



# Eye Tracking Methodology: Welcome

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**CPSC 4120/6120: Welcome**



CLEMSON UNIVERSITY  
EYE TRACKING LAB  
SCHOOL OF COMPUTING

**CLEMSON**  
UNIVERSITY

# Our web page



- I don't use Canvas
- <http://andrewd.ces.clemson.edu/courses/cpsc412>
- There'll you'll find syllabus, **schedule**
- [duchowski@clemson.edu](mailto:duchowski@clemson.edu)

# What will you learn in this class?



- Course is research-based
- Objective is to write a research paper
  - some students have published theirs (good for resume)
- Research paper requires:
  - literature review (read papers, lots of them)
  - formulate a hypothesis
  - get stimulus (images are best)
  - design experiment (short and simple is best)
  - collect data (McAdams 112C)
  - analyze data (Python, R scripts, **statistics**)

# 112 McAdams



- Only 20 eye trackers
- Access time is limited: Fri p.m., Sat, Sun, this class time

	Sunday 8/25	Monday 8/26	Tuesday 8/27	Wednesday 8/28	Thursday 8/29	Friday 8/30	Saturday 8/31
7:00 AM							
8:00 AM							
9:00 AM		DPA 3070 001 87716 201908		DPA 3071 001 88162 201908		DPA 3071 001 88162 201908	
10:00 AM							
11:00 AM			(Private)		(Private)		
12:00 PM							
1:00 PM		DPA 4830 001 XL 87721 20190		DPA 4830 001 XL 87721 20190			
2:00 PM			ART 4210 001 XL 90302 20190		ART 4210 001 XL 90302 20190		
3:00 PM							
4:00 PM		DPA 8600 001 86780 201908		DPA 8600 001 86780 201908			
5:00 PM							
6:00 PM			(Private)				
7:00 PM							
8:00 PM							
9:00 PM							
10:00 PM							
11:00 PM							





# What grade will you get?



- Grade is based on everything we do + quality of paper
- From past experience: 2-3 As, then Bs, then Cs
  - it is possible to fail this class
- What makes a good paper?
  - not necessarily good results ( $p < 0.01$ )
  - but complete process, i.e., analysis, graphs, plots
  - I would much rather get a paper with no stat. sig. than qualitative analysis
  - but qualitative analysis is ok (i.e., results in B)
  - paper must be well-written, with good bibliography
    - no citing of Wikipedia, only archival papers

# Qualitative vs Quantitative



- Qualitative study:
  - collect data
  - no real results
  - provide visualizations (heatmaps, scanpaths)
  - provide observations
  - can't really generalize or draw conclusions
- Quantitative study:
  - uses statistics to test hypothesis (e.g., ANOVA)
  - compares numbers (means and standard error)
  - numerical results

# Qualitative vs Quantitative



- Largely depends on choice of software
- Qualitative study (C):
  - Gazeport Analysis, export **visualizations**
- Quantitative study (ok, B):
  - Gazeport Analysis, export **fixations**
  - Python scripts, Excel
- Quantitative study (better, A):
  - Gazeport Analysis, export **raw data**
  - Python scripts, R
- Advanced quantitative study (best, A+):
  - PsychoPy and ioHub, no Gazeport Analysis
  - hdf5 file parsing
  - Python scripts, R



# Quick back-of-envelope example



- Study reading behavior and effect of font
- Simple and yet complicated
- Simple because we don't need too many images

Eye tracking is the process of measuring either the point of gaze (where one is looking) or the motion of an eye relative to the head. An eye tracker is a device for measuring eye positions and eye movement. Eye trackers are used in research on the visual system, in psychology, in psycholinguistics, marketing, as an input device for human-computer interaction, and in product design. There are a number of methods for measuring eye movement. The most popular variant uses video images from which the eye position is extracted. Other methods use search coils or are based on the electrooculogram.

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# Quick back-of-envelope example



- Devil is in the details
- What can you see that has been **controlled** here?
- Next, how can we compare reading behavior?

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# Quick back-of-envelope example



- Need to specify Areas Of Interest, or AOIs
- AOI per word could give us WPM (speed) d.v.
- Here the i.v. is font (sans or serif)

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# Interactive



- There is another option to the “diagnostic” paper
- Called the “systems paper”
- Usually relies on developing interactive program
- Could use PyGaze for example
- What’s involved:
  - writing code to “talk” to eye tracker (networking)
  - writing code to do something on the screen (graphics)
  - writing code to respond to gaze (signal analysis)
  - writing code to respond to user (event-driven programming)
  - can use: Python, OpenGL, PyGaze



# Other graded items



- Midterm: practical (I am subject)
  - you have to be ready to run study
- Final: take-home (easiest part of class)
- Quiz: could make letter grade difference
- Proposal: first half of paper (lit review, methodology)
  - write this in past tense
  - need complete methodology (e.g., i.v.'s, d.v.'s, n)
- Paper:
  - highest grade if complete (with stats)
  - do not use words “proof” or “prove”



# TO DO



- IRB: Institutional Review Board
  - every team needs to go through training
  - do this during E-Learning Day (Thursday)
  - every team needs to submit expedited protocol
    - many forms that need to be filled out
    - experiment needs to be designed for this to work (chicken or egg?)
  - every year this gets more and more complicated