Garrett Swan, Ph.D.

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A Pennsylvania State Cognitive Psychology PhD specializing in quantitative and qualitative human subjects research, with a focus on human memory, attention, multitasking, eye tracking, and simulation. Conducted extensive research using psychophysics, computational and cognitive modeling, eye tracking, and driving simulation to test hypotheses. Experienced with coding languages, modeling behavior, machine learning, and data science techniques.

EDUCATION

Pennsylvania State University, University Park, PA **August 2012 - May 2017**

Doctor of Philosophy (Ph.D.) in Cognitive Psychology

- Dissertation: Testing Predictions of the Binding Pool Model of Visual Working Memory
- Investigated visual work memory, attention, and metacognition in psychophysical experiments
- Optimized computational model of visual working memory using Metropolis-Hasting algorithm approach
- Generated predictions from model and developed psychophysical experiments to test and validate the model

Syracuse University, Syracuse, NY **August 2011 - May 2012**

Doctor of Philosophy (Ph.D.) in Experimental Psychology

- Transferred to Pennsylvania State University with advisor Brad Wyble

North Carolina State University, Raleigh, NC **August 2007 - May 2011**

Bachelor of Arts (B.A.) in Psychology

- Minors in Cognitive Sciences and Biological Sciences
- Graduated Magna Cum Laude

PROFESSIONAL EXPERIENCE

Cubic Defense Applications Inc., San Diego, CA **July 2021 - present**

Cognitive Modeler / Senior Data Scientist

- Lead project evaluating how individuals allocate attention while multitasking in complex multitasking environments
- Use a cognitive architecture (ACT-R) to simulate the underlying cognitive processes participants use when multitasking
    - This involved designing the model, programming the model and the task, testing the model on the task and ensuring it is simulating the task correctly, comparing the model to behavioral data, and optimizing the parameters of the model to minimize differences between the model and behavioral data
- Work remotely from San Diego, CA as a contractor for the Air Force Research Laboratory

Schepens Eye Research Institute/Harvard Medical School, Boston, MA **June 2017 - July 2021**

Postdoctoral Research Fellow

- Led projects evaluating how vision impairment affects hazard detection in driving simulation, which has resulted in 3 first author peer-reviewed publications, 3 conference presentations, and 3 invited presentations
- Utilized non-parametric statistics (permutation tests), parametric statistics (linear mixed models, general linear models, regression), and machine learning techniques (binary classification) to model data
- Collaborated with cross-functional team of engineers, psychologists, computer scientists, and optometrists
- Created and implemented software that successfully automates processing of large volumes of driving simulator data
- Mentored 7 students from diverse backgrounds (engineering, optometry, medicine) on research projects
- Worked remotely from San Diego, CA (12+ months)

University of California San Diego, La Jolla, CA **March 2020 - May 2021**

Lecturer (Non-Senate)

- Instructed Data and Model Programming for Computational Social Science Spring 2020 and Summer Session II 2020
    - Generated course content using Python libraries NumPy, Pandas, Matplotlib, Seaborn, Beautiful Soup, and SciKit-learn to web scrap, visualize, feature engineer, and model data using machine learning techniques (decision trees, linear and logistic regression, k-means clustering, and dimensionality reduction)
- Instructed upper-level Psychology courses in Visual Cognition (Fall 2020) and Illusions and the Brain (Winter 2021)
- 99% of students who submitted evaluations (n = 233) reported they would recommend professor and course

RESEARCH EXPERIENCE

Cognitive Modeler, Simulating the AF-MATB with ACT-R July 2021- present
Cubic Defense Applications Inc., San Diego, CA
Mentors: Chris Stevens, Ph.D.. and Chris Fisher, Ph.D.

- Investigating multitasking in the Air Force Multi-Attribute Task Battery
- Developing a cognitive model using the Adaptive Control of Thought – Rational (ACT-R) from scratch and compared the performance of the model to behavioral data
- Utilizing the model to generate and test a series of predictions about how multitasking performance may be impacted by fatigue, addition of other subtasks, and the experience of workload
- Submitting a conference paper to the International Conference on Cognitive Modeling (ICCM) 2022

Postdoctoral Research Fellow, Bowers Lab, Change blindness while driving August 2017- January 2022
Schepens Eye Research Institute, Boston, MA
Mentor: Alex Bowers, Ph.D.

- Investigated change blindness while driving using a virtual world created using Unity software
- Developed paradigm to generate changes that occur while individuals drive in a custom-built simulator
- Mentored optometrist in individual research project
- Submitted project for publication, funding to NIH (NRSA F32) and NSF (SBE Postdoctoral research fellowship)

Postdoctoral Research Fellow, Bowers Lab, Head Scan Reminder Device August 2018 - July 2021
Schepens Eye Research Institute, Boston, MA
Mentor: Alex Bowers, Ph.D.

- Utilized binary classification to determine the magnitude of a head movement that best predicted detection of peripheral hazards (i.e., motorcycles approaching from cross streets) in a driving simulator.
- Implemented threshold as a reminder auditory/haptic cue to drivers when they have failed to adequately scan

Postdoctoral Research Fellow, Bowers Lab, Scanning at intersections August 2017 - July 2021
Schepens Eye Research Institute, Boston, MA
Mentor: Alex Bowers, Ph.D.

- Developed algorithm to automatically quantify the size, magnitude, and frequency of lateral gaze scans
- Used a ground truth set of data using custom MATLAB scripts to manually mark gaze data, optimize parameters of the gaze scan algorithm based on ground truth using a grid-based approach, and then evaluated algorithm using non-parametric (Mann-Whitney U and Kolmogorov-Smirnov) statistics
- Mentored 1 Masters students in individual research project

Postdoctoral Research Fellow, Bowers Lab, Simulations of vision impairment August 2017 - February 2019
Schepens Eye Research Institute, Boston, MA
Mentor: Alex Bowers, Ph.D.

- Investigated how simulated impairment in contrast sensitivity and visual acuity affected pedestrian hazard detection using high-fidelity driving simulator (FAAC)
- Used different occlusion filters (Bangerter) and plus lenses to simulate vision impairment assessed using a Mars chart to measure contrast sensitivity and Test Chart 2000 Pro to measure visual acuity
- Analyzed data using model comparison (BIC), linear mixed effects models, and repeated measures analysis of variance (ANOVA)
- Mentored one optometry student, one medical student, and one field professor in individual research project

Graduate Student Researcher, Wyble Lab, Modeling visual working memory August 2012 - August 2017
Pennsylvania State University, State College, PA
Mentor: Brad Wyble, Ph.D.

- Developed computational model in MATLAB that simulates how visual features of an object can be stored in a distributed layer of neurons (i.e. binding pool) and how features can be individuated during retrieval called the Binding Pool model
- Optimized model parameters using grid-based and Markov chain Monte Carlo (MCMC) methods
- Established Binding Pool model as a general model of visual memory by simulating a variety of findings from studies using change detection and delayed estimation
- Generated set of predictions to test the model and then tested these predictions with psychophysical experiments and in a pilot EEG experiment.
- Analyzed results of experiments by estimating the variance (θ) of mixtures of von Mises distributions using maximum likelihood estimation (MLE) and then comparing θ between conditions with parametric (t and f tests) statistics and non-parametric (permutation tests, Kolmogorov-Smirnov) statistics

Graduate Researcher, Wyble Lab, Feature-based attention August 2014 - August 2017
Pennsylvania State University, State College, PA
Mentors: Brad Wyble, Ph.D., and Hui Chen, Ph.D.

- Developed psychophysical experiments in MATLAB to test hypothesis that the strength of encoding determines the strength of retrieval
- Analyzed data using parametric (χ^2 and log-linear analyses) to quantify the recognition ability of participants
- Mentored 1 undergraduate student on individual research project

Graduate Researcher, Language and Cognition Lab, Statistical learning August 2014 - August 2015
Pennsylvania State University, State College, PA

Mentors: Brad Wyble, Ph.D., Dan Weiss, Ph.D., and Nancy Dennis, Ph.D.

- Developed alternating serial reaction time (ASRT) task to investigate how bilingualism influences statistical learning
- Consented and collected data from undergraduate participants.
- Conducted experiment and analyzed results using custom scripts in MATLAB

Graduate Researcher, Wyble Lab, Traumatic brain injury and visual memory August 2013 - August 2015
Pennsylvania State University, State College, PA and University of Queensland, Queensland, Australia
Mentors: Brad Wyble, Ph.D., Frank Hillary, Ph.D., and Jennifer Fleming, Ph.D.

- Developed psychophysical experiments in MATLAB to test hypothesis that moderate to severe traumatic brain injuries affects the quality of visual memory retrieval.
- Consented and collected data from individuals with moderate to severe traumatic brain injuries at Pennsylvania State University and at Princess Alexandra Hospital
- Managed IRB submission through the Pennsylvania State University IRB and the University of Queensland and Princess Alexandra Hospital

Graduate Researcher, Wyble Lab, Visual attention in time and space August 2011 - August 2012
Syracuse University, Syracuse, NY

Mentor: Brad Wyble, Ph.D.

- Investigated how visual attention is deployed to rapidly presented targets appearing in different spatial locations to determine if the attentional blink occurs in space and time
- Conducted experiments using MATLAB and the Psychophysics toolbox

Research Assistant, Mayhorn Lab, Skill transfer with blood glucometers August 2009 - August 2011
North Carolina State University, Raleigh, NC
Mentor: Chris Mayhorn, Ph.D.

- Investigated the ability of younger and older adults to transfer skills required to calibrate a blood glucometer acquired from one blood glucometer to a different glucometer
- Consented and collected data from undergraduate and older participants
- Coded behavior (e.g. the order of steps to use a blood glucometer, time of each step) from video data

AWARDS

- **Envision Atwell award** **May 2019**
  - Award recognizes outstanding effort in low vision research for a junior investigator
  - Association for Research in Vision and Ophthalmology (ARVO), Vancouver, BC
- **Alumni Association Dissertation Award,** $5,000 value **Spring 2017**
  - Award provides funding and recognition to outstanding PhD students
  - Graduate School, Pennsylvania State University, University Park, PA
- **NSF: East Asia and Pacific Summer Institute Award,** $5,250 value **Summer 2015**
  - Awards PhD students first-hand experience to conduct research in East Asia and the Pacific
  - Office of International Science & Engineering, National Science Foundation, Alexandria, VA

TEACHING EXPERIENCE

Instructor, University of California San Diego, Department of Psychology

- CSS 2: Data and Model Programming for Computational Social Sciences (Spring 2021: 33 students)
- PSYC 182: Illusions and the Brain (Winter 2021: 164 students)
- PSYC 174: Visual Cognition (Fall 2020: 50 students)
- CSS 2: Data and Model Programming for Computational Social Sciences (Summer 2020: 11 students)
- CSS 2: Data and Model Programming for Computational Social Sciences (Spring 2020: 42 students)

Instructor, Pennsylvania State University, Department of Psychology

- PSYCH 256: Introduction to Cognitive Psychology (Spring 2017: 150 students)
- PSYCH 256: Introduction to Cognitive Psychology (Fall 2016: 80 students)
- PSYCH 260: Neurological Bases of Human Behavior (Fall 2014, Spring 2015: 30 students)

SELECTED PEER-REVIEW PUBLICATIONS

- **Swan, G**. et al. (2021). Driving with hemianopia VII. Predicting hazard detection with gaze and head scanning magnitude. *Translational Vision Science & Technology. 10*(1), 20
- Savage, S.W., Zhang, L., **Swan, G.,** & Bowers, A. R. (2021) Head scanning behavior predicts hazard detection safety before entering an intersection. *Human Factors*, August 2021.
- **Swan, G**. et al. (2020). Automatic processing of gaze movements to quantify gaze scanning behaviors in a driving simulator. *Behavior Research Methods*, 1-20.
- Savage, S.W., Zhang, L., **Swan, G.,** & Bowers, A. R. (2020) The effects of age on the contributions of head and eye movements to scanning behavior at intersections. *TRP F: Traffic Psychology and Behavior, 73*, 128-142

- **Swan, G**., et al. (2019). The effects of simulated acuity and contrast sensitivity impairments on detection of pedestrian hazards in a driving simulator. *TRP F: Traffic Psychology and Behavior, 64,* 213-226.
- **Swan, G**., et al. (2017). Working memory representations persist in the face of unexpected task alterations. *Attention, Perception, & Psychophysics*, *79*(5), 1408-1414.
- Ahmad, J., **Swan, G**., Bowman, H., Wyble, B., Nobre, A. C., Shapiro, K. L., & McNab, F. (2017). Competitive interactions affect working memory performance for both simultaneous and sequential stimulus presentation. *Scientific Reports*, *7*(1), 1-16.
- Rajsic, J., **Swan, G**., Wilson, D. E., & Pratt, J. (2017). Accessibility limits recall from visual working memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *43*(9), 1415.
- **Swan, G**., et al. (2016). Memory for a single object has differently variable precisions for relevant and irrelevant features. *Journal of Vision*, *16*(3), 32-32.
- **Swan, G**., et al. (2014). The binding pool: a model of shared neural resources for distinct items in visual working memory. *Attention, Perception, & Psychophysics*, 2136-2157.

SKILLS

- Computer languages — Matlab, Python, SQL, R, SPSS, HTML, CSS, ACT-R
- Other skills — GitHub, eye tracking, driving simulation, psychophysics, Goldmann Perimetry, Peli-Robson, Contrast Sensitivity, Test Chart Pro 2000, Unity game engine, and Tableau