approximately five minutes to administer.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from the test manual for the Wepman Auditory Discrimination Test. Proper use of the test requires the purchase of the Wepman Auditory Discrimination Test and adherence to the protocol listed in the test manual.

Preset (Administration): The Wepman must be administered individually. The examiner begins with practice examples which are listed in the Wepman testing manual. After the practice examples, the test is given with the subject's back to the examiner. This prevents any lip reading by the subject. The Wepman utilizes two test forms, each containing 40 items (an "item" being a pair of words). The examiner calls out each item and the subject must reply by indicating whether the pair of words he/she heard are the "same" (a single word repeated) or "different" (two different words).

Scoring: The examiner records on the test form a "+" after the word pair for a correct response and an "x" for an incorrect response. The final score is tallied by counting the number of "x"'s in each column and recording that number score at the bottom of the test. Inadequate development is shown on the test by the following scores:

<table>
<thead>
<tr>
<th>Age</th>
<th>Errors greater than</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

What to Look For: The examiner simply listens for correct responses from the child. Try to discriminate between a child with poor motivation versus a child with a true hearing defect.

Critique: The author of the test reports good test-retest coefficient of reliability on 109 subjects with a value of 0.91. Correlation between test results and intelligence, articulatory disorders and reading disability is reported to be 0.32. Although Joseph Wepman makes the suggestion that a relationship exists between auditory discrimination and intelligence, hearing, speaking and reading, it does not necessarily support the construct or predictive validity of the test. The entire of process of learning and intelligence has many contributory variables, auditory discrimination may be one of them.

The practicing optometrist must use caution when administering the Wepman Auditory Discrimination Test. Due to the nature of the testing, the examiner must use proper
phonetic pronunciation of each word presented. Improper administration (pronunciation) can lead to many false-positive and false-negative scores. It is recommended by Paul Kohl, O.D. and the authors of the PUCO Visual Perceptual Testing Manual that the optometrist or examiner be officially trained on proper phonetic pronunciation of each word in the Wepman Auditory Discrimination Test by a speech pathologist or an audiologist. Dr. Kohl feels that the Wepman should only be used as a screening criteria for referral and not for a definitive diagnosis.

Survey Results:
How often used: 7.58. 10 of the responding optometrists indicated they use the Wepman "occasionally". 7 reported they use the test "rarely", while 55 optometrists marked they "don't use" this test.

Usefulness: 2.67. 7 optometrists found this test to be "extremely" or "very" useful. 11 found it to be "moderately" useful.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Publisher: Language Research Associates
P.O. Box 2085
Palm Springs, CA 92262

References:
WOLD-PACIFIC COPY TEST (WPCT)

Adapted from the Wold Sentence Copying Test by Laukkanen, Kenison, Oland, and Eliason

Purpose: The Wold-Pacific Copy Test was adapted from the Wold Sentence Copying Test (WSCT) by Laukkanen, Kenison, Oland and Eliason. Laukkanen et al. created the Wold-Pacific version because they questioned the WSCT's validity as no norms were ever derived empirically for the WSCT. The norms published by Dr. Wold were extrapolated from a similar but not identical sentence copying test, the Ayres Measuring Scale for Handwriting.

Like the original WSCT, the purpose of the Wold-Pacific Copy Test is to assess the child's visual-motor skills utilized during the real world classroom task of copying a sentence onto a piece of paper. Copying sentences requires the use of many abilities including seeing the sentence, holding parts of the sentence in short term memory, and performing the physical act of writing. The Wold-Pacific version is unlike the original WSCT in that it quantifies several additional factors related to copying performance. Visual memory, letter/number/word "chunking" ability, visual-motor ability, and eye/head movement problems are assessed by the Wold-Pacific Copy Test.

Indications: The Wold-Pacific Copy Test contains normative data for children in grades 2 through 6. The test is indicated for any child who complains of difficulty completing assignments, difficulty copying from the chalkboard, or demonstrates poor penmanship. The test is also indicated for any child who is struggling in school or is otherwise having learning difficulties.

Apparatus and Setup: The Wold-Pacific Copy Test consists of "the Wold sentence" and a Wold-Pacific "number group" formatted as a sentence. A easel with the word or number sentence is placed 40 cm from the subject. The Wold Sentence consists of 29 words and 108 letters with a visual acuity demand of 20/120. The sentence is grammatically correct but unpredictable and difficult to memorize. The Wold-Pacific number groups to be copied simulated the Wold sentence with identical "word" lengths, spacing and visual demand. The subject is given a pencil, a lined piece of paper, and a lap desk for support. The examiner sits perpendicular to the child and the easel in order to easily count the number of head/eye movements (no differentiation is made between head and eye movements during copying). Time is measured with a stop watch. The child wears his/her habitual near prescription during testing.

Time Required: The Wold-Pacific Copy Test usually takes less than 10 minutes to complete both sections of the test.

In an effort to maintain test validity and reliability, the following administration and scoring instructions are adapted directly from Eliason's optometric thesis on the Wold-Pacific Copy Test.

Preset (Administration): The Wold sentence (with a 20/120 acuity demand) is placed on an easel 40 cm from the test subject. The child is given a pencil, a lined piece of paper, and a lap desk to copy on. The child is then given this standard set of instructions: "I am going to give you a sentence to copy. Print it as accurately and quickly as you can. I will be measuring how long it takes you to finish. If you make a mistake, don’t erase it, cross it out and continue on. You may begin when I say. Do you understand? Ready? Go."
Four men and a jolly boy came out of the black and pink house quickly to see the bright violet sun, but the sun was hidden behind a cloud.

The Wold-Pacific "number group" sentence (also with a 20/120 acuity demand) is then placed on the same easel 40 cm from the test subject. The child is given this standard set of instructions:

"I am going to give you a sentence of numbers to copy. Print it as accurately and quickly as you can. I will be measuring how long it takes you to finish. If you make a mistake, don't erase it, cross it out and continue on. You may begin when I say. Do you understand? Ready? Go."

0918 045 731 7 54016 083 2830 538
91 894 77513 195 2181 51474 9955968 33
852 841 567321 380010 740, 971 218 731
605 835963 108506 5 32508.

What to Look For: The time it took the child to complete the sentence of "letters" and "numbers" is measured and the number of head/eye-movements made by the child during each test are recorded. The number of omissions and additions are also recorded and will be used for the adjusted time value. The quality of the copying task may also be assessed (i.e. spacing between letters and words, uphill/downhill writing style, or deterioration of penmanship with fatigue). The examiner may also record posture and working distance, fine motor control (pencil grasp), visual-motor hierarchy, bi-manual integration, and reversals.

Scoring: The original Wold Sentence Copying Test determines the letters copied per minute by dividing 6,600 by the number of seconds taken to complete the test (108 letters plus 2 punctuation marks = 110 symbols, times 60 seconds/minute = 6,600). These values were then compared to the grade equivalent norms provided by Wold. As stated above, the WSCT norms are of questionable validity as they were borrowed from the norms established for the Ayres Measuring Scale for Handwriting (found on the first table below).

Scoring the Wold-Pacific Copy Test: The Wold-Pacific Copy Test does not attempt to calculate the letters copied per minute. The examiner scores the WPCT by measuring the adjusted time it takes to complete the "letter" and "number" copying tasks. The adjusted time allows for additions and omissions made by the child during testing (formula included below). The examiner must also count the number of head/eye movements made during the copying task. The raw number is then compared to the norms established by Eliason and Oland/Kenison.

The formula for the adjusted time is as follows:

\[ \text{Adjusted Time} = \text{Raw time} \times \left[ \frac{108}{108 + \text{additions} - \text{omissions}} \right] \]
Comparison of Normative Data Between the original Wold Sentence Copying Test and the Two Studies Completed on the Wold-Pacific Copy Test

<table>
<thead>
<tr>
<th>Grade</th>
<th>Letters/Minute Eliason</th>
<th>Letters/Minute Oland</th>
<th>Letters/Minute Ayers/Wold</th>
<th>Numbers/Minute Eliason</th>
<th>Numbers/Minute Oland</th>
<th>Numbers/Minute Eliason</th>
<th>Head/Eye Movement Letters Eliason</th>
<th>Head/Eye Movement Letters Oland</th>
<th>Head/Eye Movement Letters Kenison</th>
<th>Head/Eye Movement Numbers Eliason</th>
<th>Head/Eye Movement Numbers Oland</th>
<th>Head/Eye Movement Numbers Kenison</th>
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</thead>
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<td>38.3</td>
<td>39.7</td>
<td>25.4</td>
<td>35.0</td>
<td>58.0</td>
<td>45.4</td>
<td>44.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>51.2</td>
<td>49.2</td>
<td>36.9</td>
<td>36.4</td>
<td>28.3</td>
<td>36.9</td>
<td>41.9</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>66.0</td>
<td>53.3</td>
<td>52.4</td>
<td>41.3</td>
<td>27.5</td>
<td>36.9</td>
<td>41.9</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>77.1</td>
<td>71.0</td>
<td>57.6</td>
<td>56.5</td>
<td>20.2</td>
<td>42.0</td>
<td>36.0</td>
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</tr>
<tr>
<td>6</td>
<td>94.3</td>
<td>77.8</td>
<td>54.5</td>
<td>61.7</td>
<td>19.3</td>
<td>32.6</td>
<td>36.3</td>
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Results for Letter Copying Speed and Head/Eye Movements (Eliason's Norms)

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<tr>
<th>Grade</th>
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<th>Mean</th>
<th>Std. Dev.</th>
<th>Total Err.</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>22</td>
<td>179.4</td>
<td>39.6</td>
<td>2.8</td>
<td>35.0</td>
<td>11.9</td>
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<tr>
<td>3</td>
<td>30</td>
<td>135.5</td>
<td>33.6</td>
<td>2.8</td>
<td>25.2</td>
<td>10.3</td>
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<td>4</td>
<td>22</td>
<td>101.6</td>
<td>19.7</td>
<td>2.7</td>
<td>18.2</td>
<td>7.4</td>
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<td>5</td>
<td>24</td>
<td>86.6</td>
<td>15.4</td>
<td>2.1</td>
<td>20.2</td>
<td>8.1</td>
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<td>6</td>
<td>24</td>
<td>72.1</td>
<td>15.4</td>
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<td>19.3</td>
<td>8.1</td>
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Results for Number Copying Speed and Head/Eye Movements (Eliason's Norms)

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Total Err.</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>22</td>
<td>269.6</td>
<td>69.2</td>
<td>6.1</td>
<td>58.0</td>
<td>16.6</td>
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<td>3</td>
<td>30</td>
<td>181.3</td>
<td>40.1</td>
<td>6.0</td>
<td>45.4</td>
<td>10.3</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>130.6</td>
<td>29.1</td>
<td>2.9</td>
<td>36.8</td>
<td>5.7</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>116.6</td>
<td>21.1</td>
<td>1.6</td>
<td>42.0</td>
<td>9.4</td>
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<tr>
<td>6</td>
<td>24</td>
<td>91.1</td>
<td>22.0</td>
<td>1.4</td>
<td>32.6</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Critique: The Wold-Pacific Copy Test has more content and predictive validity than the original Wold Sentence Copying Test due to direct norming. Unlike the original WSCT, the Wold-Pacific version also attempts to separate short term linguistic processing and memory from the other aspects of the copying task. Children with better language fluency or auditory memory might be expected to "chunk" together word phrases of the letter sentence. With the addition of the "number group" sentence to the WPCT, children with better language fluency could be differentiated from students with poor fluency. The children with good language fluency would demonstrate a larger discrepancy between their ratio of adjusted time copying letters versus the adjusted time copying numbers. The "number group" word parts cannot be easily grouped together in phrases, therefore it
would provide no advantage to the student with better language fluency. The Wold-Pacific version attempts to quantify how often head/eye movements are utilized in the copying task. Frequent head/eye movements between the material to be copied and the paper indicates that the subject may have a limited ability to hold information in short term memory.

Norms for the Wold-Pacific Copy Test are from two studies on the newly developed WPCT: Oland and Kenison in 1993, and Eliason in 1995. The Oland/Kenison study was conducted on 64 students (18 third graders, 13 fourth graders, 17 fifth graders, and 16 sixth graders). The Eliason study had 122 subjects (the number of students per grade is provided in the table above). The normative data provided by Eliason "were roughly comparable to those published by Oland and Kenison but differed significantly to those published by Wold." Eliason also found the Wold-Pacific version showed test-retest reliability coefficients of 0.91 and 0.94 for letter and number copying speed, respectively. The same study by Eliason showed test-retest reliability coefficients of 0.90 and 0.93 for the number of head/eye movements for the letter and number copying sentences, respectively. Eliason only completed test-retest reliability data on sixth graders (the retest was conducted one day after the initial test). Test-retest data is needed for grades 2-5. Eliason's study attempted to determine whether WPCT copying performance correlated with academic performance as measured by the California Test of Basic Skills (CTBS). Eliason found only a low to moderate correlation to copying performance in the areas of reading and math.

Additional norming studies of the WPCT are currently in progress at Pacific University College of Optometry. Upon completion of the ongoing study, the data from all three studies will be combined to calculate normative values for a larger study group with different socioeconomic backgrounds. However, more extensive normative studies encompassing all socioeconomic and cultural backgrounds would only strengthen the WPCT's norms. Further studies on WPCT's test-retest reliability and content validity are also recommended before optometrists and educators embrace this new revision of the Wold Sentence Copying Test.

The authors of the Wold-Pacific Copy Test believe that this revised test "may prove to be a useful screening test for educators and optometrists, by alerting them when a child makes an excessive number of head and/or eye movements or if the child performs the test much slower than their peers."3

Survey Results (1997):
How often used: 2.86. 41 of the total 91 optometrists reported using the original Wold Sentence Copying Test "all the time" or "frequently". 36 marked "rarely" use or "don't use".

Usefulness: 3.40. 33 optometrists marked the original Wold Sentence Copying Test as "extremely" or "very" useful. 28 responses for this category were left blank.

PUCO VPTM Subsection Authors:
Original Authors (1998):
Karl Bakken, Melissa Severns

Sources: Wold-Pacific Copy Test
Hannu Laukkonen, O.D., M.Ed.
Pacific University College of Optometry
Forest Grove, OR 97116

Wold Sentence Copy Test
Academic Therapy Publications
20 Commercial Blvd.
Novato, CA 94947
References:
APPENDIX A

Analysis of Visual Perceptual Factors Assessed in Common Perceptual Diagnostic Tests
<table>
<thead>
<tr>
<th>Test of Assessment</th>
<th>Age Appropriateness</th>
<th>Visual Memory</th>
<th>Visual Sequencing</th>
<th>Visual Auditory</th>
<th>Visual Motor</th>
<th>Figure Ground</th>
<th>Visual Closure</th>
<th>Vocabulary Assessment</th>
<th>Dyslexic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Dyslexia Test (ADT)</td>
<td>Ages 18 and up</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Beery Visual-Motor Integration (Beery VMI)</td>
<td>Ages 2-10 to 11-1</td>
<td>Yes</td>
<td>Yes</td>
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<td></td>
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<tr>
<td>Birch-Belmont Test</td>
<td>Grades K-5; best for grades 1 and 2</td>
<td></td>
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<tr>
<td>Developmental Test of Visual Perception (DTVP-2)</td>
<td>Ages 4 to 10</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<td>Dyslexia Determination Test (DDT)</td>
<td>Grades 1 to college post-graduate</td>
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<td>The Dyslexia Screener (TDS)</td>
<td>Grades 1 to 5</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<td>Dyslexia Screener for First Graders (DSF)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<td>Gardner Reversal Frequency Test</td>
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<td></td>
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<td>Getman Visual Manipulation Test</td>
<td>Grades K - 4</td>
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<td>Yes</td>
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<td>Yes</td>
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<td>Jordan Left-Right Reversal Test</td>
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<td>Visual Sequencing</td>
<td>Visual Auditory</td>
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<td>Figure Ground</td>
<td>Visual Closure</td>
<td>Vocabulary Assessment</td>
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<td>MKM Monocular / Binocular Reading Test</td>
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<td>Winterhaven Form Copy Test</td>
<td>Ages 2 - 11</td>
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APPENDIX B

Analysis of Visual Factors Trained by Selected Perceptual Training Instruments
## Analysis of Visual Factors Trained by Selected Perceptual Training Instruments/Techniques

by Stacy Bell (1997) and James Kundart (1999)

<table>
<thead>
<tr>
<th>Procedure for Remediation</th>
<th>Visual Memory</th>
<th>Visual Sequencing</th>
<th>Visual Auditory</th>
<th>Visual Motor</th>
<th>Figure Ground</th>
<th>Visual Closure</th>
<th>Dyslexia</th>
</tr>
</thead>
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<tr>
<td>Tachistoscopic Training</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Cheiroscopic Training</td>
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<tr>
<td>Wayne Saccadic Fixator</td>
<td>Optional</td>
<td>Optional</td>
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<tr>
<td>Wayne Peripheral Awareness Trainer</td>
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<tr>
<td>Accomotrac Biofeedback Training for Vergence Posture</td>
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<tr>
<td>Balance Beam and Balance Board Training</td>
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<td>Optional</td>
<td>Yes</td>
<td></td>
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<td></td>
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<tr>
<td>Marsden Ball</td>
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<td>Yes</td>
<td>Optional</td>
<td>Yes</td>
<td>Yes</td>
<td>Optional</td>
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<td>Ishihara Color Plates</td>
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<td></td>
<td></td>
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<td>Yes</td>
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<tr>
<td>Mazes and Puzzles (with lenses and prisms)</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
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<td>Yes</td>
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<td>Yes</td>
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<tr>
<td>Commodore Amiga Software for Vision Training (Optimum)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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APPENDIX C

Analysis of Perceptual Diagnostic Tests Utilized by Practicing Developmental Optometrists
Analysis of Perceptual Diagnostic Tests Utilized by Practicing Developmental Optometrists.

Authors: Karl J. Bakken, and Melissa K. Severns
Pacific University College of Optometry, Forest Grove, Oregon

Abstract:
A survey of practicing developmental optometrists was conducted in order to determine what perceptual diagnostic tests were utilized in their practice. The survey asked how often they used the specific diagnostic test and how effective or useful they felt the test was at discovering perceptual deficits. A response rate of only 3.03% does not signify a majority and therefore does not give predictive validity to our results. We discovered that the five most "used" tests were 1) Beery VMI; 2) TVPS; 3) OEM; 4) Piaget; and 5) King Devick, and the five most "useful" tests were 1) Beery VMI; 2) OEM; 3) King Devick; 4) TVPS; and 5) Piaget. Our results may be skewed as the scoring of our survey did not allow for blank responses and many improperly marked surveys (blank responses) forced us to leave those numbers out of our statistics. We recommend repeating the survey with clear scoring instructions for each question asked of the participating optometrists.

Introduction:
The Pacific University College of Optometry (PUCO) Visual Perceptual Testing Manual was created in 1988 by Hannu Laukkanen, O.D., Daniel Kosterman, Marcus Morben, Terry Rudensey, and Samuel Soesbe. Their purpose was to create a reference for the interns working in the vision therapy clinic. The manual gives a list of common perceptual tests used in the clinic and a detailed guide for proper administration. The goal was to standardize the administration of each test given the large number and turnover rate of student interns administering perceptual tests in our educational setting.

The purpose of our survey was to determine whether the PUCO diagnostic perceptual test battery mirrored that of practitioners in the "real world". Our assumption was that practicing developmental optometrists utilize a battery of perceptual tests which work well for them and we wanted their input. We understand that the net worth of a diagnostic test is not due entirely on how often it is used, but we also believe in the "strength in numbers" principle.

The information gained from practitioners will then guide the evolution of our PUCO Visual Perceptual Testing Manual. This would allow the student interns who use this manual during their vision therapy rotation to become more familiar with the visual perception tests used by their future colleagues.

Methods:
Approximately 3000 surveys were sent out to practicing developmental optometrists courtesy of Optometric Extension Program (OEP). The survey gave a list of some of the new diagnostic perceptual tests which we planned to add to the PUCO VPTM as well as a mixture of some tests already included within the manual. Alongside these tests we listed two categories from which to respond: how often administered and test's perceived usefulness. Each category requested a scaled response from 1 - 5. The how often administered category responses ranged from 1: "don't use" to 5: "all the time". The test usefulness category ranged from 1: "not" to 5: "extremely". We also included some space for the practicing optometrist to write in any additional tests they used frequently or deemed useful.

To get an idea of who returned our surveys we asked if they administered vision therapy in their practice and to indicate whether it was exclusively home-based, office-based, or a combination of both office and home therapy. Finally, in order to determine if there were regional biases in test popularity, we also asked for a zip code or postal code.
Results:
Ninety-one surveys were returned (A response rate of only 3.03%). We tallied the responses for each category mentioned above, counting the number of "five's", "four's" etc. that each test received and calculated the means for each diagnostic test. These results can be found on the attached table and charts. The five most "used" tests were 1) Beery VMI; 2) TVPS; 3) DEM; 4) Piaget; and 5) King Devick. The five most "useful" tests were 1) Beery VMI; 2) DEM; 3) King Devick; 4) TVPS; and 5) Piaget.

All 91 respondents indicated that they incorporate vision therapy into their practice. Two optometrists utilized home-based therapy only, two optometrists marked office-therapy only, and the remaining 87 indicated that both office and home-based therapy were utilized.

Discussion
We quickly found that our survey was not specific enough when explaining why we wanted a response in both how often a test was administered in the practice and how useful the practitioner believed the test to be. Our belief was that certain optometrists might use certain tests because of the referring source, or because other professionals recognize and understand it, so that it might facilitate intra, inter-professional communication even though the test's results might not be especially useful diagnostically to the vision therapy practitioner. For example, the TVPS ranked second in most used tests but ranked only fourth highest in the usefulness category. The DEM is the third most used but ranked second in usefulness. We also wanted to allow the practitioner to state their opinion on a particular test even though he/she might not utilize it often within his/her practice. We understand that some of these diagnostic tests might be used only with certain types of patients and are not a part of the normal perceptual screening.

Another problem we had in analysis resulted from how to score a blank response. We did not know if it was left blank because 1) it was never used or it had no usefulness; 2) it was an unfamiliar test; or 3) the optometrist assumed their response in the how often administered category would transfer over to the usefulness category (eg. a rating of 5 in "how often used" and a blank space in the "usefulness" category). Instead of interpreting what each doctor meant by their blank response, we tallied up the number of blank responses received for each test (see table) but did not incorporate those responses into the average rating value.

Acknowledgment
First of all we would like to thank OEP for printing up and including our survey in their mailing. OEP has greatly reduced our costs and increased our chance on returns and survey validity due to the wide distribution of its members.

Next, we wish to thank all of the practitioners who so graciously took time to respond to and return our survey. Your input will enhance both our thesis and our education here at Pacific University.

Finally, we would like to thank Hannu Laukkanen, O.D., M.Ed. for his editorial comments and advice. We would also like to thank him for his patience.
APPENDIX D

1997 Survey Results of Perceptual Diagnostic Tests Utilized by Practicing Developmental Optometrists
APPENDIX E

Original 1997 Perceptual Diagnostic Test Utilization Questionnaire
Our names are Melissa Severns and Karl Bakken, third year students at Pacific University College of Optometry (PUCO). We need your help. Would you please take the time to complete the survey below and either mail or Fax it back to us? We would like to know what tests and methods behavioral practitioners are currently using. We are updating the PUCO Diagnostic Perceptual Testing Manual and would like it contemporary with practitioner needs.

<table>
<thead>
<tr>
<th>Test</th>
<th>How Often</th>
<th>Usefulness</th>
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<tbody>
<tr>
<td>Beery Visual-Motor Integration Test (Beery VMI)</td>
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<tr>
<td>Auditory-Visual Integration Test / Birch-Belmont</td>
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<tr>
<td>Developmental Test of Visual Perception (DTVP-2)</td>
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<td>Dyslexia Determination Test (DDT)</td>
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<td>Dyslexia Screener for First Graders (DSF)</td>
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<tr>
<td>The Dyslexia Screener (TDS)</td>
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<tr>
<td>The Adult Dyslexia Test (ADT)</td>
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<tr>
<td>Denver Developmental Screening (DDS)</td>
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<tr>
<td>Gardner Reversal Frequency Test</td>
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<td>Getman Visual Manipulation Test (VMT)</td>
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<tr>
<td>Getman Visual Recall Test</td>
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<tr>
<td>Groffman Visual Tracing Test</td>
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<tr>
<td>Visagraph Computerized Eye-Movement Analysis</td>
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<tr>
<td>Kaufman Assessment Battery for Children (K-ABC)</td>
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<td>King-Devick Saccade Test (KD)</td>
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<tr>
<td>MKM Monocular and Binocular Reading Test</td>
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<tr>
<td>Motor Free Visual Perception Test (MVPT)</td>
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<tr>
<td>NSUCO Oculomotor Test</td>
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<tr>
<td>Peabody Picture Vocabulary Test (PPVT)</td>
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<tr>
<td>Piaget Left-Right Awareness Test</td>
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<tr>
<td>Developmental Eye Movement Test (DEM)</td>
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<tr>
<td>SUNY Developmental Test Battery</td>
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<tr>
<td>Test of Visual Analysis Skills (TVAS)</td>
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<tr>
<td>Test of Visual Perceptual Skills (TVPS)</td>
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<tr>
<td>Visual-Aural Digit Span (VADS)</td>
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<tr>
<td>Wepman Auditory Discrimination Test (WADT)</td>
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<tr>
<td>Wold Sentence Copying Test</td>
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</table>

Please list and rate perceptual tests that you use that are not listed above. 1 ___________ 2 ___________ 3 ___________ 4 ___________ 5 ___________ 6 ___________

Do you routinely administer vision therapy into your practice? ___ (yes/no)
If so, is it home-based therapy only ___ (yes/no)
office therapy only ___ (yes/no)
both home and office therapy ___ (yes/no)

Please tell us your zip code or postal code ________________________________

Please Fax this form to us at PUCO: (503) 359-2929 or if you mail this form to us, please fold and staple it so that our address shows on the outside. THANK YOU VERY MUCH FOR YOUR TIME AND ASSISTANCE.

____ Check here if you wish to have a copy of our survey results (please include your name and mail address).
____ Check here if you also wish to receive a copy of the PUCO Perceptual Diagnostic Manual. We will mail you a manual after it is completed and bill you for printing/postage. (Be sure to include your name and mail address)

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ACKNOWLEDGMENT

First, we would like to thank our advisor, Dr. Hannu Laukkanen, for his editorial comments, suggestions and enormous patience throughout the duration of our project. Next, we also would like to thank the Optometric Extension Program for printing and distributing our original survey to OEP's members. We wish to thank all the practicing optometrists who took the time and effort to complete and return our questionnaire. We also wish to thank Dr. Michele Bither for her input and suggestions. Lastly, we would like to thank Beta Sigma Kappa for their financial assistance to our project, and to many other projects like it, which hope to advance optometric knowledge.