Online Procedures for Photophobic Testing

Isabella Sims, Justice Suh, Avery Novick
Faculty Advisor: Professor Arthur Shapiro

Photophobia and Traumatic Brain Injury

•**TBI**: Brain dysfunction caused by an outside force, usually a violent blow to the head

- **Photophobia** is a *symptom* of Traumatic Brain Injury
    - Sensitivity to light
    - Migraines

Product Overview: What problems are we solving?

There is currently no standard way to test for photophobia

Doctors and patients waste time and money using exhaustive / anecdotal strategies

Ophthalmologists feel helpless when patients expresses general visual symptoms that likely point to photophobia

Why our Product is Needed

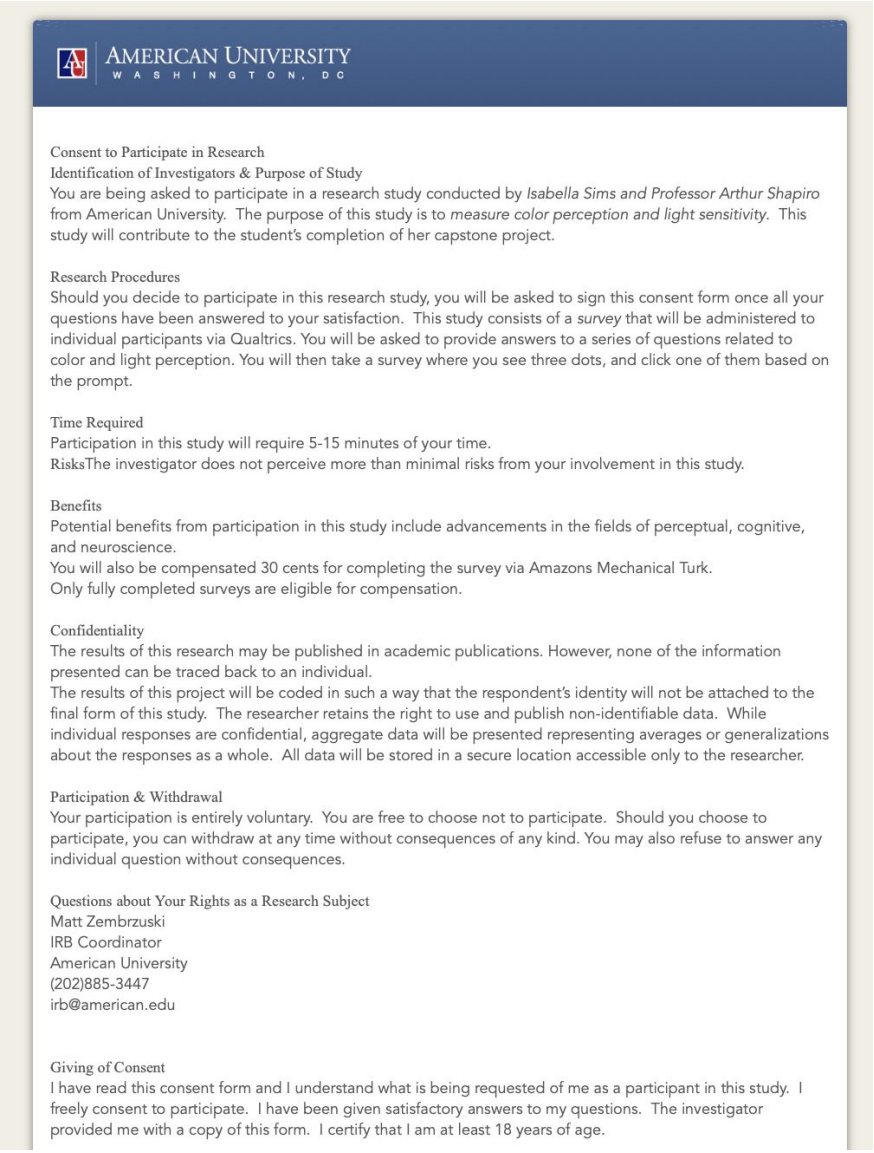
- Patients need relief from symptoms of photophobia
- It will save time and effort for both parties
- It is far more cost effective than existing strategies
- It removes the ambiguity from diagnosis

Product Feature Overview

Preliminary questionnaire and task Instructions

Test 1

Test 2



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Consent to Participate in Research

Identification of Investigators & Purpose of Study

You are being asked to participate in a research study conducted by *Isabella Sims and Professor Arthur Shapiro* from American University. The purpose of this study is to *measure color perception and light sensitivity.* This study will contribute to the student's completion of her capstone project.

Research Procedures

Should you decide to participate in this research study, you will be asked to sign this consent form once all your questions have been answered to your satisfaction. This study consists of a *survey* that will be administered to individual participants via Qualtrics. You will be asked to provide answers to a series of questions related to color and light perception. You will then take a survey where you see three dots, and click one of them based on the prompt.

Time Required

Participation in this study will require 5-15 minutes of your time.

RisksThe investigator does not perceive more than minimal risks from your involvement in this study.

Benefits

Potential benefits from participation in this study include advancements in the fields of perceptual, cognitive, and neuroscience.

You will also be compensated 30 cents for completing the survey via Amazons Mechanical Turk.

Only fully completed surveys are eligible for compensation.

Confidentiality

The results of this research may be published in academic publications. However, none of the information presented can be traced back to an individual.

The results of this project will be coded in such a way that the respondent's identity will not be attached to the final form of this study. The researcher retains the right to use and publish non-identifiable data. While individual responses are confidential, aggregate data will be presented representing averages or generalizations about the responses as a whole. All data will be stored in a secure location accessible only to the researcher.

Participation & Withdrawal

Your participation is entirely voluntary. You are free to choose not to participate. Should you choose to participate, you can withdraw at any time without consequences of any kind. You may also refuse to answer any individual question without consequences.

Questions about Your Rights as a Research Subject

Matt Zembrzuski
IRB Coordinator
American University
(202)885-3447
irb@american.edu

Giving of Consent

I have read this consent form and I understand what is being requested of me as a participant in this study. I freely consent to participate. I have been given satisfactory answers to my questions. The investigator provided me with a copy of this form. I certify that I am at least 18 years of age.

Consent Form

browser data_Browser	browser data_Version	browser data_Operating System	browser data_Resolution
Click to write the question text - Browser	Click to write the question text - Version	Click to write the question text - Operating System	Click to write the question text - Resolution
Chrome	86.0.4240.198	Windows NT 6.3	1024x768
Chrome	86.0.4240.198	Windows NT 10.0	1920x1080
Chrome	86.0.4240.198	Windows NT 6.3	1920x1080
Chrome	87.0.4280.66	Windows NT 6.3	1366x768
Chrome	86.0.4240.198	Windows NT 6.3	1920x1080
Chrome	87.0.4280.66	Windows NT 6.1	1366x768
Chrome	87.0.4280.66	Windows NT 10.0	1536x864
Chrome	87.0.4280.66	Windows NT 10.0	1364x768
Chrome	87.0.4280.66	Windows NT 6.1	1366x768
Chrome	86.0.4240.198	Windows NT 6.1	1366x768
Chrome	86.0.4240.193	Windows NT 6.1	1366x768
Opera	72.0.3815.320	Windows NT 10.0	1366x768
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Chrome	87.0.4280.66	Windows NT 6.1	1366x768
Chrome	84.0.4147.125	Windows NT 6.3	1366x768

Metadata Collection

There are two parts to this survey. In this part, participants see 3 dots of different brightness levels. They are asked if the center dot appears more similar to the dot on the left or dot on the right. The procedure is repeated for all combinations of 8 dots of different brightness levels, and repeated for a dark background and for a light background. Each participant will have (84 x 2 trials, which will take approximately 5-10 minutes). To receive compensation observers must enter the completion code given at the end of the survey on Mturk. A completion code will only be given to those who complete the entirety of the survey

- Continue to survey
- Exit survey

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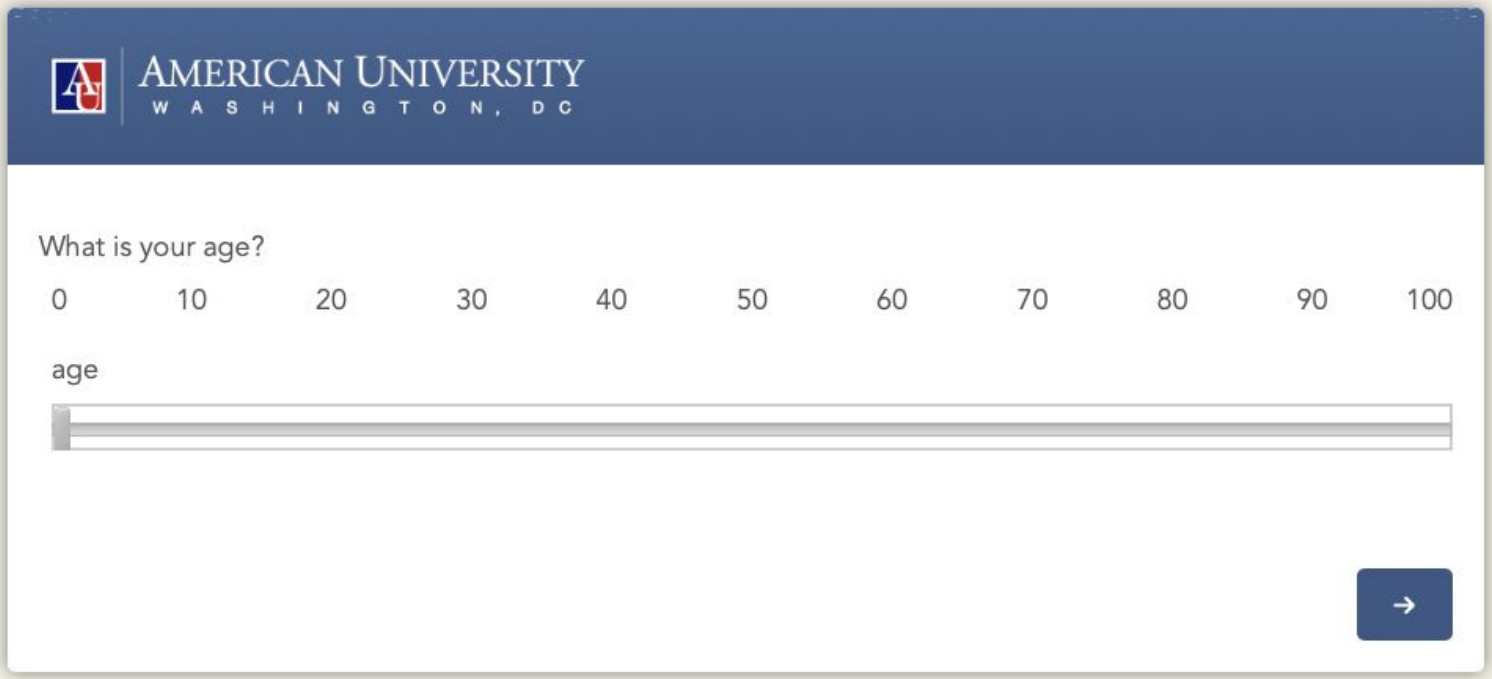

Survey Powered By Qualtrics


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Do you wear glasses or contacts?
Yes
No
Survey Powered By Qualtrics

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Have you ever been diagnosed with a neurological or visual impairment?

- ○ No
- ○ Yes - traumatic brain injury
- ○ Yes - photophobia
- ○ Yes - color blindness
- ○ Other (please specify)

  [ ]
- ○ Prefer not to say

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What is your gender?

- Male
- Female
- Other
- Prefer not to say

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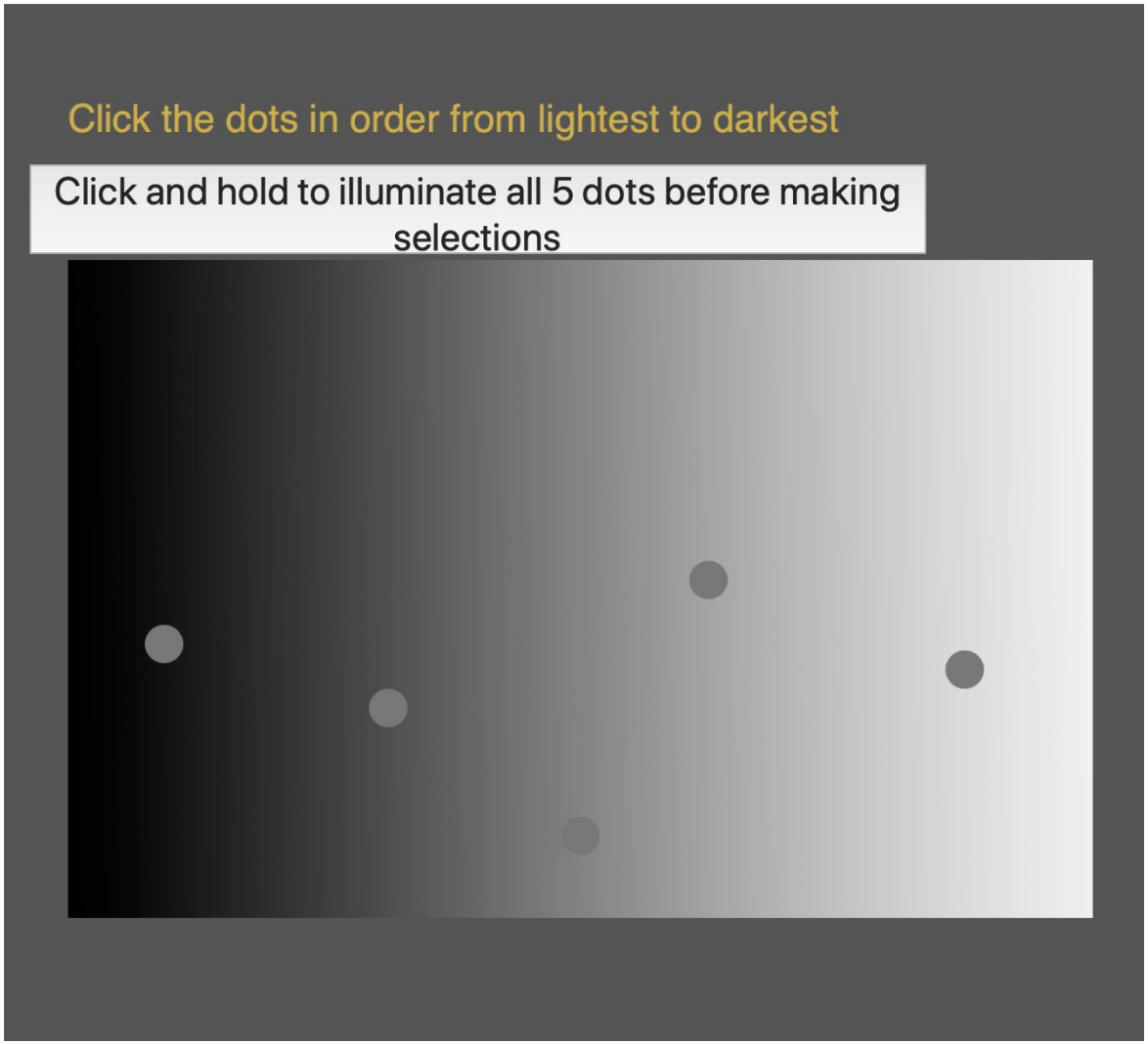
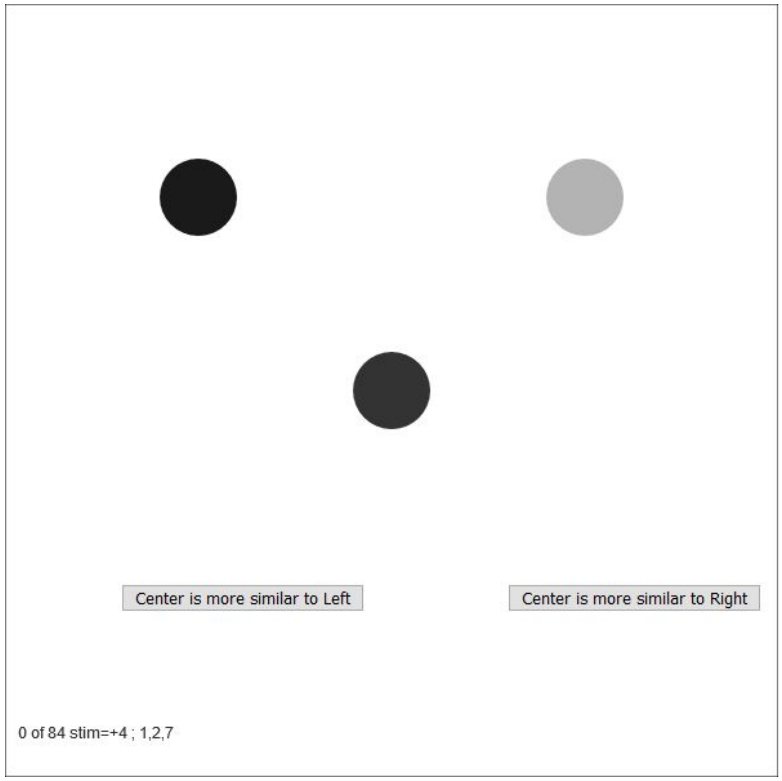
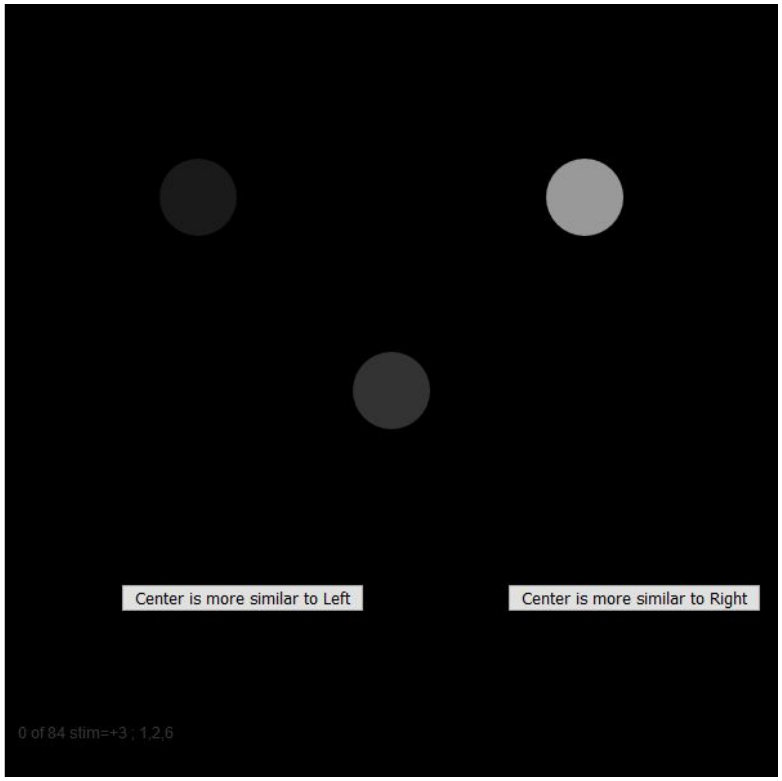

Click the dots in order from lightest to darkest
Click and hold to illuminate all 5 dots before making selections

Test 1

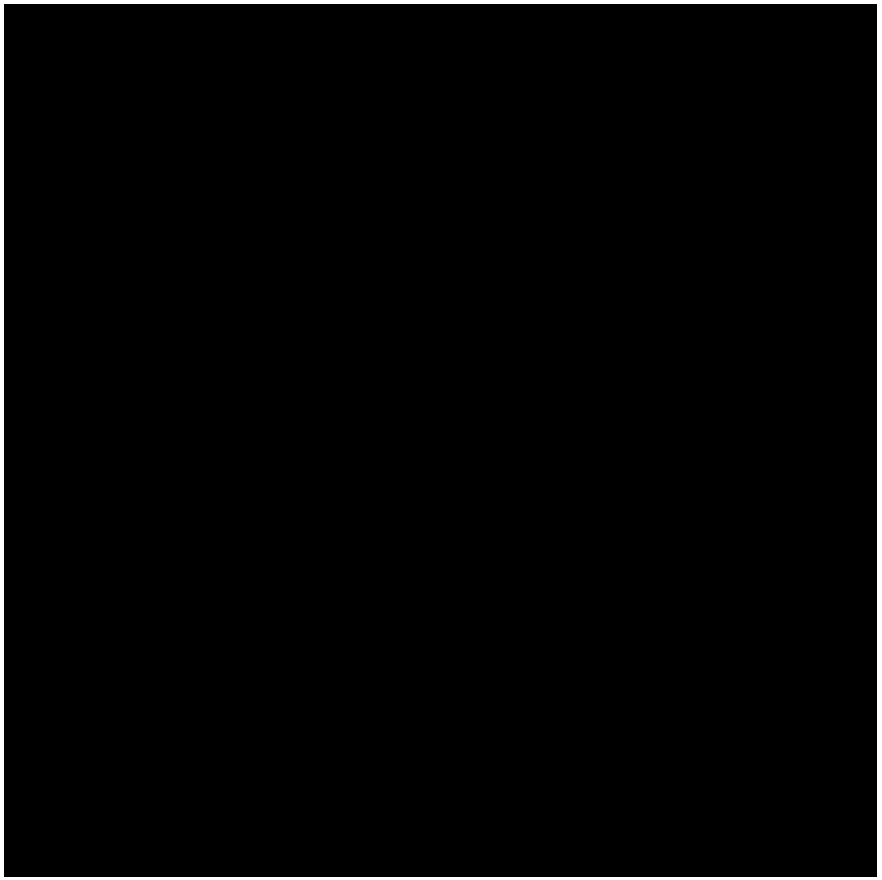
Test 1 Rankings

Test 2


Center is more similar to Left
Center is more similar to Right
0 of 84 stim=+4 ; 1,2,7


Center is more similar to Left
Center is more similar to Right
0 of 84 stim=+3 ; 1,2,6

Product Demo – Test 1



Product Demo – Test 2

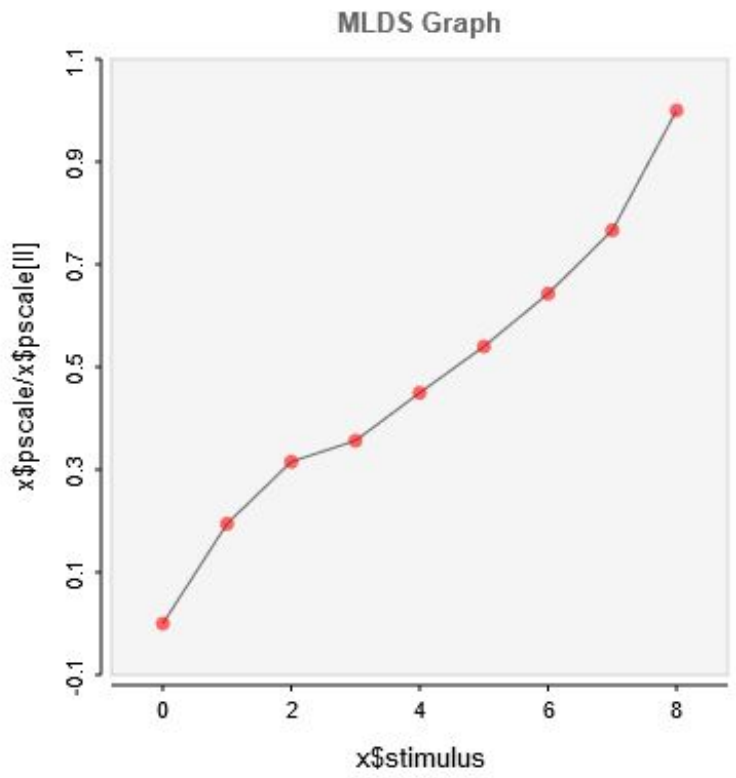
Results: R^2

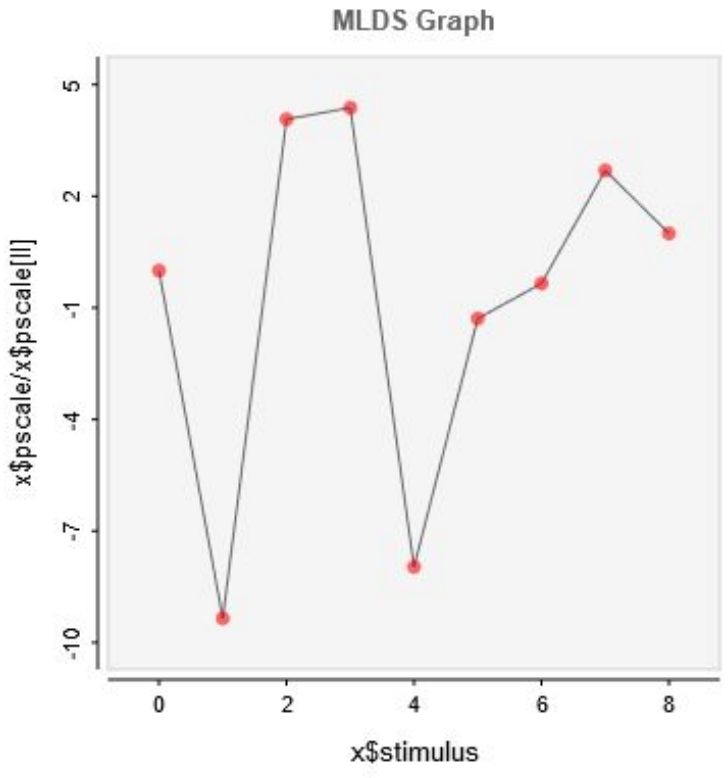
VIS PROBLEMS

Question	Average r2
Kings	0.32
Wheel	0.10
Grad	0.35
Checker	0.17
Checker 2	0.17
Wheel 2	0.37
Kings 2	0.11
Grad 2	0.72
Average	**0.29**

NORMAL

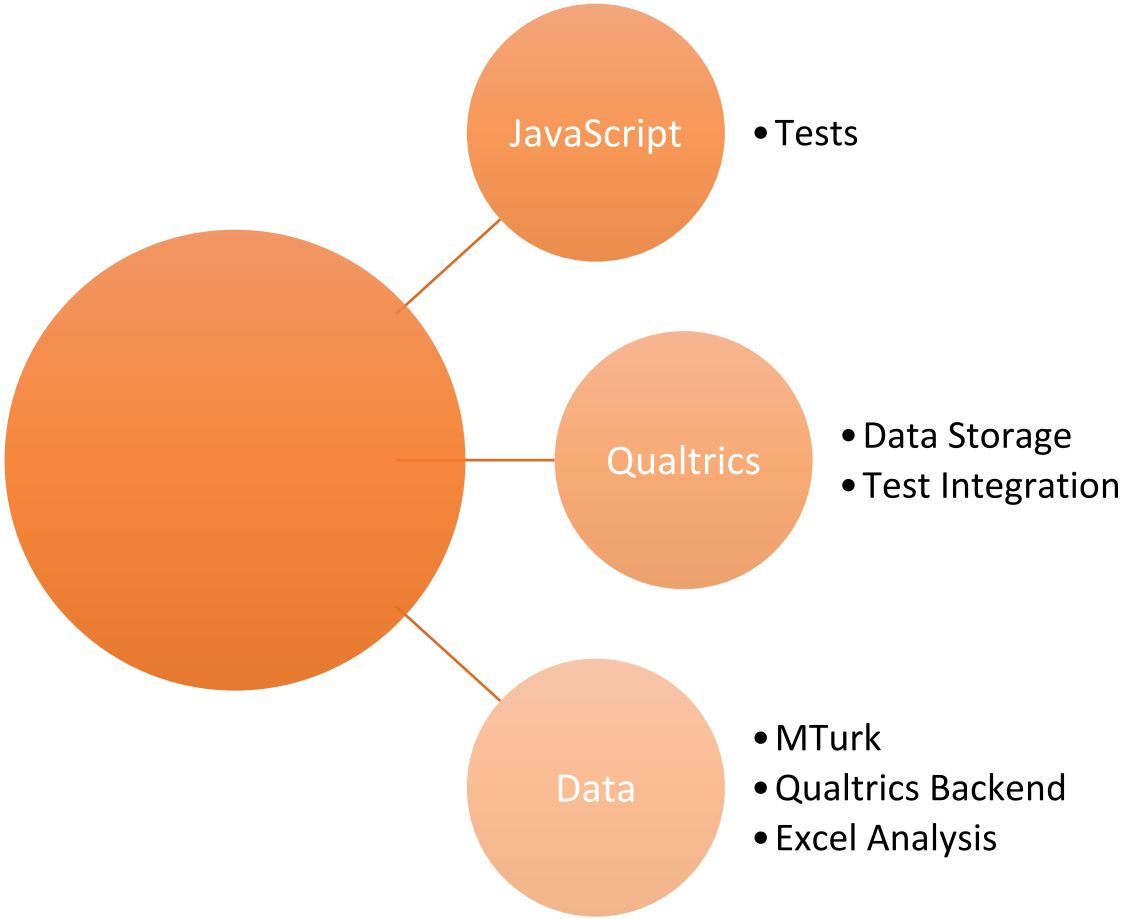
Question	Average r2
Kings	0.38
Wheel	0.38
Grad	0.64
Checker	0.40
Checker 2	0.43
Wheel 2	0.44
Kings 2	0.41
Grad 2	0.68
Average	**0.47**





Results - MLDS

System Architecture



Customer Feedback

- Our customers expressed full satisfaction with our delivery
- All deliveries were made on time and in the span of 2 weeks
- In the future they would like to get IRB approval to use these tests on their patients

The Process

- Qualtrics – Test integration (5%)
- Test 1 refactoring (50%)
- Coding tests with P5.js library (5%)
- IRB ---> Mechanical Turk (5%)
- Excel Data Analysis (20%)
- Peer / Self Test (10%)
- Miscellaneous (5%)

•Every 2 weeks: Johns Hopkins meetings

•At least once per week: meetings with advisor Professor Shapiro

- September
  - **Test 1 first draft**
  - **Test 2,3,and 4 completed**
  - Test 1 refactored
  - **Preliminary ranking of dots using high pass filters**
- October
  - **Test 1 and 2 integrated to Qualtrics**
  - Initial data analysis done with first group of observers (peers)
  - Second and third analysis done with peer observers
  - **Test 2 integrated and finalized**
  - **Test 1 continuously refactored and tested- many new features added**
  - Test 1 filters redone each time a dot location, photo, or color value changes
  - More data analysis - test 2 continues to produce medically accurate data
  - **IRB approval**
- November
  - 2 more analyses done on peer observers
  - Tutorial video added to survey
  - More data analysis with more peer observers
  - **Combined both tests together**
  - **Test 1 and 2 run on Mturk**
  - **MLDS algorithm translated from R to JavaScript**
- December
  - Data analysis on MTurk responses
  - Test 1 data achieves high enough r^2 values for medical IRB submission
  - **Both tests prove capacity to differentiate between observers with and without photophobia**

Future Enhancements

- Integration of the remaining 2 tests
- Automation of data analysis process
- Automatic detection of screen dimensions
- UI/UX enhancements

Project Dynamics

Isabella Sims:

- Test 1 features, MTurk, IRB approval & compliance, Hopkins communication, metadata collection, test data collection (embeds), Test 1 rankings

Avery Novick

- Test 1 data analysis, instructional video, combining test 1 and 2, Test 1 features

Justice Suh

- Qualtrics integration, test 2 data analysis, data collection (javascript code to send data to back end), MLDS algorithm

Lessons Learned

Following instructions > creativity

Higher stakes = larger time commitment

Test early, often, and on people who aren't involved in development or in your circle