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The effect of reading during the latency period of a cycloplegic upon the refractive endpoint of the cycloplegic exam

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Abstract

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Nada J. Lingel

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THE EFFECT OF READING DURING THE LATENCY PERIOD OF A CYCLOPLEGIC UPON THE REFRACTIVE ENDPOINT OF THE CYCLOPLEGIC EXAM

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Biographies

Jeffrey D. Melicher

Jeff attended University of North Dakota from 1985-1988, majoring in Biology. He received his B.S. degree in Visual Science from Pacific University in Forest Grove, OR. He attended Pacific Universtiy College of Optometry from 1988-1992 where he received his docorate on May 17, 1992.

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Jeff attended Lewis & Clark College before entering Pacific University College of Optometry. He received his doctorate on may 17, 1992.

Abstract:

The cycloplegic refraction is a useful tool for determining the refractive error of a patient, but it is important for the accommodative system to be both fully paralyzed and completely relaxed when determining this endpoint. This study compared the cycloplegic refractive endpoints of twenty-two subjects on two separate occasions to determine if the activities performed by the patient during the latency period of the cycloplegic agent influenced the refractive endpoints. The subjects performed a near task of reading after drop instillation during one session and a far task of viewing television during the other. The results show no significant difference between the endpoints of the cycloplegic refraction after either task.

Key Words:

Cycloplegic Refraction, Refractive Endpoint, Cyclopentolate, Parasympatholytic, Latency Period

Acknowledgments:

We would like to thank Clay Briscoe, Patrick Britton, and Dan Perala for help in managing the patients. Thanks also to Bradley Coffey, O.D. for statistical consulting and our adviser, Nada J. Lingel, O.D. for her help.

This paper is dedicated to the memory of Danny Bickel.

Introduction:

Parasympatholytic drugs are used in optometric practice to help determine the patient's true refractive error.[1] These drugs act by paralyzing the ciliary muscles of the eye to prevent accommodation.[1] If accommodation is completely relaxed by this paralysis, the cycloplegic endpoint will yield a refractive error of the maximum plus. If instead accommodation is paralyzed in a position that is not completely relaxed, the refractive error will show less than the maximum plus. Theoretically it is possible that a near task, such as reading, performed while the drug is taking affect, could paralyze the ciliary muscles in a position that is not fully relaxed.

This study was designed to determine whether the task performed by the patient during the latency period of the cycloplegic agent influences the outcome of the cycloplegic exam. Of particular interest was the effect of reading during the latency period of Cyclopentolate™. Cyclopentolate™ was chosen because it is considered by many to be the drug of choice for inducing cycloplegia due to its effectiveness, duration and recovery time.[2,3,4,5] Reading was chosen as the near activity because it is common practice at Pacific University College of Optometry to offer reading material to our patients while waiting for the cycloplegic drops to take affect. This practice is also suggested in the practice management literature.[6,7,8] Since the purpose of the cycloplegic exam is to find the true far refractive error[1], knowing what impact, if any, near viewing can have on this finding would prove useful to the clinician.

Methods:

Twenty-two subjects, all affiliated with the Pacific University College of Optometry participated in this study that involved two visits to the Pacific University College of Optometry Family Vision Center. Of the 22 subjects, 11 of them were male and 11 were female. The subjects ranged from 21-32 years of age, with an average of 23.7 years of age. The average sphere refractive error was -2.12 with a standard deviation of 2.7 and a range from -8.25 to +2.50. The cylinder correction averaged -0.62 with a standard deviation of 0.50 and a range from 0 to -1.75. The cylinder axis mode was against-the-rule. A histogram of the cylinder axes can be seen in figure 1.

Two masked examiners performed all the refractions and three assistants helped with other portions of the study. Upon arriving at the research site, a brief case history and entering visual acuities were taken. The subject's refractive status was determined using the Nidek Auto Refractometer model AR-1100 as a starting point followed by a binocular subjective refraction using standard optometric testing. The refraction was performed in a conventional refracting room with a refracting distance of 5 meters. Standard lighting conditions were maintained and each examiner used the same room throughout the study. An ocular health exam that included Goldmann tonometry, biomicroscopy and ophthalmoscopy was performed to rule out any abnormalities or contraindications to the use of a parasympatholytic agent. The recommended dosage of

one drop of 1% Cyclopentolate™ was then instilled in each of the subject's eyes.[2,3,5]

For the next thirty minutes, while the Cyclopentolate™ was taking effect[1,2,3], the subjects performed either a near task or a far task. For the near task, the subjects read material of their own choice. It was explained to the subjects that although their vision would become blurry, it was important to attempt to read as long as possible and to avoid looking up from the page for the full 30 minutes even when they could no longer read. Those assigned the far task were asked to watch a television that was placed approximately 30 feet away. This group was instructed not to look at anything close. All the subjects wore their best distance correction during the task performance and were closely supervised during the 30 minutes.

At the end of thirty minutes the residual accommodation was tested monocularly to insure proper cycloplegia. This was done by placing a reading card of the phoropter at 50 cm and the patient's best distance correction plus 2.00 D sphere in the phoropter. As the patient read the card out loud, it was pushed towards the patient until he or she could no longer read it. This distance was measured and converted into residual accommodation. Although this is a subjective determination, Ward and Charman point out that subjective tests for residual accommodation are larger than objective determinations.[3] Although residual accommodation of 2.00 diopters or less is generally considered necessary for adequate cycloplegia,[4,9,10] Priestly indicates that the residual accommodation found with Cyclopentolate™ 1% averages 1.25 diopters.[11] Because of

this and our subjective method of determining the residual accommodation, we required no more than 1.50 diopters of push-up amplitude to consider the patient adequately cyclopleged.

If the residual accommodation was less than 1.50 diopter, the subject's refractive status was determined again by the same methods. Individuals who showed inadequate cycloplegia were not continued in the study.

In the literature, the longest reported average duration of Cyclopentolate™ is more than 24 hours, but less than three days.[1,2] To allow adequate time for no residual effects, the same procedure was performed no less than one week later with the subjects performing the opposite task. The subjects were refracted by the same examiner on all occasions, with the examiners being masked as to which task had been performed at each sitting. At the conclusion of the second session, an ocular health check consisting of binocular indirect ophthalmoscopy and 78D fundus biomicroscopy was performed.

Results:

Only one subject failed to meet the criteria for adequate cycloplegia and was excluded from the study. This subject was of non-Caucasian descent; a factor that has been reported in the literature as decreasing the effectiveness of Cyclopentolate™[1,3,12].

The data was divided into four main groups. These groups were: Near week-Dry (non-cycloplegic) refraction (ND), Near week-Wet refraction (NW), Far week-Dry refraction (FD), and Far week-Wet refraction (FW). Each of these groups consisted of sphere,

cylinder power, axis, and equivalent sphere findings. Although twenty-two subjects were used in the study, each eye was considered individually for statistical analysis, giving us a total of forty-four eyes.

A two-tailed paired t-test was used to compare sphere power of one group with sphere power of another, cylinder power with cylinder power, and equivalent sphere with equivalent sphere. A $P \leq 0.05$ was used to determine statistical significance. The mean result for each of these findings can be found in table 1. Statistical results can be seen in Appendix 1.

The change in cylinder axis from one group to another did not lend itself well to statistical presentation, so axis deviation was shown using frequency histograms. These can be seen in figures 2-5 and show that the majority of axis shift was between 0 and 10 degrees.

There was no significant difference found between the Near week wet group and the Far week wet group sphere, cylinder or equivalent sphere. There was a difference found when comparing the dry group's sphere and equivalent sphere to the wet group's sphere and equivalent sphere. No significant difference was found with the cylinder power of any of these groups. To determine the internal validity of this study the dry results from week one were compared to the dry results of week two. No significant difference was found between these groups showing that the measurement of the refractive errors did not change significantly from the first week to the second.

Conclusions:

The goal of this study was to determine if the clinician should control the task of the patient after the installation of a cycloplegic drop, specifically 1% Cyclopentolate™. The data suggests that the task performed by the patient during the latency period of cyclopentolate will not affect the patient's refractive endpoint and therefore the clinician need not monitor or limit the patient's activity during that time.

This study also found a significant difference between wet and dry refractive endpoints as would be expected. This result was found in both sphere and equivalent sphere comparisons, regardless of the task performed. Cylinder power and axis however, were not significantly affected. This suggests that astigmatism is relatively stable and will not be greatly affected by a cycloplegic drug.

Figure 1: Frequency of Cylinder Axes

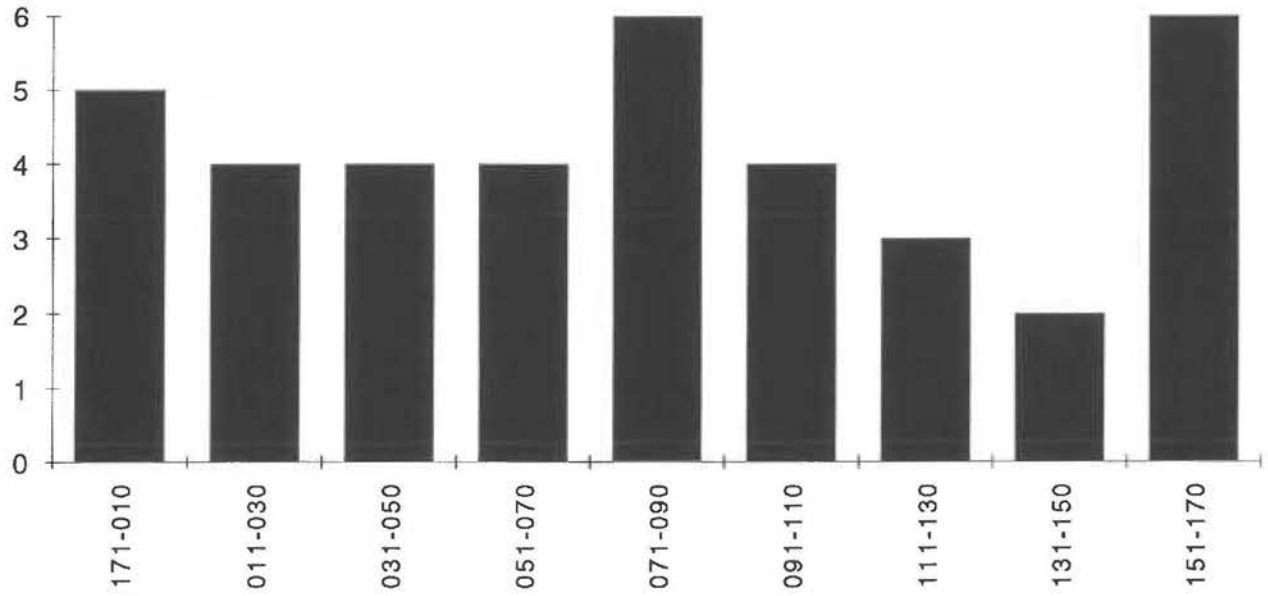

Table 1: Mean Values

	Sphere		Cylinder		Axis		Equiv. Sphere	
	ave.	std.	ave.	std.	ave.	std.	ave.	std.
Near Dry	-2.12	2.70	-0.62	0.47	93	56	-2.37	2.83
Near Wet	-1.87	2.81	-0.75	0.50	103	60	-2.12	2.95
Far Dry	-2.12	2.67	-0.62	0.44	90	53	-2.37	2.77
Far Wet	-1.75	2.83	-0.62	0.47	88	59	-2.12	2.90

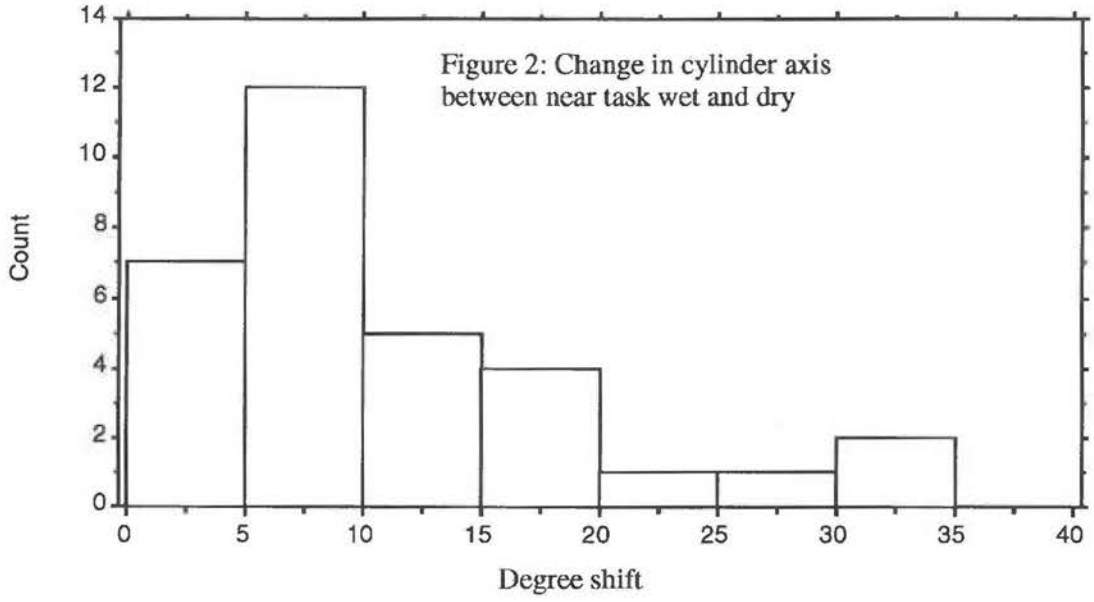

Figure 2: Change in cylinder axis between near task wet and dry

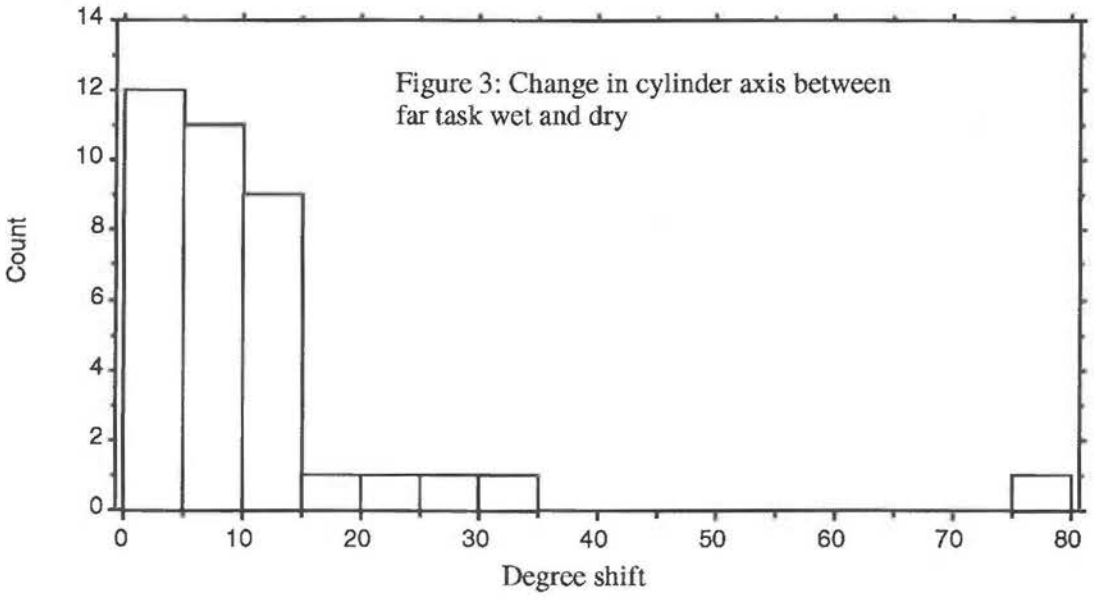

Figure 3: Change in cylinder axis between far task wet and dry

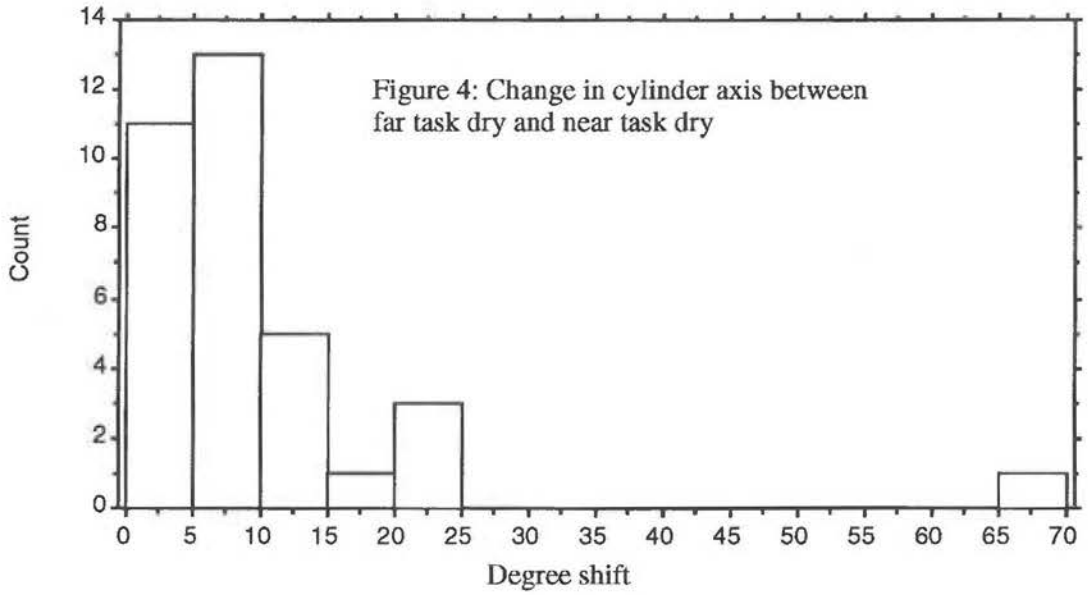

Figure 4: Change in cylinder axis between far task dry and near task dry

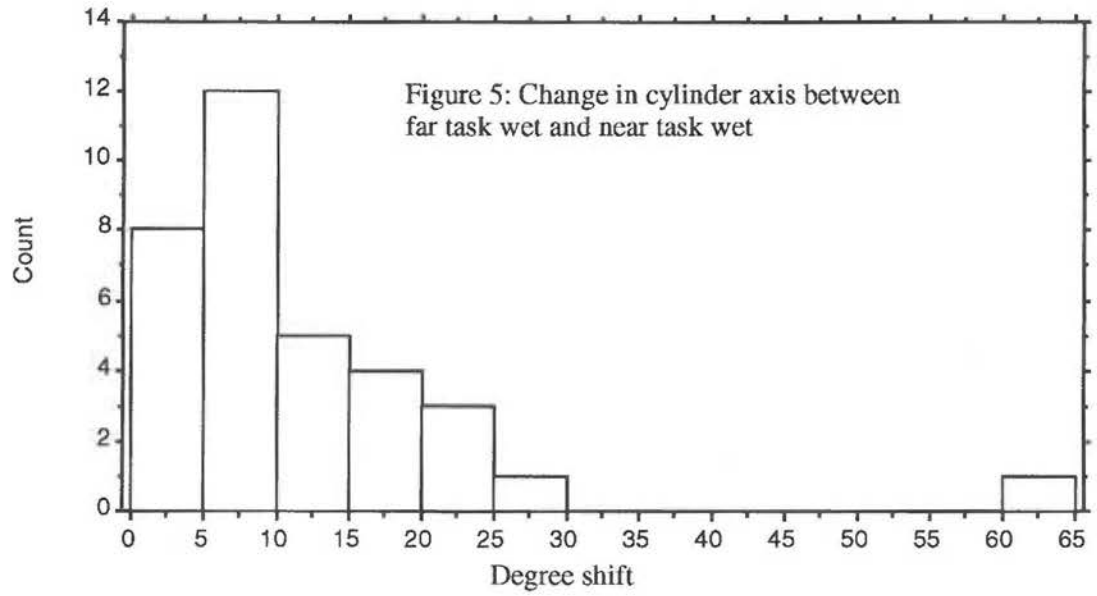

Figure 5: Change in cylinder axis between far task wet and near task wet

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Appendix 1

DRY GROUP COMPARED TO WET GROUP

Paired t-Test X_1: ND sph Y_1: NW sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.29	-3.846	.0004

Paired t-Test X_2: ND cyl Y_2: NW cyl

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	.045	1.135	.2626

Paired t-Test X_3: ND eq sph Y_3: NW eq sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.267	-3.595	.0008

Paired t-Test X_4: FD sph Y_4: FW sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.324	-2.45	.0185

Paired t-Test X_5: FD cyl Y_5: FW cyl

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	.028	.797	.4296

Paired t-Test X_6: FD eq sph Y_6: FW eq sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.311	-2.502	.0163

NEAR GROUP COMPARED TO FAR GROUP

Paired t-Test X_1: Wk1 Sph Y_1: Wk2 Sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.028	-.053	.9577

Paired t-Test X_1: Wk1 Cyl Y_1: Wk2 cyl

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.017	-.15	.8814

Paired t-Test X_1: Wk1 Eq Sph Y_1: Wk2 Eq Sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.036	-.064	.9494

Paired t-Test X_4: NW sph Y_4: FW sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.074	-.565	.5749

Paired t-Test X_5: NW cyl Y_5: FW cyl

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.023	-.599	.5526

Paired t-Test X_6: NW eq sph Y_6: FW eq sph

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
43	-.085	-.663	.5108

Appendix 2

Informed Consent Form

Institution

A.	Title of the project:	The Effect of Reading During the Latency Period of a Cycloplegic Drug Upon the Refractive Endpoint of the Cycloplegic Exam.
B.	Principal Investigators:	Jeff Carkner 357-1896 Jeff Melicher 357-0628 Danny Bickel
C.	Adviser:	Nada Lingel O.D. 359-5906
D.	Location:	Pacific University College of Optometry Forest Grove, OR
E.	Date:	1991

1. Description of project

This research project is designed to determine if an extended reading task can influence the final results of the cycloplegic exam. Clinically, the cycloplegic exam is used to determine the true far refractive error of the eye by relaxing the focusing mechanism of the eye. This project will determine if the muscles inside the eye which control the focusing mechanism relax fully. The subjects will be given cycloplegic drops on two visits. During one visit the subject will read after the drops and on the other visit the subject will look at a far target. The researchers will measure and compare the refractive endpoints from each visit.

2. Description of risks

Risks associated with this project are mainly due to the drops and include a burning sensation, a possible increase in intraocular pressure in open-angle glaucoma, possible angle-closure glaucoma, allergic reactions, and some nervous system symptoms. The burning sensation will subside within two minutes after instillation of the drops. Open-angle glaucoma patients will be excluded from this project. Allergic reactions include redness, itching, watering, and a stringy discharge. The nervous system reaction occurs primarily in children and consists of mild hallucinations that last for several hours.

In order to reduce the risks, each subject will be screened for possible adverse reaction by a thorough case history, tonometry, and assessment of the anterior chamber angle. These risks are rare and the experimenters will take care to eliminate the individuals at risk.

3. Description of benefits

This study will serve to increase the basic understanding of how the focusing mechanism of the eye responds to reading in the cycloplegic exam.

4. Alternatives advantageous to subjects

Not applicable

5. Records of this project will be maintained in a confidential manner and no name-identifiable information will be released.

6. Compensation and medical care

If you are injured in this experiment it is possible that you will not receive compensation or medical care from Pacific University, the experimenters, or any organization associated with the experiment. All responsible care will be used to prevent injury however.

7. Offer to answer any inquiries

The experimenters will be happy to answer any questions that you may have at any time during the course of the study. If you are not satisfied with the answers you receive, please call Dr. James Peterson at 357-0442. During your participation in the project you are not a Pacific University patient or client for the purposes of the research and all questions should be directed to the researchers and/or the faculty advisor who will be solely responsible for any treatment (except for an emergency). You will not be receiving complete eye, vision or health care as a result of participation in the project; therefore you will need to maintain your regular program of eye, vision, and health care.

8. Freedom to withdraw

You are free to withdraw your consent and to discontinue participation in this project or activity at any time without prejudice to you.

I have read and understand the above. I am 18 years of age or over (or this form is signed for me by my parent or guardian).

Printed name _____

Signed _____ Date _____

Address _____ Phone _____

City _____ State/Zip _____

Name and address of a person not living with you who will always know your address.

_____

Near Group - Please find an article that you are interested in and begin reading. Your vision will become blurry in a matter of minutes. Even though it may become difficult to read, please do not remove your glasses or look up from the page. Continue to attempt to read as long as possible and keep looking at the page even after you cannot read it. Please do not tell anyone performing the examination on you what group you are in as they need to be "masked".

Far Group - Please watch the TV for the entire 30 min. Try not to look at anything up close. Please do not tell anyone performing the examination on you what group you are in as they need to be "masked".