

CSLI Eye-Tracking Workshop Syllabus

June 20th - 21st, 2013

Staff

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Learning goals

- Understand the benefits and technical challenges of using eye-tracking to study language processing
- Design and implement a simple eye-tracking study using the visual world paradigm
- Analyze data from this study in R, creating visualizations of dwell-times on regions of interest and time-course measures

Materials

- All participants should bring a laptop computer with R installed. We will assume a working knowledge of statistics and R.
- Programming in R
 - Repository of code used in this workshop
 - [A good book on data analysis with R](#)
 - [A short online intro to R](#)
 - [Two-minute video tutorials on R](#)
 - [arRgh - R data types](#)
 - ggplot2 plotting package: [simple intro](#), [qplot chapter](#)
- One major goal of this workshop is to use and contribute to a library of R code for analyzing eye-tracking data.
 - [The "et-ana" repository is stored at google code.](#)
 - You can use version control to get the repository
 - [Subversion book quick start](#)
 - [Repository Mirror](#) (code and examples for the course)

Readings – to be done in advance

- Paper on which workshop project will be based:
 - [Stiller, Goodman, and Frank \(submitted\). "Ad-hoc Implicatures in Preschool Children".](#)
- Papers whose methods and results will be discussed (and a subset of the data will be used in the data analysis practicum):
 - [Degen & Tanenhaus \(under review\). "Naturalness of alternatives and the processing of scalar implicatures: A visual world eye-tracking study"](#)
- Classic papers on eye-tracking and language

- [Tanenhaus et al. 1995. Integration of Visual and Linguistic Information in Spoken Language Comprehension. Science](#)
- [Eberhart et al. 1995. Eye-movements as a window into spoken language comprehension in natural contexts. Journal of Psycholinguistic Research.](#)

Equipment

We will be using two [SMI RED](#) 120Hz eye-trackers borrowed from the Frank lab. Most of what we cover will be general for use with pretty much any tracker, as long as you can get raw data out of it.

Project

Implementing an eye-tracking version of the experiments reported in [this](#) paper (also linked in the **Readings** section), which looks at pragmatic language processing.

Schedule

Thursday, June 20th

8:30 - Light breakfast provided at CSLI

9:00 - [Introduction, course goals \(Lecture: Frank\)](#)

- Very brief history of eye-tracking: Yarbus, Haith, etc.
- Fun stuff you can do with eye-tracking:
 - Adaptive technologies: [Dasher](#)
 - Developmental studies: [Frank, Vul, Johnson \(2009\)](#)

9:30 - [Eye-tracking designs for language research \(Lecture: Degen\)](#)

- Visual world fixation time course (comprehension)
 - rational speech perception: [Clayards et al. \(2008\)](#)
 - spoken word recognition/cohort effects: [Allopenna et al. \(1998\)](#)
 - syntactic ambiguity resolution: [Tanenhaus et al. \(1995\)](#)
 - scalar implicature processing: [Huang & Snedeker \(2009\)](#); [Grodner et al. \(2010\)](#); [Breheny et al. \(2013\)](#); [Degen & Tanenhaus \(under review\)](#)
- Other paradigms
 - Anticipatory looking: [Altmann & Kamide \(1999\)](#); [Johnson et al. \(2003\)](#)
 - Prediction for production: [Griffin & Bock \(2000\)](#); [Gleitman et al. \(2007\)](#)

10:30 - [Implementing an eye-tracking experiment \(Facilitated discussion: Frank\)](#)

- Goals: reproduce Stiller et al. paradigm
- Discussion of experimental design considerations

12PM - Lunch provided at CSLI

1:00 - Intro to eye-tracking data analysis (Practicum: Degen)

- Starting with a preprocessed dataset

- Part 1: Compute dwell-time in a region during a time period
- Part 2: Time-course (spaghetti plots)
- Part 3: Saccade launch latency histograms

3:00 - Small groups collect data on pragmatics experiment

- Walk-through of setup of eye-trackers
- Setting up the pragmatics experiment
- Students run each on the experiment

5:00 - Finish

Friday, June 21st

8:30 - Light breakfast provided by CSLI

9:00 - [Preprocessing ET data \(Frank\)](#)

- Getting data in from the tracker and getting to a useful format for analysis
- Sanity checking (boundaries, distributions)
- Useful plots (ggplot2 intro)
- Merging and handling descriptive data (R merge)
- Regions of interest

12:00 - Lunch provided at CSLI

1:00 - Analysis of experimental data (Degen)

- We provide consolidated, cleaned dataset for students to work on
- Goal: produce spaghetti plots and other visualizations
- Statistics of dwell times

2:30 - Discussion of results and revisions of experimental paradigm

3:00 - Other eye-tracking directions (group discussion)

4:00 - Finish

Drinks afterwards

Extra Optional Readings

- Survey and handbook articles on eye-tracking in reading and the visual world
 - [Rayner 1998, "Eye movements in reading and information processing: 20 years of research". *Psychological Bulletin*](#)
 - [Tanenhaus 2007, "Spoken language comprehension: insights from eye movements", in *Oxford Handbook of Psycholinguistics*](#)
 - [Tanenhaus 2007, "Eye movements and spoken language processing", in *Eye movements: A window on mind and brain*](#)
 - [Altmann 2011, "The mediation of eye movements by spoken language", in *The Oxford Handbook of Eye Movements*](#)
- Papers about different kinds of analysis for eye-tracking data

- problems with doing ANOVAs over proportions (not restricted to eye-tracking data): [Jaeger, T. F. \(2008\). Categorical Data Analysis: Away from ANOVAs \(transformation or not\) and towards Logit Mixed Models](#)
- mixed effects logistic regression: [Barr, D. J. \(2008\). Analyzing “visual world” eyetracking data using multilevel logistic regression.](#)
- growth curve analysis: [Mirman, D., Dixon, J. A., & Magnuson, J. S. \(2008\). Statistical and computational models of the visual world paradigm: Growth curves and individual differences.](#)