Yun-Fei Liu, PhD

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EDUCATION

PhD and MA, Psychological and Brain Sciences **SEP 2018 – DEC 2023**
Johns Hopkins University (JHU), Maryland, USA

MS, Biomedical engineering **SEP 2013 – JUN 2015**
National Taiwan University (NTU), Taiwan; GPA: 4.05/ 4.3

BS, Electrical Engineering **SEP 2009 – JUN 2013**
National Taiwan University (NTU), Taiwan; GPA: 4.08/ 4.3

PUBLICATIONS

- **Y. Liu**, M. Bedny (in press). Learning to program "recycles" preexisting frontoparietal population codes of logical algorithms. *Journal of Neuroscience*
- M. Hauptman, **Y. Liu**, M. Bedny (2024). Built to Adapt: Mechanisms of Cognitive Flexibility in the Human Brain. *Annual Review of Developmental Psychology. 10.1146/annurev-devpsych-120621-042108*
- **Y. Liu**, C. Wilson, M. Bedny (2024). Contribution of the language network to the comprehension of Python programming code. *Brain and Language. 10.1016/j.bandl.2024.105392*
- **Y. Liu**, B. Rapp, M. Bedny (2023). Reading Braille by Touch Recruits Posterior Parietal Cortex. *Journal of Cognitive Neuroscience. 10.1162/jocn_a_02041*
- **Y. Liu**, J. Chen, C. Wilson, M. Bedny (2023). Neural Representations of Algorithms in the Logical Reasoning Network are Recycled for Programming Code Comprehension. *2023 Conference on Cognitive Computational Neuroscience. 10.32470/CCN.2023.1334-0*
- S. Nastase, **Y. Liu** et al. (2021). The "Narratives" fMRI dataset for evaluating models of naturalistic language comprehension. *Scientific data. 10.1038/s41597-021-01033-3*
- M. Meshulam, L. Hasenfratz, H. Hillman, **Y. Liu**, M. Nguyen, K. A. Norman, U. Hasson (2021). "Neural alignment predicts learning outcomes in students taking an introduction to computer science course." Nature Communications 12(1): 1922. 10.1038/s41467-021-22202-3
- **Y. Liu**, J. Kim, C. Wilson, M. Bedny (2020). Computer code comprehension shares neural resources with formal logical inference in the fronto-parietal network. *eLife. 10.7554/eLife.59340*
- S. Nastase, **Y. Liu**, H. Hillman, K. A. Norman, U. Hasson (2020). Leveraging shared connectivity to aggregate heterogeneous datasets into a common response space. *NeuroImage. 10.1016/j.neuroimage.2020.116865*
- F. Lin*, **Y. Liu***, H. Lee, C. Chang, I. Jaaskelainen, J. Yeh, W. Kuo (2019). Differential brain mechanisms during reading human vs. machine translated fiction and news texts. *Scientific Reports *co-first authored. 10.1038/s41598-019-49632-w*

WORKS IN PREPARATION

- Y. Liu, M. Bedny, K. Kutten (in prep). Why Programming Skills Still Matter in the AI-Era
- Y. Liu et al. (in prep). Reasoning but not language abilities predict programming learning outcome in students without prior programming experience
- Y. Liu et al. (in prep). The Cognitive Neuroscience of Programming: A literature review

FUNDINGS

2023 ***Collaborated on the preparation of National Science Foundation grant #2318685***
PI: Dr. Marina Bedny
Project: Neural recycling and plasticity in computer programming expertise

2023 ***COVID Relief Dissertation Completion Award, JHU***
Dissertation title: Neural recycling for programming: exploring the cognitive and neural substrates of a culturally-invented symbol system

2019-2020 ***Study Abroad Scholarship, Ministry of Education, Taiwan.***
Project: The neural mechanism of programming code comprehension, taking Python as an example

RESEARCH EXPERIENCE

POSTDOCTORAL RESEARCHER, JOHNS HOPKINS UNIVERSITY, MARYLAND, USA **JAN 2024 – PRESENT**
Neuroplasticity and Development lab, supervisor: Dr. Marina Bedny

- Applied advanced computational and data-science methods (e.g., non-parametric statistics, Bayesian inference) and machine learning (e.g., principal component analysis, support vector machine, recurrent neural network) to broaden the inter-disciplinary research project on programming.

PHD CANDIDATE, JOHNS HOPKINS UNIVERSITY, MARYLAND, USA **SEP 2018 – DEC 2023**
Neuroplasticity and Development lab, supervisor: Dr. Marina Bedny

- Headed a project to study the neuro-cognitive basis of computer programming. Led a five-member team across three years, conducting 400+ testing sessions to collect behavioral data from 90+ programming students and neuroimaging data from 30+ students and 25+ expert programmers.
- Designed and conducted a project on the neural basis of braille reading. Worked closely with 12 congenitally blind individuals during MRI scans, practiced inclusive communication.

RESEARCH SPECIALIST II, PRINCETON UNIVERSITY, NEW JERSEY, USA **NOV 2017 – JUN 2018**
Hasson Lab, supervisor: Dr. Uri Hasson

- Integrated a decade's worth of legacy big dataset consisting of MRI data collected from 10+ experiments with 300+ participants across ~900 MRI scanning sessions, amounting to more than 135,000 hours of spatio-temporal data; implemented the shared-response model to enable analysis across experiments.
- Collaborated as a key member of a four-member team for a 6-month longitudinal MRI scanning research project.
- Resolved memory-related issues of the "BrainIAK" Python toolbox developed by the lab, enhancing its capability.

RESEARCH ASSISTANT, NATIONAL TAIWAN UNIVERSITY, TAIWAN **SEP 2016 – SEP 2017**
Lab of Magnetic Resonance in Medicine, supervisor: Dr. Hsiao-Wen Chung

- Explored the application of natural language processing to Mandarin Chinese using latent semantics analysis.

MASTER DEGREE STUDENT, NATIONAL TAIWAN UNIVERSITY, TAIWAN **FEB 2014 – JUN 2015**
Brain Imaging Lab, supervisor: Dr. Fa-Hsuan Lin

- Designed and implemented a project to investigate the temporal coherence during natural passage reading; applied inter-subject correlation method MRI data collected from 24 individuals.

RESEARCH ASSISTANT, NATIONAL TAIWAN UNIVERSITY, TAIWAN **SEP 2012 – JAN 2014**
Cell Behavior Lab, supervisor: Dr. Po-Ling Kuo

- Cultivated melanoma cells, A549 cells, and 3T3 cells to support the development of 3D cell culture scaffold.

PRESENTATIONS

CONFERENCE TALK: ASSOCIATION FOR PSYCHOLOGICAL SCIENCE (APS) **MAY 2025**

- Computer programming instruction rapidly "recycles" logical algorithm representations in fronto-parietal reasoning systems

CONFERENCE TALK: DAGSTUHL SEMINAR #22402 **OCT 2022**

- Neural recycling of logical reasoning network for programming code comprehension

CONFERENCE TALK: COGNITIVE NEUROSCIENCE SOCIETY (CNS) **APR 2022**

- Symposium organizer. Symposium title: Neural recycling of reasoning networks by STEM domains: evidence from studies of math, engineering and programming
- Speakers: Dr. Martin Monti, Dr. David Kraemer, Dr. Marie Amalric, Yun-Fei Liu
- Talk title: Neural Recycling of logical reasoning network for programming code comprehension

CONFERENCE TALK: SOCIETY FOR THE NEUROBIOLOGY OF LANGUAGE (SNL) **OCT 2021**

- The involvement of bilateral supramarginal gyrus in orthographic processing during Braille reading

CONFERENCE TALKS: COGNITIVE NEUROSCIENCE SOCIETY (CNS) **APR 2020**

- Code comprehension shares the same neural basis as formal logic
- Overlapping neural responses to symbolic math and formal logic in the intra-parietal sulcus

INVITED TALK: WEI JI MA LAB MEETING, NEW YORK UNIVERSITY **NOV 2023**

- Code comprehension: an interplay between logic and language

INVITED TALK: GATEWAY COMPUTING WORKSHOP, JOHNS HOPKINS UNIVERSITY **JUL 2023**

- Neural and behavioral correlates of programming in Python novices

INVITED TALK: THE SCIENCE GONG SHOW, JOHNS HOPKINS UNIVERSITY **APR 2023**
- When your brain gets a CODE

INVITED TALK: HASSON LAB MEETING, PRINCETON UNIVERSITY **OCT 2020**
- The neural basis of code comprehension

INVITED TALK: SAXE LAB MEETING, MIT **SEP 2020**
- The neural basis of code comprehension

INVITED TALK: TAIWANESE STUDENT ASSOCIATION, JHU **FEB 2019**
- Japanese: a language beyond your imagination

INVITED TALK: HACKNTU, NATIONAL TAIWAN UNIVERSITY **AUG 2015**
- What's flying in the NeuroSky: Introduction to NeuroSky technology and possible application in hackathon events

INVITED TALK: INFORMATION CENTER, MINISTRY OF THE INTERIOR, TAIWAN **APR 2015**
- Your READy brain: The neuroscience of reading, from a single letter/character to a whole passage

INVITED TALK: INFORMATION CENTER, MINISTRY OF THE INTERIOR, TAIWAN **JUL 2013**
- Virtual immortality: The spatial world beyond the cable line

CONFERENCE POSTER: SOCIETY FOR THE NEUROBIOLOGY OF LANGUAGE (SNL) **SEP 2025**
- Language as "assistive technology" for programming: perisylvian language network encodes meaning of Python programming algorithms

CONFERENCE POSTER: ASSOCIATION FOR PSYCHOLOGICAL SCIENCE (APS) **MAY 2025**
- Computer programming instruction rapidly "recycles" logical algorithm representations in fronto-parietal reasoning systems

CONFERENCE POSTER: COGNITIVE COMPUTATIONAL NEUROSCIENCE (CCN) **AUG 2023**
- Neural representations of algorithms in the logical reasoning network are recycled for programming code comprehension

CONFERENCE POSTER: COGNITIVE NEUROSCIENCE SOCIETY (CNS) **MAR 2023**
- Learning to code recycles representations of logical algorithms in fronto-parietal network

CONFERENCE POSTER: COGNITIVE NEUROSCIENCE SOCIETY (CNS) **APR 2022**
- The neural basis of logical reasoning is engaged during the comprehension of algorithms in programming beginners

CONFERENCE POSTER: SOCIETY FOR THE NEUROBIOLOGY OF LANGUAGE (SNL) **OCT 2022**
- Language system contributes to "gist" extraction during code comprehension

CONFERENCE POSTERS: COGNITIVE NEUROSCIENCE SOCIETY (CNS) **APR 2020**
- Code comprehension shares the same neural basis as formal logic
- Overlapping neural responses to symbolic math and formal logic in the intra-parietal sulcus

CONFERENCE POSTER: SOCIETY FOR NEUROSCIENCE (SFN) **NOV 2017**
- Using inter-subject correlation to probe the neural response to article genre and readability during natural reading

CONFERENCE POSTER: ORGANIZATION OF HUMAN BRAIN MAPPING (OHBM) **JUN 2015**
- Inter-Subject Neural Correlation during Natural Article Reading

TEACHING EXPERIENCE

TEACHING ASSISTANT – LECTURING
- *Research Methods in Psychology* (JHU, 2021)
- *Linear Algebra* (NTU, 2017)

TEACHING ASSISTANT – DISCUSSION LEADING
- *Mind, Brain, and Experience* (JHU, 2020)
- *Special Topics in Micro- and Nano-Biotechnology* (NTU, 2014)

GUEST LECTURES

- "If either LOGIC or CODE then not (so much) Language", at *Foundations of Logical Thinking* (JHU, 2022)
- "The neural basis of code comprehension", at *Mind, Brain, and Experience* (JHU, 2021, 2020)
- "Thinking animals, thinking of animals", at *Introduction to Psychology* (JHU, 2019)

PROFESSIONAL DEVELOPMENT

GOOGLE GENERATIVE AI INTENSIVE COURSE **MAY 2025**
- A one-week introduction to the latest artificial intelligence and hands-on workshop.

BRAINS, MINDS, AND MACHINES SUMMER SCHOOL **AUG 2024**
- Marine Biological Laboratory, Wood Hole, MA, USA
- A three-week course series delving deeply into the research on intelligence.
- Course project: Seeking the neural representations of programming algorithms using recurrent neural network

DAGSTUHL SEMINAR #22402 **OCT 2022**
- Schloss Dagstuhl Leibniz-Zentrum für Informatik, Wadern, Germany
- Seminar topic: Foundations for a new perspective of understanding programming
- Invited to join this one-week discussion on programming code comprehension and the current cognitive and neuroscientific progress on our understanding of this topic.

OTHER PROFESSIONAL EXPERIENCES

DATA ANALYST, CENTER FOR SCIENTIFIC INTEGRITY **JUL 2025 – PRESENT**
- Contributed to the Medical Evidence Project by building a comprehensive meta-analysis database of 9000+ studies and 300,000+ analyses, enhancing transparency and reproducibility in biomedical research.
- Advanced methods for identifying and correcting errors in published meta-analyses, strengthening the reliability of evidence that informs clinical and scientific practice.

FOUNDING MEMBER AND CHIEF EDITOR, SCI'MORE PODCAST **AUG 2020 – JUN 2023**
- Edited more than 10 out of the approximately 25 episodes released during my tenure.
- Trained aspiring editors on technical know-hows in interview moderation and audio editing.

BUSINESS DEVELOPMENT AGENT, NEUROSKY COMPANY, TAIPEI, TAIWAN **JUN 2014 – SEP 2015**
- Contributed to the commercial application of electrophysiological biosensors.
- Collaborated with MacKay Memorial Hospital on a clinical validation study for heart rate variability (HRV) algorithms. Results led to the design of the BMD-101 biosensor chip, later adopted in the Asus ZenWatch.

TEACHING ASSISTANT – ADMINISTRATIVE AND TECHNICAL SUPPORT
- *Linear Algebra; Biomedical Engineering; Scientific Research and Academic Career; Introduction to Psychology; Real World Human Data.*

SERVICES

DEPARTMENTAL SHOWCASE ORGANIZER, JHU **APR 2025**
- Johns Hopkins University alumni week event.
- Presented and promoted research works in the Department of Psychological and Brain Sciences and the Department of Cognitive Science.

EARLY CAREER COLLOQUIUM COMMITTEE, JHU **SEP 2021 – JUN 2023**
- Promoted emerging scientists from historically excluded groups in psychology and neuroscience.
- Hosted speakers: Dr. Kathryn Graves, Dr. Asieh Zadbood

SELECT AWARDS

2023 ***G. Stanley Hall Scholar's Award, JHU***
2023 ***Winner, The Science Gong Show, JHU***
2021 ***Alumni Choice Award, Three Minute Thesis competition, JHU***
2021 ***3rd place, IMBES research pitch competition***
2021 ***Robert S. Waldrop Junior Investigator Award, Dept. of Psychological and Brain sciences, JHU***
2020 ***Walter L. Clark Teaching Award, Department of Psychological and Brain sciences, JHU***
2015 ***3rd Place, Three Minute Thesis competition, NTU***
2013 ***Gold Medal Award, Long Story Short presentation competition, NTU***