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Title: Measuring the Behavioral Effects of Intraocular Scatter

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Author Questionnaire

1. Microscopy: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**

2. Software: Does the part of your protocol being filmed include step-by-step descriptions of software usage? **No**

3. Interview statements: Considering the COVID-19-imposed mask-wearing and social distancing recommendations, which interview statement filming option is the most appropriate for your group? **Please select one**.

☒ Interviewees wear masks until videographer steps away (≥6 ft/2 m) and begins filming, then the interviewee removes the mask for line delivery only. When take is captured, the interviewee puts the mask back on. Statements can be filmed outside if weather permits.

4. Filming location: Will the filming need to take place in multiple locations? **No**

Current Protocol Length

Number of Steps: 11
Number of Shots: 21

Introduction

1. Introductory Interview Statements

REQUIRED:

1.1. **Jeffrey Nightingale:** The behavioral consequences of intraocular scatter are often severe and central to many common problems such as driving accidents. This study represents a novel method for measuring the effects of scatter on visual recognition.

1.1.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera

1.2. **Jeffrey Nightingale:** The main advantage of this methodology is its high degree of ecological validity while using relatively simple optics.

1.2.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera. *Suggested b-roll: 2.1.1, 2.2.1*

OPTIONAL:

1.3. **Jeffrey Nightingale:** Cataract is the leading cause of blindness in the world. Prior to overt disease, the lens scatters light and degrades vision for decades. Proper measurement could motivate more timely treatment.

1.3.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera

1.4. **Jeffrey Nightingale:** Despite similarities in refractive condition, visual performance often varies dramatically between individuals. This method provides some quantification of the source of such variance. Existing optical systems could easily be adapted to include glare acuity measurements.

1.4.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera. *Suggested b-roll: 2.4.1, 2.4.2*

Ethics Title Card

1.5. This study was approved by the University of Georgia institutional review board, and the experimental procedures were conducted in accordance with Good Clinical Practice Guidelines and the ethical principles of the Declaration of Helsinki.

Protocol

2. Constructing the Glare Acuity Apparatus

2.1. Working on an optical table, install a 1000-Watt xenon arc lamp with the associated power supply at the posterior end of the bench **[1]**. Install the first lens at a position that collimates the light from the source **[2]** and introduce an optical element to remove heat within the optics generated by the intense light source **[3]**.

2.1.1. WIDE: Talent installing xenon arc lamp

2.1.2. Talent installing first lens

2.1.3. Talent placing heat removing optical device

2.2. Introduce the next lens within the optical system to focus light to a small point on the 100-millimeter circular neutral density filter, which attenuates light over a linear range of about 2 log units of optical density **[1]**. Determine the nominal position of the filter using a digital readout coupled to a potentiometer *(Pronounce POTENTI-ometer)* **[2]**. Install a diffuser behind the neutral density filter **[3]**.

2.2.1. Talent introducing the next lens in the system near to circular filter *Videographer: This step is important!*

2.2.2. Digital read out displaying measurement.

2.2.3. Installation of the diffuser

2.3. Use a calibrated radiometer *(Pronounce RADI-ometer)* to determine the actual amount of light transmitted that corresponds to the circular filter's position and to periodically confirm that the overall energy within the system remains constant over the course of the experiment **[1]**.

2.3.1. Talent using the radiometer *Videographer: This step is important!*

2.4. Use a mechanical shutter or a blocking filter and holder to occlude the stimulus between trials **[1]**. Add the next lens to the system, a collimating lens, placed such that light expands to match the diameter of each letter aperture, fully illuminating the optotype **[2-TXT]**.

2.4.1. Talent using the shutter or the blocker *Videographer: This step is important!*

2.4.2. Talent adding collimating lens to the system **TEXT: Diameter; lens: 10.16 cm, letter: 7.62 cm** *Videographer: This step is important!*

2.5. Construct the letter apertures or purchase them as metal stencils **[1]**. Place the letter apertures in a circular rotator **[2]** with spring-loaded tabs and divots to lock each letter in place so there is no movement of the wheel during the experiment **[3]**.

2.5.1. Letter apertures

2.5.2. Talent placing the letter apertures in rotator *Videographer: This step is important!*

2.5.3. Talent locking the letter in rotator

2.6. Next, baffle the system **[0]** such that subjects can only see the back-illuminated letter apertures **[1]**. For instance, place the optics of the system in one room with the subject in an adjoining room **[2]**.

2.6.0 Baffle Installation

2.6.1. Back illuminated letter *Videographer: This step is important!*

2.6.2. WIDE: Subject in another room

2.7. Position a hole within the doorway adjoining the rooms and align it so that subjects cannot see the experimenter or stray light **[1]**.

2.7.1. Talent displaying the hole in the doorway *Videographer: This step is important!*

2.8. To ensure that the position of the eye relative to the visual system is fairly precise, create some form of head and chin rest assembly mounted on a movable cart **[1]**. Add a mount behind the tube **[2] [3]** to allow for the use of trial lenses to correct for refractive error using standardized lenses without tinting**[4]**.

2.8.1. Head ~~and chin resting~~ assembly

2.8.2. Mount with trial lenses

2.8.3. Cart as a whole

2.8.4. Trial lenses being installed

2.9. Use a laser level to ensure alignment of the eye piece with the optics **[1-TXT]**.

2.9.1. Talent using laser level **TEXT: 7 m from the plane of the eye**

3. Measurement of Glare Recognition Acuity

3.1. Before beginning the protocol, explain the nature of the experimental task by showing the subject suprathreshold stimuli **[SHOT 1] [SHOT 2]**. Use a random letter generator to organize the letters on the wheel into a unique, random order **[SHOT 3 - 3.1.1]**. Use the method of limits to get close to the threshold and then constant stimuli to obtain a precise value of the subject's glare recognition acuity threshold **[SHOT 4 - 3.1.2]**.

SHOT 1: WIDE: talent explaining (shot over the shoulder) the protocol to the subject **NOTE: Use as 3.1.1.**

SHOT 2: MEDIUM: (in the dark) talent explaining to the subject what is

happening next **NOTE: Use as 3.1.2.**

3.1.1. **SHOT 3:** Talent using the random letter generator to rotate the wheel - random letter generator shots wide then tight *Videographer: This step is difficult!* **NOTE: Use as 3.1.3.**

3.1.2. **SHOT 4:** Talent using the methods of limits to get close to the threshold - wide of letters coming into view with light decreasing in intensity then switching to new letters and beginning the process again. *Videographer: This step is difficult!* **NOTE: Use as 3.1.4.**

3.2. Before beginning the protocol, explain the nature of the experimental task by showing the subject suprathreshold stimuli **[1]**. Ensure that the subject is aware that the task is fairly simple. Run enough trials to generate a psychometric function that allows for derivation of an accurate probabilistic threshold **[2]**.

3.2.1. Talent explaining the protocol to the subject

3.2.1M Monitor shot **NOTE: Use as 3.2.1.**

3.2.2. Talent running a trial *Videographer: This step is difficult!*

Results

4. Results: Intraocular Scatter Assessment

4.1. The results indicated the variation in the number of letters seen at one relatively bright intensity level. A wide variation was present even when testing healthy young subjects **[1].**

4.1.1. LAB MEDIA: Figure 6

4.2. Data from the halos and spokes were obtained from different samples of 23 young subjects. Both samples were recruited from the student population at the University of Georgia and all subjects had good acuity **[1]**.

4.2.1. LAB MEDIA: Figure 7

4.3. The minimum distance required to resolve two points of light as distinct was also measured. Despite the sample being so homogeneous, there was wide variation in the behavioral measures of scatter, which standard clinical measures of visual function fail to quantify **[1]**.

4.3.1. LAB MEDIA: Figure 8

Conclusion

5. Conclusion Interview Statements

5.1. **Jeffrey Nightingale:** It is important to remember to use a light source that effectively simulates white sunlight. A mounted laser level is useful to ensure overall alignment.

5.1.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera. *Suggested B-roll: 2.1.2, 2.9.1*

5.2. **Jeffrey Nightingale:** There are a number of known variables that covary with glare disability such as age, covert anterior ocular diseases etc. The effects of such variables on recognition under glare conditions have yet to be evaluated. This method will allow such studies

5.2.1. INTERVIEW: Named talent says the statement above in an interview style shot, looking slightly off-camera