Lili Karashchuk

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Interdisciplinary scientist, especially interested in the basic and applied science of sensorimotor control.

Education

2017–23	**Ph.D. Neuroscience**, *University of Washington, Seattle*
2012–17	**B.A. Statistics and Computer Science**, *University of California, Berkeley*

Publications

2023
in preparation
L Karashchuk*, JSL Li*, SL Brunton, JC Tuthill, BW Brunton. "A layered architecture models robust multi-legged locomotion of *Drosophila*", *in preparation*

2023
name change to Lili
JJ Sun*, **L Karashchuk***, A Dravid*, S Ryou, S Fereidooni, JC Tuthill, A Katsaggelos, BW Brunton, G Gkioxari, A Kennedy, Y Yue, P Perona. "BKinD-3D: Self-Supervised 3D Keypoint Discovery from Multi-View Videos", *CVPR*

2021
P Karashchuk, KL Rupp, ES Dickinson, S Walling-Bell, E Sanders, E Azim, BW Brunton, JC Tuthill. "Anipose: a toolkit for robust markerless 3D pose estimation", *Cell Reports*

2021
*co-first authors
CJ Dallmann*, **P Karashchuk***, BW Brunton, JC Tuthill. "A leg to stand on: computational models of proprioception", *Current Opinion in Physiology*

2018
AC Jenkins, **P Karashchuk**, L Zhu, M Hsu. "Predicting human behavior toward members of different social groups", *Proceedings of the National Academy of Sciences*

2017
P Paredes, AR Feirreira, C Schillaci, G Yoo, **P Karashchuk**, D Xing, C Cheshire, J Canny. "Inquire: Large-Scale Early Insight Discovery for Qualitative Research", *Proceedings of the 2017 ACM conference on Computer-Supported Cooperative Work (CSCW 2017)*.

Patents

2022
P Mantovani, J Rodriguez, **P Karashchuk**, A Ekelem, MAMH Rahman. "Device and system for real-time gait modulation and methods of operation thereof", Patent US20200215324A1

2021
MR Vescovi, TA Vega Gálvez, **P Karashchuk**, TR Gruber, DR Guzzoni. "Unconventional virtual assistant interactions", US Patent 10,956,666

2020
P Karashchuk, TA Vega Gálvez, TR Gruber. "Intelligent automated assistant in a messaging environment", US Patent 10,691,473

Selected awards

2022 — **Grant recipient**, *NSF SBIR Award Phase 2*
Continued NSF SBIR Phase 1 and received a $1M grant to prototype markerless tracking to quantify kinematics for rehabilitation and diagnosis.

2020 — **Grant recipient**, *NSF SBIR Award Phase 1*
As part of Evolution Devices, received a $250,000 grant to prototype markerless tracking to quantify kinematics for rehabilitation and diagnosis.

2018 — **Finalist**, *Toyota Mobility Unlimited Challenge*
Evolution Devices was 1 of 5 companies to receive a grant of $500,000 to develop solutions for improving mobility. We built a device that uses electrical stimulation to help people with foot drop regain mobility.

2017 — **Fellow**, *NSF Graduate Research Fellowship*
Received competitive fellowship to support research in neuroscience

2015 — **1st Place**, *Big Ideas @ Berkeley*
Pitched an API for brain computer interfaces, which would allow anyone to easily develop brain computer interfaces, without minimal knowledge of signal processing, machine learning, or neuroscience. We won $13,500 to further develop this idea.

Invited talks

2022 — "Dynamics of animal movement: From motion capture to neural feedback loops", *American Physical Society's March Meeting*

2022 — "How to estimate animal pose: Past and future"', *UW Neuroscience Symposium*

2021 — "Measuring engagement through brain correlations", *Gray Matters Evenings with Neuroscience*

2020 — "Anipose: A toolkit for robust 3D markerless tracking", *Neural Computation and Engineering Connection*

2020 "Anipose: A toolkit for robust 3D markerless tracking", *UW Neuroscience Symposium*

Conference presentations

2022 LC Donahue, **P Karashchuk**, E Celnikier, MAMH Rahman, JM Rodriguez, A Ekelem, P Mantovani. "Combining telerehabilitation with functional electrical stimulation for walking for people with multiple sclerosis: a pilot study", *Annual Meeting of the Consortium of Multiple Sclerosis Centers*

2022 **P Karashchuk**, S Walling-Bell, C Dallmann, JC Tuthill, BW Brunton. "A feedback model for predicting targeted perturbations of proprioceptors during fly walking", *Computational and Systems Neuroscience (Cosyne) Conference*

2021 **P Karashchuk**, KL Rupp, ES Dickinson, S Walling-Bell, E Sanders, E Azim, BW Brunton, JC Tuthill. "Anipose: a toolkit for robust markerless 3D pose estimation", *CV4Animals Workshop at CVPR*

2021 **P Karashchuk**, KL Rupp, ES Dickinson, S Walling-Bell, BW Brunton, JC Tuthill. "A generative model of 3D leg kinematics of walking *Drosophila*", *Neural Computation and Engineering Connection (NCEC)*

2020 **P Karashchuk**, ES Dickinson, K Rupp, BW Brunton, JC Tuthill. "Inter-joint coupling dynamics of walking *Drosophila* from complete 3D leg kinematics", *Computational and Systems Neuroscience (Cosyne) Conference*

2017 **P Karashchuk**, AC Jenkins, M Hsu. "Toward Socially Aware Computing and Artificial Intelligence", *Cognitive Computational Neuroscience (CCN) Conference*

2016 **P Karashchuk**, P Krueger, I Sáez, M Hsu. "Neural basis of social learning under incomplete payoff information", *Society for Neuroscience (SfN) Conference*

Research experience

2023–present **Scientist I**, *Allen Institute for Neural Dynamics, Seattle*
Currently building a system to observe fine 3D kinematics and muscle dynamics of mice in naturalistic environments.

2017–2023 **PhD Researcher**, *University of Washington, Seattle*
Performed research to study the natural walking kinematics in the fruit fly. Designed and implemented a pipeline to track animal joints in 3D and a method for discovering 3D keypoints from video without annotations. Modeled the walking kinematics with sensory and motor delays, finding limits on delays needed for robust fly walking.

2013–2017 **Neuroeconomics Research**, *University of California, Berkeley*
Performed neuroeconomics research at the Hsu lab (`neuroecon.berkeley.edu`). Spearheaded analysis of fMRI data to determine the neural basis of social learning under incomplete information. Led integrated analysis of various job and behavioral economic game datasets to show how a common set of judgements underlies decisions towards others.

2014–2017 **LiveJournal Data Analysis**, *University of California, Berkeley*
Analyze the full LiveJournal data. Pioneered using word2vec to search the data for semantically related sentences, and helped deploy this system for access by ethnographers.

Industry experience

2016–2023 **Chief Science Officer**, *Evolution Devices*
Lead research on human motion to optimize algorithms for electrical stimulation. Built initial prototype of the device. Developed algorithm to track phase of walking cycle from sensors on the knee. Led implementation of markerless motion tracking system for research on human kinematics.

2015 & 2016
Summer Internship **Siri Advanced Development Team**, *Apple*
Developed a variety of prototypes of new interactions involving Siri and pitched them to Apple VPs. Applied and received 2 patents based on work.

2015
Museum exhibit **Mind Controlled Robot Arm**, *Exploratorium*
Worked in a tight deadline (1 month) to develop a professional exhibit housed at the Exploratorium: a mind controlled robot arm. I developed the signal processing, machine learning, and the EEG headset to make this work. Details at `explorecogtech.com`.

Teaching experience

2018 **Teaching assistant**, *Introduction to Systems and Behavioral Neuroscience*, University of Washington
Assisted in teaching lab-based course on systems and behavioral neuroscience. Led the lab in one section, including introducing the experiments, debugging rigs for students, and grading lab report and exams.

2017   **Developed neurotech course**, *Neurotech @ Berkeley*, University of California, Berkeley
`https://github.com/lambdaloop/bci-course`
Created a full course with weekly labs and lectures on running and analyzing experiments with EEG.

2012–2014   **Course Developer**, *The Structure and Interpretation of Computer Programs*, University of California, Berkeley
Wrote most of the backend used to manage CS 61AS, a self-paced intro to CS course, including scripts to handle attendance, deadlines, and slip days. I also wrote a full scheme interpreter in javascript so that students could run it with minimal setup, and a script to schedule lab assistants using simulated annealing.

Service

2021-2022   **Curriculum committee**, *Neuroscience Program*, University of Washington
Advised on changes to the curriculum. Pitched a new seminar-style course to introduce incoming graduate students to the latest techniques in neuroscience.

2020-2021   **Seminar committee**, *Neuroscience Program*, University of Washington
Helped plan the seminars for the neuroscience program, including hosting and introducing speakers, organizing speaker meeting schedules, and picking which speakers to invite for the seminar.

Outreach

2017–2022   **Neurotech outreach**, *Synaptech*, University of Washington
`https://synaptechuw.org/`.

- Worked on projects with undergrads in weekly meetings, ranging from controlling Pong paddles with EMG to visual novel where choices change based on brain state.
- Applied and received over $10,000 of funding for neurotech equipment.
- Helped organize two hackathons (Synaptech Hackjam and Neurahack). Neurahack was in collaboration with Center for Neurotechnology at UW and was the biggest neurotech hackathon ever hosted (with about 40 people attending).
- Created and hosted a series of workshops on analyzing EEG and fMRI data, ranging from sleep to brain on LSD.

2017   **Co-founder**, *Neurotech @ Berkeley*, University of California, Berkeley
`https://neurotech.berkeley.edu/`
Created a club to discuss and practice neurotechnology. Applied for funding and hosted events to work on project and bring people together. It has since grown to over 100 members.

Competition awards

2016   **2nd Place**, *Stanford health++ hackathon*
We created a low-cost solution for foot drop, a symptom in which people have trouble lifting their foot when walking (due to muscle or nerve degeneration) leading to an abnormal gait. In 24 hours, we made a functioning prototype that would stimulate the appropriate muscle to lift the foot when it detects the user is walking.

2014   **1st Place, Most Technically Challenging, Most Awesome**, *CalHacks*
Created a mind controlled drone. We classified EEG data to control a quadcopter.

2014   **Most Useful**, *Hackers@Berkeley HackJam*
Scraped events on campus and displayed them in clean interface, with email/sms reminders.

2014   **Most Innovative**, *Emotiv Insight Designathon*
Designed a program that would mix art and brainwaves to create a unique experience

2013   **Honorable Mention**, *CSUA Hackathon*
Created a web version of Borges's Library of Babel, a library which holds all the possible books.

2012   **Best Game**, *Hackers@Berkeley HackJam*
Created a clone of bomberman using pygame, with basic computer AI, setups for OS X and Windows, and pleasing square graphics. Available at `github.com/lambdaloop/bomberman`

2011   **1st Place**, *Fitchburg State University Programming Contest*

2011   **1st Place**, *American Computer Science League, Individual Overall*

2010   **1st Place**, *Providence College Programming Contest*