

MOHAMMAD DASTGHEIB

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SUMMARY

Quantitative UX Researcher and Behavioral Data Scientist specializing in **Spatial Computing (AR/XR) and Biometric Interaction Systems**. Experienced in designing advanced computational testbeds and multi-phase user studies to track, model, and optimize human-system interaction using eye-tracking, computer vision, and neural metrics. Proven track record of translating messy, high-dimensional physiological telemetry (gaze dynamics, pupillometry, behavioral metrics) into mechanistic user-state models and actionable design recommendations.

SKILLS

Quantitative Research & Experimental Design: Multi-session Psychophysical Protocol Design, Dual-Task Paradigms, Concurrent Physical-Cognitive Effort Manipulations (Isometric Handgrip/MVC), Continuous Dynamometer Telemetry, Usability & Interaction Benchmarking (ISO 9241-9/Fitts' Law), Task Performance Analytics, Subjective Workload Assessment (NASA-TLX), Inclusive Design across Diverse Demographics (younger and older adult populations).

Biometrics & Physiological Measurement: Eye-Tracking (Pupillometry/Gaze Dynamics, TEPR/AUC), Wearable Biosensors (HRV/GSR, Dynamometry), Continuous Force Stream Processing, Digital Signal Processing (DSP, Welch PSD, Butterworth Filtering), EEG/EOG/EMG (Polysomnography, 10-20 mapping, Spectral Analysis), XR HMDs (Multimodal Gaze+Hand Tracking integration), R, Python, MATLAB, TypeScript, React, R Shiny (ShinyApps.io/Docker).

Computational Modeling & Analytics: Hierarchical Bayesian Inference (Stan/brms/rstanarm, PSIS-LOO), Drift Diffusion Modeling (hDDM, Wiener DDM), Linear Ballistic Accumulator Modeling (PyMC), Gradient Boosting & Probability Calibration (XGBoost, Platt Scaling), Psychometric Function Analysis (Psignifit 4, probit/Weibull GLMMs), Mixed-Effects Modeling (lme4 with Orthogonal Polynomial Contrasts), Subject-Wise Cross-Validation (Leave-One-Subject-Out), Pupil Signal Processing, R (Tidyverse Ecosystem), SQL.

EXPERIENCE

Graduate Researcher (Cognitive Neuroscience)

Sep 2021 – Present

University of California, Riverside

Riverside, CA

- **Multi-Population Dual-Task Studies:** Designed and executed multi-session behavioral experiments (N = 120+ across younger and older adult cohorts) examining concurrent physical effort (isometric handgrip) and cognitive task difficulty across three perceptual domains (visual working memory, auditory and visual discrimination), with continuous pupillometry to index real-time arousal state.
- **Bayesian Cognitive Modeling:** Applied hierarchical Drift Diffusion Models and psychometric function analysis to decompose perceptual decisions into latent components — pinpointing evidence accumulation quality as the primary mechanism through which physical effort impairs performance in older adults.
- **Pupillometry & Arousal Modeling:** Built end-to-end preprocessing pipelines (blink interpolation, baseline correction, TEPR/AUC extraction) for high-resolution eye-tracking data; modeled trial-level arousal as a covariate to separate stable between-person baselines from dynamic within-person fluctuations predicting moment-to-moment perceptual sensitivity.

Research Assistant (AI Annotation & Validation)

Apr 2021 – Aug 2021

Surgical Safety Technologies (SST)

Toronto, ON

- **Surgical AI Annotation:** Contributed to an instance segmentation module for real-time surgical tool detection and tracking, performing frame-level annotation and validation of fine-grained spatial tool actions in laparoscopic video data, informed by systematic review of healthcare ML literature.
- **Inter-Rater Reliability Analysis:** Applied statistical algorithms to quantify agreement metrics across surgical analysts, ensuring annotation consistency and ground-truth quality for downstream computer vision model training.

Graduate Researcher (Cognitive Neuroscience)

Sep 2017 – Jan 2020

Queen's University

Kingston, ON

- **Polysomnographic Data Collection & EEG Analysis:** Designed and executed a three-condition within-subjects experiment (N = 64) with continuous EEG/EOG/EMG recording and FFT-based spectral decomposition (alpha/theta power) to investigate how napping, mindfulness meditation, and active wakefulness differentially modulate memory consolidation.

- **Bayesian Statistical Modeling:** Implemented hierarchical Bayesian GLMs (R/rstanarm) to analyze behavioral performance across declarative and procedural memory tasks, including sleep-stage subgroup analyses (SWS presence/absence) and exploratory sex-by-condition interaction effects.

PROJECTS

Grip-Force Spectral Analytics Pipeline [\[GitHub\]](#)

Lead Computational Researcher

- Built an end-to-end digital signal processing (DSP) pipeline in Python (SciPy) to transform 13,700+ trials of continuous 100 Hz dynamometer data ($N = 65$ older adults) into target-normalized error records using linear detrending and 4th-order zero-phase Butterworth high-pass filters.
- Extracted trial-level frequency-domain features via log-transformed Welch PSD estimations, isolating a low-frequency visuomotor tracking band (0.5–3.0 Hz) and a high-frequency physiological tremor band (8.0–12.0 Hz) to index online cognitive-motor strain.
- Formulated mixed-effects logistic regression models (lme4) incorporating orthogonal polynomial contrasts up to the 4th order for task difficulty, revealing a significant negative tremor-accuracy association under load ($OR = 0.64$, $p = .008$) amplified at harder stimulus levels.
- Engineered a strict spectral outlier screening protocol ($|z| > 3.5$) to robustly mitigate high-leverage recording artifacts, validating stability via winsorization and evaluating out-of-sample predictive gains through subject-wise cross-validation ($\Delta AUC \approx 0.006$).

XR Adaptive Interface Framework [\[Case Study\]](#) [\[GitHub\]](#) [\[arXiv Preprint\]](#)

Lead Researcher & Software Prototyper

- Built a remote web-based XR interaction testbed (React/TypeScript, Vercel) implementing an ISO 9241-9 Fitts' Law pointing task across hand and gaze modalities with a policy-driven adaptive engine, collecting comprehensive trial-level telemetry across $N = 69$ participants (15,000+ trials).
- Quantified modality-specific failure modes: hand yielded higher throughput (5.17 vs. 4.73 bits/s) and far lower error rates (1.8% vs. 19.1%), with gaze failures driven almost entirely by accidental activations — directly characterizing the Midas Touch problem in XR gaze interaction.
- Applied hierarchical Bayesian LBA modeling (PyMC) to verification-phase response times, revealing that gaze imposes a substantially longer intent-confirmation burden than hand input — with direct implications for adaptive intervention design.

Surgical Cognitive Dashboard [\[Case Study\]](#) [\[GitHub\]](#)

Sole Designer & Developer

- Built two tightly coupled R/Shiny applications — a real-time Production Dashboard and an interactive Training Lab — fusing pupillometry (TEPR/AUC), HRV (RMSSD), grip force, and tremor signals into a cognitive state monitor (Normal / High-Load / Lapse) for surgical trainees; zero body-worn hardware, sub-60-second setup.
 - Trained and calibrated a 3-class XGBoost classifier ($PR-AUC > 0.85$ for High-Load; Platt-scaled ECE < 0.06) and implemented three modality-specific adaptive alert threshold policies optimizing for operational KPIs (≤ 0.6 alerts/min, recovery latency, alarm adherence) rather than classifier accuracy alone.

User-State Prediction Pipeline (Pupil-DDM) [\[GitHub\]](#)

Computational Data Scientist

- Implemented a hierarchical Bayesian Wiener DDM pipeline (hDDM/brms) decomposing 18,000+ trials of behavioral RT and accuracy data into latent decision parameters — drift rate, boundary separation, and starting-point bias — across effort, difficulty, and task modality conditions; validated via PSIS-LOO model comparison and posterior predictive checks.
- Integrated trial-wise pupillometry (TEPR/AUC) as a physiological arousal covariate in pupil-augmented DDM extensions, identifying measurement confounds under dual-task conditions (Pareto- $k > 0.91$) and producing defensible null inferences with graded evidence classification.

EDUCATION

University of California, Riverside

PhD, Psychology / Cognitive Neuroscience (GPA: 3.93)

Riverside, CA

Sep 2021 – Sep 2026

Queen's University

M.Sc., Psychology (GPA: 3.83)

Kingston, ON

Sep 2017 – Jan 2020

York University

Hon. B.Sc., Biological Sciences & Psychology

Toronto, ON

Sep 2013 – Jun 2017