Yiran Zhao

My research envisions a future where behavioral health interventions are mindless: requiring minimal effort and delivering just-in-time effectiveness. Inspired by clinical translational research, my approach involves (1) identifying physiological pathways and cognitive processes, (2) activating these pathways and processes through wearable devices, and (3) rigorously evaluating the interventions both in-lab and in the wild. To advance this vision, I was the primary author of a successful NSF HCC Medium grant funded in Fall 2022. My research has been published in leading HCI venues, including IMWUT, CSCW, CHI, and DIS, with forthcoming publications in behavioral health venues such as JMIR.

As I finish my Ph.D. research, I aim to bring closed-loop, unobtrusive intervention to the real world through commercialization. My current aim is to apply for entrepreneurship-focused postdoc positions and incubators.

PhD Candidate (they/them)
Information Science
Computer and Information Science
Cornell Tech
New York, NY

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yiran.zhao@infosci.cornell.edu

EDUCATION

2019 – Present **Cornell Tech**
Ph.D. Information Science
Advisor: Tanzeem Choudhury, Qian Yang, Rana Zadeh

2017 – 2019 **University of Washington**
M.S. Biomedical and Health Informatics
Advisor: Wanda Pratt, Ari Pollack, Shwetak Patel

2013 – 2017 **Georgia Institution of Technology**
B.S. Biomedical Engineering; minor of Computer Science
Advisor: Hang Lu, Eric Schumacher

PUBLICATIONS AND CONFERENCES

P9 Evaluate Closed-Loop, Mindless Intervention in-the-Wild: A Micro-Randomized Trial on Offset Heart Rate Biofeedback
Yiran Zhao, Tanzeem Choudhury
IMWUT 2024

P8 Translation Effectiveness of Offset Heart Rate Biofeedback as Mindless Intervention for Alcohol Craving Among Risky Drinkers: Controlled Experiment
Yiran Zhao, Jatin Arora, Yujie Tao, Dave Miller, Alexander Adams, Tanzeem Choudhury
JMIR Formative Research (In Press)

P7 BreathePulse: Peripheral Guided Breathing via Implicit Airflow Cues for Information Work
Tan Gemicioglu*, Thalia Viranda*, **Yiran Zhao***, Olzhas Yessenbayev, Jatin Arora, Jane Wang, Pedro Lopes, Alexander T. Adams, Tanzeem Choudhury
IMWUT 2024
*authors with equal contribution in alphabetical order of last names

P6 Affective Touch as Immediate and Passive Wearable Intervention
Yiran Zhao*, Yujie Tao*, Grace Le, Rui Maki, Alexander Adams, Pedro Lopes, and Tanzeem Choudhury
IMWUT 2023

P5 Calibrating Clinicians' Trust in AI Decision Support Systems Using Biomedical Literature
Qian Yang, Yuexing Hao*, Kexin Quan*, Stephen Yang*, **Yiran Zhao***, Volodymyr Kuleshov, Fei Wang
CHI 2023
*authors with equal contribution in alphabetical order of last names

C3 The Communal Loom: Integrating Tangible Interaction and Participatory Data Collection for Assessing Well-Being
Niti Parikh*, **Yiran Zhao***, Maria Alinea-Bravo, Tapan Parikh
CHI 2022: Tangible Interaction for Well-being

C2 CRAFT @ Large: Building Community Through Co-Making
Yiran Zhao, Maria Alinea-Bravo, Niti Parikh
ISAM 2021

P4 Support Goal-Based Collaboration for Hospitalized Children
Yiran Zhao, Yoojung Kim, Calvin Apodaca, Regina Casanova-Perez, Shefali Haldar, Sonali R. Mishra, Julia C. Dunbar, Ari Pollack, Wanda Pratt
CSCW 2021

P3 CASPER: Capacitive Serendipitous Power Transfer for Through-Body Charging of Multiple Wearable Devices
Edward Jay Wang, Manuja Sharma, **Yiran Zhao**, Shwetak Patel
ISWC 2018

C1 E-archery: Prototype Wearable for Analyzing Archery Release.
Yiran Zhao, Shanu Salunke, Alexander Leavitt, Kevin Curtin, Nghia Huynh, and Clint Zeagler
Ubicomp 2016
Best Paper Wearable Sports Workshop

P2 Investigating the Intersession Reliability of Dynamic Brain-State Properties
Derek M. Smith, **Yiran Zhao**, Shella D. Keilholz, and Eric H. Schumacher
Brain Connectivity 2018, 8(5), 255-267.

P1 Reverse-Correlation Analysis of the Mechanosensation Circuit and Behavior in *C. elegans* Reveals Temporal and Spatial Encoding
Daniel A. Porto, John Giblin*, **Yiran Zhao***, Hang Lu
Nature Scientific Reports 2019, 9(1), 1-14

GRANTS AND FELLOWSHIPS

Sept 2022 **Collaborative Research: HCC: MEDIUM: Body as Intervention: Toward Closed-Loop, Embodied Behavioral Health Interventions**
National Science Foundation
Award Amount: $686,879.00
Role: Lead author

Sept 2021 **Digital Life Initiative Doctoral Fellow**
Cornell Tech

May 2021 **Public Interest Tech Impact Doctoral Fellow**
Cornell Tech

RESEARCH

Nov 2023 - Current **CalmingMoments: Evaluate Offset Heart Rate Biofeedback as Closed-Loop Intervention In-the-Wild**
Mixed-Method | Micro-randomized Trial | Closed-Loop System Engineering
Cornell Tech; Advised by Tanzeem Choudhury, Qian Yang, and Rana Zadeh

- Designed and engineered a closed-loop system that detects sympathetic activity and activates offset heart rate biofeedback via heart rate monitor and Apple Watch; engineered the mobile system to collect contextual data
- Designed a micro-randomized trial to evaluate the effect of the intervention and what contextual factors moderate the effectiveness
- Running the deployment study with 48 participants, each using the system in their free-living environment for a week.

Published in IMWUT 2024

May 2023 - Aug 2024 **BreathePulse: Examining Peripheral Guided Breathing via Implicit Airflow Cue**
Mixed-Method | Behavioral Experiment | Rapid Prototyping
Cornell Tech; Advised by Tanzeem Choudhury, Alexander Adams, and Pedro Lopes
- Designed and prototyped a laptop mounted device that guides slow-breathing via subtle airflow around the nostrils
- Designed a behavioral experiment and collected data on ~40 participants; Analyzed physiological, self-report, and performance data using Linear Mixed Models; Analyzed qualitative data through thematic analysis
- Mentored three first-year PhD students to execute the project

Published in IMWUT 2024

May 2022 - Nov 2022 **Guidance Haptics on the Wrist for Eyes-Away Target Acquisition in Mixed Reality**
Mixed-Method | Mixed Reality | Behavioral Experiment
Meta Reality Labs; Advised by Aakar Gupta, Tanya Jonker
- Designed vibrotactile patterns on-the-wrist that intuitively facilitated eyes-away and eyes-free target acquisition in mixed reality
- Developed the experimental setting in Unity; Conducted behavioral experiments with ~40 participants; Analyzed eye-gaze behavior, eye-hand coordination, task completion benchmarks, and cognitive load; Analyzed target-finding strategy based on think-aloud and

May 2021 - May 2022 **CRAFT @ Large: Building Community Through Co-Making**
Qualitative | Rapid Prototyping | Co-Design | Informal Methods of Design
Cornell Tech; Advised by Niti Parikh, Deborah Estrin
- Conduct weekly workshops for community members to co-make through informal methods of design; Conducted qualitative interview with recreational and art therapists to understand how therapists design recreational and crafting sessions and assess residents' progression through such sessions
- Design Unity-based AR interaction to mitigate creators' information on created artifact

Published in ISAM 2021

Feb 2021 - Feb 2023 **BioScholar: Investigating how clinicians use literature as explainable decision support**
Qualitative | Sense-making | Clinical Decision-Making | Human-AI Interaction
Cornell University; Advised by Qian Yang
- Conducted qualitative interview and think aloud sessions with clinicians and clinical librarians to understand how they search, evaluate and make sense of biomedical literature to facilitate decision making at point-of-care; Synthesized implications for how AI-powered clinical decision support systems can improve explainability

Published CHI 2023

Nov 2020 – Nov 2022 **Romotouch: Mitigating stress through affective touch**
Mixed-Method | Rapid Prototyping | Behavioral Experiment | Mental Health Intervention
Cornell Tech; Advised by Tanzeem Choudhury, Pedro Lopes
- Developing wearable actuators to deliver affective touch as a mindless, inherently pleasant stress intervention. Designed and conducting controlled behavioral experiments to evaluate the effect in heart rate variability, subjective stress rating, affects and pleasantness

Published in IMWUT 2023

Feb 2020 – Current **Cravigator: Mindless craving intervention through vibrotactile heart rate biofeedback**
Quantitative | Sensor Fusion | Behavioral Experiment | Mental Health Intervention
Cornell Tech; Advised by Tanzeem Choudhury, Emanuela Offidani
- Designed and conducting experiment to evaluate the effectiveness of smartwatch-based, stress-lowering vibrotactile heart rate feedback on reducing craving for alcohol and nicotine
- Developing closed-loop system that detects the usage and craving for e-cigarette and automatically activates stress-lowering intervention to reduce e-cigarette usage.

In Review in JMIR Formative Research

Jan 2018 – Oct 2020 **Plan&Talk: Supporting collaborative goal-setting for hospitalized adolescent patients**
Qualitative | Interface Design | Patient Engagement
University of Washington; Advised by Wanda Pratt and Ari Pollack
- Designed and developed an interface to facilitate collaborative goal-setting for hospitalized children; Conducted design workshops and expert review workshops
- Lead a technology probe study to characterize the effect of goal-based on patient-caregiver-care provider collaboration for hospitalized adolescents; conducted semi-structured interviews; coded interview data, observation notes and app usage data

Published in CSCW 2021

March 2018 – Sept 2018 **CASPER: Capacitive serendipitous power transfer for through-body charging of multiple wearable devices**
Quantitative | Rapid Prototyping | System Characterization | Wireless Charging
University of Washington; Advised by Edward Wang, Shwetak Patel
- Developed digital jewelry prototypes for a capacitive through-body charging system; characterized the charging requirements of the electronics for the jewelry and implemented as tattoos with lights and a charging jacket; developed the design guideline for such system

Published in ISWC 2018

Jan 2016 – May 2017 **Reverse-correlation analysis of the mechanosensation circuit and behavior in *C.Elegans* reveals temporal and spatial encoding**
Quantitative | Computer Vision | Neural Engineering
Georgia Institute of Technology; Advised by Hang Lu
- Designed PDMS microfluidic devices; Applied computer vision and system identification techniques to analyze neural imaging data and model the neural circuit in *C. elegans*

Published in Nature Scientific Reports 2019

Sept 2015 – May 2017 **Investigating the intersession reliability of dynamic brain-state properties**
Quantitative | Machine Learning | Cognitive Neuroscience
Georgia Institute of Technology; Advised by Derek Smith, Eric Schumacher
- Analyzed functional MRI data of human brain with computer vision and machine learning to identify the activation patterns of brain networks; developed MATLAB-based application for fMRI signal processing and unsupervised learning

Published in Brain Connectivity 2018

INDUSTRY

Summer 2022 **Meta Reality Lab**
Redmond, WA
Research Intern; Manager: Aakar Gupta
- Led the investigation on how to design vibrotactile patterns on-the-wrist to intuitively facilitated eyes-away and eyes-free target acquisition in mixed reality; Developed vibrotactile patterns by designing dfferent waveforms for LRAs; Developed the experiment condition in Unity; Designed and oversaw behavior experiments with ~40 participants.

Summer 2018 **Proteus Digital Health LLC.**
Redwood City, CA
Algorithm Engineer Intern
- Led the development of algorithms based on sensors in a wearable pill detection patch (ECG, device temperature, skin conductivity and accelerometer) for user activity classification and device attachment quality classification; Implemented such algorithms in iOS and Android application; Conducted on-person field study

Sept 2015 – May 2017 **Invention Studio**
Georgia Institute of Technology
Prototyping Instructor
- Instructed, trained and advised students on prototyping with 3D printing, waterjet, laser cutting, electronics and circuits, and various metalwork and woodwork tools

PROJECTS

Jan 2017 – May 2017 **AirTech: Home-Use Lung Function Monitoring Device**
Rapid Prototyping | Mobile Development | Sensor Fusion
- Partnered with Micro-C LLC., led the development of a lung function monitoring device and iOS application for pediatric lung disease patients. The system quantified air flow rate using pressure sensors and exhaled gas components using CO_2 sensor, conducted test validity check, and automatically recorded test results to compatible iOS application

Jan 2016 – Sept 2016 **E-archery: Prototype Wearable for Analyzing Archery Release**
Quantitative | Rapid Prototyping | Sports Training
Advised by Clint Zeagler, Thad Starner
- Led the development of a wearable glove and Android application system for archery form classification from accelerometer and IMU sensor data; conducted user interview with the university's archery team

Published in Ubicomp 2016

TEACHING AND MENTORSHIP

Graduate Student
Yujie Tao (University of Chicago to Stanford University)
Stephen Yang (Cornell University to University of Southern California
Xuanbo Jia (Cornell University)
Tran My Kim Dang (Cornell University)
Jane Wang (Cornell University)

Graduate Courses
Ubiquitous Computing
Applied Machine Learning
Data Science in the Wild
Psychological and Social Aspects of Technology
Prototyping Studio of Human-Computer Interaction and Design

K-12 Projects
Infectious Disease Modeling and Vaccine Mechanism for COVID-19
Playful Digital Interaction with Traditional Instruments
Self-Tracking and Prediction of Menstrual Pain: Support Adolescents Female to Design Technology for Themselves

Entrepreneurship
2021 Conrad Challenge
- PsychAid: Emergency Mental Support for Anthropogenic Disasters
- Smoke Fighter: Sense, Act, and Incentify Smoking Cessation Wristband
- SpiritAware: Aviation Safety Guardian
- Harmony 1.0: Voice-Based Assistant for Older Adults Living in Assisted-Living Homes

2022 Conrad Challenge
- MemoFace: Assist People Living with Prosopagnosia with Smart Glasses
- Rescue-BED: Just-in-Time Adaptive Intervention System for Binge-Eating Disorder

2023 Conrad Challenge
- PatientPalAI: LLM-Based Personal Healthcare Assistant
- MelodyCrafters: Haptic Glove for Passive Haptic Learning of Piano
- Dr. Sculptor: Smart Mirror for Posture Training

Non-Profit
Engineers without Borders Uganda Clean Water Program

PATENT

Application
DEVICE, SYSTEM, AND METHOD FOR CONTEXT-AWARE MEASUREMENT BASED MEDICAL COMPLIANCE
Aditya Dua, Bill Weeks, Ronny Li, Neraj Bobra, Yiran Zhao
Provisional Application Filed on June 15th, 2018

SKILLS

Data Analytic/ML	MATLAB, Python, Keras, OpenCV, TensorFlow, R, PLAS, Mathematica, Netlogo, GPower, AFNI
CAD	Solidworks, Autodesk Fusion 360, Sketch Up, Inkscape, Adobe Illustrator
Prototyping	Unity, PSoC, Arduino, 3D Printing, laser-cut, waterjet, electronics, woodwork, metalwork
Programming	Java, C, Python, JS, Flask, ReactJS, Assembly, GBA, Lua, php, Unix Shell, Android, iOS, Latex
Cloud Computing	SQL, MongoDB, AWS
Interface Design	Sketch, Figma, Balsamiq
Qualitative Study	Interviews, think aloud, survey/questionnaires design, participatory design, cognitive modeling
Language	Mandarin – native; English – fluent; Japanese – moderate; Korean – beginner