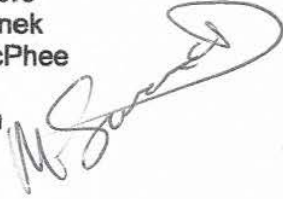


**ASSESSING THE VALIDITY OF THE TAYLOR VISAGRAPH II**  
OPTM 797 Senior Project

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Comments

The student investigators conducted this project scientifically and diligently. Although some difficulties were encountered getting appropriate subjects it will serve as a reliable pilot study for future investigations. The student investigators appropriately established the study design and procedures with little need for advice from the faculty advisor. The research idea is an important area to investigate for optometry.

The paper is very well written and is easily readable. Results are reported accurately and the discussion offers plausible insights, even though the data is insignificant, and honestly points out weaknesses of the study and makes suggestions for future improvements. A little more development in this area would have made the paper perfect.

**Each student should be awarded a grade of A-**

Considerations for Future Study:

Possible Conclusions:

- 1) Trying to read fast causes better reading
  - Logically doesn't make sense - treatment is simplistic and of short duration
  - Use a purely confounding experimental treatment
  - Adding a non-treatment control group that does not improve would support this conclusion
  - Since GORT didn't improve
    - GORT is insensitive for this population and couldn't support the conclusion.

Replace the GORT or use immature readers to show true improvement or lack of improvement.

Eye Movement data improved – supports conclusion
- 2) Trying to read fast does not improve reading skills, but the EM score did improve
  - The Eye-Movement test is unreliable or not a valid predictor of reading ability
  - Since we don't expect an improvement validity is questioned. Only appears better – need larger sample and stats
  - There is an instrument learning curve – no-treatment control group
  - GORT did not show an improvement in overall reading, however, it was insensitive because of the subject population.
- 3) General reading ability did not improve but learned a new strategy for increasing a reading sub-skill with acceptable compromise to comprehension (improvement??)
- 4) If #1 is true, next research question should be can V-T cause improved reading Eye Movements
  - Consider a second experimental group with EM training without reading for speed.

ASSESSING THE VALIDITY OF THE TAYLOR VISAGRAPH II

OPTM 797 Special Studies

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The purpose of this study was to assess the validity of the Taylor Visagraph II. Ten pre-optometry students were tested with the Visagraph and the Gray Oral Reading Test (GORT). They were then given a take home reading assignment aimed at increasing reading fluency. One week after the initial testing, the subjects were retested on the Visagraph and the GORT. Both the Visagraph and the GORT measures showed an improvement, with the Visagraph results having a more significant change.

Eye movements are one method of measuring reading ability. The ability to read well is instrumental in a person's development. If a child is a poor reader, this can affect many other areas of his or her learning, severely limiting them from reaching their full potential. The Taylor Visagraph II is an instrument designed to measure eye movements during reading, and its makers claim that the Visagraph can then be used during a reading program to help monitor the progress of reading development. The evidence suggests that though the Visagraph may record an improvement in the eye movements of reading and consequently an increase in score, it does not necessarily indicate that the person has become a better reader overall.

Over one hundred years ago researchers started to be aware of eye movements during reading. Javal realized that the eye makes a series of saccades rather than one smooth motion across the page. (4) Edmund Burke Huey was the first to make a recording of the eye's movements as a passage was read. His work illustrated that the eyes often return to reread a word (a regression), and that they do not stop (or fixate) and look at every word, but rather can take in several at one time. (4) Poor readers are thought to fixate more than good readers, and likewise poor readers have more regressions than good readers. (2) Furthermore, the difficulty of the reading material affects the number of fixations and regressions. (2)

Solan and other researchers (2,5) have shown that with training a reader's eye movements can become more efficient, and they believe therefore the person becomes a better reader. "Instability in saccades and fixations lead to an increased number of regressions, no matter the cognitive level of text" (5), so by training the eye to move properly the reading efficiency should improve.

## **METHODS**

### *Sample*

The research sample for this study was comprised of college-aged students enrolled in the pre-optometry club. Of the 10 subjects, 4 were male and 6 were female. Their ages ranged from 18 years 8 months to 26 years 2 months. None of the subjects had been previously diagnosed with dyslexia or any other reading disorder. The original selection criteria included: 1) near visual acuity of 20/40 or better, 2) stereopsis on the Wirt rings of 80" or better, 3) a gradient AC/A of 4/1 to 7/1, and 4) meet Sheard's criterion. As data was gathered, however, it was determined that the criteria were too strict, as they were excluding almost all of the subjects. The inclusion criteria was then modified by allowing AC/A ratios down to 2/1 and by no longer requiring Sheard's. This adjustment allowed a sample of 10 subjects.

### *Materials*

A short questionnaire was used to obtain basic biographical data from the subjects, including address, date of birth, any refractive correction worn, and whether or not the subject had ever been diagnosed with a reading disability. The questionnaire also asked the subject if they had experienced any discomfort while reading or doing near work, and asked them to subjectively rate themselves as a reader. (e.g. I am a good reader, I wish I were a better reader, etc.) (see Appendix C).

The Taylor Visagraph II is an instrument consisting of a pair of goggles attached to a computer monitor. The goggles are worn over any habitual correction, and project an infrared light onto the eyes of the subject. The reflection of this light during eye movements is monitored and recorded, and the computer processes the information.

Reading passages are categorized by grade and have a standardized format. Each selection is a standard length, and is followed by 10 yes/no answer comprehension questions. The information resulting from each reading selection is displayed in a printout of graphical data.

The Gray Oral Reading Test consists of a number of reading passages. The subject is to read the passages aloud, while the examiner records the length of time needed to read the passage, as well as the number of mistakes, or "oral miscues" made. Following each reading selection, there are five multiple-choice questions designed to test the reader's comprehension of the passage. There are two forms of the test, Form A was used in this project.

The take home assignment given to the subjects consisted of reading passages, similar to those used in the Visagraph. Like the Visagraph, each passage was a standard length and was followed by ten comprehension questions. A log sheet was given for the subject to record which passage was read on each day, as well as space to record the length of time it took to read the passage and the number of comprehension questions answered correctly.

### *Procedures*

Each subject completed an entering questionnaire and approximately ten minutes of standard optometric procedures including visual acuity, phorias, vergences, and stereopsis. The subjects were then seated at a standard table and chair with their spectacle or contact lens prescription in place. The Taylor Visagraph II goggles were placed on the subject and adjusted for comfort and to provide an unobstructed view while reading. The subjects were then given instructions found in the Visagraph manual on



steps involved in making a recording of the eye movements. Four passages were presented and read silently, and the comprehension questions were then answered. The initial reading in each case was to demonstrate to the subject the process and to ensure that the equipment was set up properly. Only the latter three recordings were used for scoring. The passages selected for each subject were chosen randomly from a selection of age-appropriate readings. If comprehension was not sufficient (based on test guidelines) then up to two additional readings were completed until three total usable recordings were made.

Following the Visagraph, the GORT was administered to the subjects. Each subject read the passages aloud while the examiner recorded elapsed time and oral miscues. Following each passage, the subject answered the comprehension questions. The basal and ceiling levels found in the GORT manual were used to determine at which point to start and stop the test.

Before the patient left, they were given a packet of additional reading passages to read at home. Each subject was asked to read two passages a day and answer the comprehension questions. The subjects were told to concentrate on reading the passages as fast as they could. The time needed to read each passage and the number of comprehension questions answered correctly were recorded on a log form. The subjects returned this log form when they returned for the follow-up testing.

One week after the initial testing, the subjects returned and the Visagraph and GORT were readministered. The process this second time was similar to the first, except that no pretesting was done. The subjects were not given reading passages from the Visagraph that they had read at the initial testing.

## **Results**

For the Visagraph, six measures were looked at to determine if any change occurred between the initial and follow-up testing. These included: Grade equivalent, number of fixations, number of regressions, rate of comprehension, words per minute (WPM), and the relative efficiency. The mean and standard deviation were calculated for each of these measures (Appendix A). The means for the grade equivalent, words per minute, and relative efficiency increased from the initial testing to the follow-up. (Grade equivalent: 8.8 at the initial testing, 12.1 at the follow-up; WPM: 210 to 266; relative efficiency: 1.71 to 2.79) The remaining three measures had a decrease in the means from initial to follow-up testing. (Fixations: 107.2 to 90.2; regressions: 16.5 to 9.0; and Comprehension: 9.67 to 8.17)

There were four factors considered for the GORT. They were the Grade equivalent, the oral reading quotient (ORQ), the percentile rank, and the sum of the standard scores (Appendix B). To facilitate analyzing the data, several adjustments were made to the GORT results. Any grade equivalents that were recorded as >12.9 were changed to 13.0. Likewise, ORQ scores of >148 were modified to 150, and percentile rankings of >99 were changed to 99.9. There was an increase in each of these means from the initial testing to that of the follow-up. (Grade equivalent: 12.72 to 12.74, ORQ: 147.7 to 149.2, Percentile: 99.51 to 99.9, and sum of the standard score: 45.5 to 51.2.)

## **Discussion**

The results of the Visagraph recordings indicate that the subjects did become more efficient at directing their eye movements during reading. The subjects were able to



fixate fewer times per passage and they needed to re-read (regressions) fewer times at the subsequent testing than at the initial. Furthermore, they were able to read at a faster rate (WPM). However, the mean number of comprehension questions answered correctly decreased, possibly indicating that the improvement came at the cost of better comprehension. Although, the decrease in comprehension is clinically insignificant, remaining above eighty percent.

The results of the GORT show slight overall mean increases at the follow-up testing, though not of a significant amount. This may be due to several factors. First, it could indicate that though the subjects improved their eye movements during reading (as shown by the Visagraph results), they did not become better readers on the whole (as measured by the GORT). A second factor is that the GORT was not a sensitive enough test for this sample population. Most of the subjects scored at the top of the scale on the GORT at the initial testing, so even if they did improve as readers they could not score any higher on the test. More research needs to be completed using a sample population that is at a lower reading level (such as grade school children) so this problem can be avoided and clearer results can be obtained.

One issue that needs to be addressed is the “artificial” task that oral reading causes, such as in the GORT. A competent reader can read much faster silently than they can aloud, usually with as good as or better comprehension. Oral reading forces the subject to read much slower and to spend a finite amount of time on every word as they speak it. Silent reading as done in the Visagraph can be done without consciously focusing on every word.

This research also did not take in to account the learning process. It is impossible

to distinguish in this study how much of the improved results are actually due to the subjects' increased reading ability, and how much is due to the subjects' learning to take the test better. Further research should be done using a control group that does not do the take home task, but completes the initial and follow-up testing, to see if test learning and familiarity has any bearing on the results.

As mentioned above, more research needs to be done. This study was intended as a pilot study. It was not expected to show an improvement in the mature readers; however, the data shows a definite increase. This casts doubt on the validity of the Visagraph II. Younger, less accomplished readers may show an even higher rate of improvement as these initial results may predict.

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## APPENDIX A: VISAGRAPH RESULTS

	<u>Initial Testing</u>						<u>Follow-up Testing</u>					
	Gr. Equiv.	Fix.	Reg.	Comp.	WPM	Rel. Effic.	Gr. Equiv.	Fix.	Reg.	Comp.	WPM	Rel. Effic.
Subject 1	7.9	111.3	22.0	10.00	209	1.55	10.3	101.0	13.3	7.67	228	1.98
Subject 2	12.7	85.3	12.0	8.00	290	3.32	12.5	87.0	10.0	9.33	269	2.85
Subject 3	5.6	133.6	12.6	8.67	176	1.21	8.4	118.3	8.7	8.00	202	1.66
Subject 4	12.2	94.6	9.0	8.67	243	2.35	13.0	86.7	7.3	8.67	268	2.80
Subject 5	6.0	118.3	25.0	9.33	182	1.27	5.8	119.7	21.0	8.67	181	1.23
Subject 6	11.9	101.7	19.0	8.67	277	2.30	7.6	103.0	19.3	9.67	262	2.18
Subject 7	10.6	102.3	17.3	8.67	237	2.00	10.5	101.7	17.0	9.33	242	2.09
Subject 8	7.1	120.0	19.3	9.00	195	1.42	9.0	109.3	19.3	8.00	219	1.73
Subject 9	11.4	113.7	6.3	8.33	262	2.21	12.7	104.7	6.0	9.33	289	2.62
Subject 10	9.7	103.0	11.0	9.33	210	1.86	13.8	79.3	4.7	8.67	304	3.59
Mean	8.8	107.2	16.5	9.67	210	1.71	12.1	90.2	9.0	8.17	266	2.79
Standard Dev.	0.9	4.15	5.5	0.335	0.5	0.155	1.75	10.85	4.3	0.5	38	0.805

## APPENDIX B: GORT RESULTS

	<u>Initial Testing</u>				<u>Follow-up Testing</u>			
	Grade Equiv	ORQ	Percentile	Sum Std Score	Grade Equiv	ORQ	Percentile	Sum Std Score
Subject 1	13.0	150	99.9	49	13.0	150	99.9	55
Subject 2	13.0	150	99.9	50	13.0	150	99.9	58
Subject 3	9.0	127	96.0	29	10.9	142	99.9	34
Subject 4	11.7	150	99.9	47	13.0	150	99.9	55
Subject 5	16.9	150	99.9	41	13.0	150	99.9	52
Subject 6	13.0	150	99.9	60	13.0	150	99.9	63
Subject 7	12.9	150	99.9	43	13.0	150	99.9	52
Subject 8	12.1	150	99.9	40	12.5	150	99.9	44
Subject 9	12.6	150	99.9	42	13.0	150	99.9	41
Subject 10	13.0	150	99.9	54	13.0	150	99.9	58
Mean	12.72	147.7	99.51	45.5	12.74	149.2	99.9	51.2
Standard Dev.	1.82	6.90	1.17	8.11	0.63	2.40	0.00	8.45

APPENDIX C

**Assessing the Validity of the Taylor Visagraph II  
Questionnaire and pre-testing**

Subject number \_\_\_\_\_

Name \_\_\_\_\_ male female (circle one)

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

Date of Birth \_\_\_\_\_

Do you wear: Glasses, Contact lenses, None (circle one)

If yes, when or for what purposes do you wear them?

Always Reading only Driving only Other \_\_\_\_\_

To your knowledge, have you ever been diagnosed with dyslexia or any other reading disability? Y N

If yes, what was the diagnosis? \_\_\_\_\_

How do you view yourself as a reader? (check all that apply)

\_\_\_\_\_ I am confident that I am a good reader and I like to read.

\_\_\_\_\_ I feel I could be a better student if I could read better.

\_\_\_\_\_ I wish I was a better reader.

Do you ever experience discomfort while reading or doing other types of near work? Y or N (please describe)

\_\_\_\_\_

\_\_\_\_\_

DO NOT WRITE BELOW THIS LINE

Visual acuity, near: OD OS w w/o Rx

Stereopsis (wirt rings): \_\_\_\_\_ "

Von Graefe phoria at 40 cm \_\_\_\_\_

Von Graefe phoria at 40 cm through +1.00 OU \_\_\_\_\_ Gradient AC/A \_\_\_\_\_

Base-out or Base-in (circle one) blur or break (circle one) point at 40 cm \_\_\_\_\_

Meets Sheard's criterion: Y N