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David B. Ramsay

Summary

David is a PhD student at the MIT Media Lab, a Fulbright Scholar, a Musician, and a Systems Engineer. He has 3 years consumer electronics industry experience, a Masters from MIT, and undergraduate degrees in Electrical Engineering and Music. David has experience in circuit design and manufacturability (Altium and Spice), programming (embedded C, full-stack Javascript, and Python), audio signal processing (neural networks/deep learning as well as standard approaches), machine learning (probabilistic modeling), and system design (particularly acoustic/psychoacoustic designs). He is well-versed in modern social psychology and its statistical techniques.

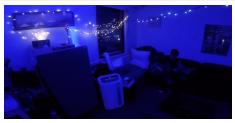
David's goal for his PhD is to apply rigorous, empirically grounded psychology and philosophy to the design of ubiquitous technology-- to measure and maximize user focus, wellbeing, fulfillment, and interpersonal connection.

Projects

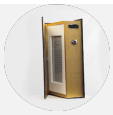
Captivates (Altium, Fusion 360, React Native/BLE)
-an eyeglasses platform designed for manufacturability in China, for in-the-wild physiological measurement of a user's face temperature, head position, and blink behavior.

Equinox (Altium, Fusion 360, React Native/BLE)
-a watch that forces you to guess the time before telling you the time, which also measures ambient light cues and prompts users for survey answers. A tool to measure time perception.

Guitarbot (ROS on Linx, Fusion 360)
-a guitar stand that wanders to different locations in a room and learns where it should position itself to encourage or discourage guitar playing.



GreenRoom (Python, Javascript, Altium, BLE)
-a guitar attachment that causes the room lighting to change and additional reverb to be overlaid whenever the guitar is picked up.



Huxley (Python, Javascript)
-an e-ink book that learns to become the book you are most likely to pick up when you notice it. The affordances are meant to resemble a book as much as possible; there are no menus or state.

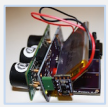
Feather (Fusion 360, React Native/BLE)
-a leg band that tests your threshold for noticing a small shock; as you are focused on other things, This threshold becomes slightly higher. Based on a reverse engineered Pavlok product.

Cognitive Audio (Python, Javascript, Tensorflow)
-a collection of projects attempting to better capture and model semantic, gestalt features of audio for predicting how people will perceive and attend to them.

Sonear (Altium)
-a wearable microphone array designed to connect to EEG to automatically probe the direction of the sound a user is attending to. An MIT patent has been filed on this concept.

YourAd (Python, Javascript)
-a tool to replace all of your ads in the browser with custom ads you design targeted at yourself. It includes an ad creation tool to quickly make ads of all dimensions in the proper color scheme.

Emotion and Behavior Classification for Parent-Child Interaction (Python)
-used CHILDES database and paralinguistic/linguistic features to classify utterances for affect and behavior type (praise/command/ etc.) using SVMs.



LearnAir: Intelligent, Personal Air Quality Monitoring (Python/Altium)
-used machine learning to estimate accuracy of cheap sensors under a variety of conditions, and built a backend database solution to automatically apply/update ML model for sensor data.

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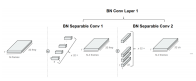
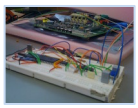
Shenzhen Product Design for Manufacturability (Altium/Solidworks)
-spent six weeks in Shenzhen, designed circuit for audio device with touchscreen and enclosure, had the circuit board and injection molding done in Shenzhen factories.

Mindsprout: Tracking Child Development with Audio (Python/Javascript)
-prototyped several iOS apps (using React-Native) for tracking child development by sending and analyzing audio to our sever. Tested w/test-flight (15 parents), in-home observation with five.



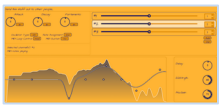
On-Device Continuous Speech Recognition Modeling (Spice)
-deep learning model design performed at Google AI and presented at Interspeech 2019, to optimize dual processor model designs on device.

Speaker/Microphone Array Design, System Prototyping, & Speech Intelligibility (Matlab)
-audio signal processing, measurement, and system prototyping at Bose Corporation. One product prototype made it to manufacturing and is now available, one patent issued.

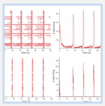


Fulbright Music Interfaces for People with Disabilities (Matlab/C)
-developed a real-time DSP algorithm to make guitar more accessible to people with disabilities, and implemented it on an Analog Devices SHARC development kit. Published ISSC 2011.

Avatars for Exercise Motivation (Javascript)
-designed a mobile web app that allowed users to design an avatar and connect/track their fitbit, and ran a 20 person, two week user study to see what type of experience is most motivating.

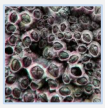


GroupLoop: a Network-Enabled Audio Feedback Instrument (Javascript/WebRTC)
-website using WebRTC, webaudio, and webmidi to create a distributed feedback loop instrument. Published NIME 2015.



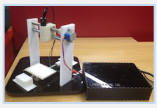
Computational Model of Neural Network for Respiration (Berkeley Madonna)
-Biologically inspired computational modeling of mammalian brainstem neural populations that control respiration, undertaken at NIH. Recently wrote basic NN library in C.

Audio Measurement Toolbox (Python)
-publicly available toolset to automate impulse response measurements and speaker system characterization, written in Python.



Barnacle and Spider Silk Material Properties Research (Labview)
-imaging and study of material properties of biologic materials at the Naval Research Lab. Atomic force microscopy, designed stress/strain tests and data acquisition, etc. Published 2008.

MetaPiano (Welding/Machine Shop)
-deconstructed and reconstructed 'pinball machine' from a piano, group art project. This is now on display in the MIT Museum.



Mini-Laser Cutter (3D printing/Laser Cutting/Arduino)
-built over a few weeks in Shenzhen, parts were sourced from the local market. This could burn a predefined pattern into a business card.

In Progress:

Wearables for Focus Estimation – probabilistic combination of measures of focus for better continuous estimation of a user's state of attention.

Empirical Basis for Design Decisions – Evaluating design interventions by analyzing their effects on long-term, continuous, in-the-wild estimates of cognitive states.

EmotionSpeech Wearable – a wearable tool for low-power analysis of emotional content in speech, that pushed data over Bluetooth to the phone.

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Professional

Google Inc. — *2017, 2018*
Software Engineering/Research Intern

Published research on deep learning models for on-device, continuous speech recognition as part of Google AI team in Zurich. Implemented Poincare Embeddings and Generative Adversarial Networks in tensorflow, as well as other machine learning algorithms, as part of the Fuschia Intelligence team in Mountain View.

Bose Corporation — *2010 - 2014*
Electrical/Systems Engineer II

2 years in Audio Applied Research as a Systems Engineer:

Designed, constructed, and tuned complex audio prototypes for Home Entertainment applications. Advanced limiting schemes, equalization, speaker spatialization array topologies, and critical listening/evaluation skills.

Designed, implemented, and tested a microphone array using self-implemented speech intelligibility standards; gained familiarity with audio measurement techniques and real-time processing.

Selected for Highly Competitive PACE rotation program:

6 months in Noise Reduction Technology's Advanced Development Group. Designed and tested perceptually based noise management algorithms in Matlab, objective-C.

6 months in Automotive Systems' Electrical Engineering Group. Tested board layouts and worked on embedded/analog circuit design.

Dublin Institute of Technology — *2010 -2011*
Fulbright Researcher

Developed and prototyped a DSP (SHARC) based system to allow handicapped musicians to play guitar using real-time feature extraction and pitch shifting; Matlab and C programming, Microchip/ADI hardware.

GE Energy — *2009*
Electrical Engineering Co-op

Led business support project teams, and worked with Power Engineers to automate the substation design process, in the Transmission and Distribution Projects Division. Presented work to upper-level management.

National Institutes of Health — *2008*
Biomedical Engineering Intern

Constructed a computational model of interacting neural populations in the brainstem under Dr. Jeffery Smith, as part of the Biomedical Engineering Summer Internship Program (16 students selected nationwide).

Naval Research Laboratory — *2004 - 2007*
Materials Property Research Intern

Constructed data acquisition systems and test rigs to measure barnacle baseplate mechanics. Modulus mapping/atomic force microscopy of spider silk. Three consecutive internships in the Tribology department.

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Education

MIT Media Lab — *2014 - present*

PhD Student in Responsive Environments Group
MS, MIT Media Lab 2016

-Affective Computing, Behavior Change, etc. Listener in Computer Networks, OS Engineering, Machine Learning.
-Master's Thesis on machine learning techniques for distributed sensor hardware. Summer in Shenzhen.
-Teaching Assistant for IoT Workshop, Sensors for Interactive Environments, and Future of Music.

Bose Corporation (internal) — *2013*

Dr. Bose's complete MIT Acoustics course, as well as internal classes on Audio Measurements and DSP.

Berklee Online School — *2012*

Professional Certificate in Music Production

Five classes including Art of Mixing, Mastering Techniques, Recording, and Production Analysis.

Case Western Reserve University — *2005 - 2010*

BS, Electrical Engineering (*conc. signal processing*)
BA, Music
Minor in Biomedical Engineering

Dual Degree. Digital Communications, Signals and Systems, Signal Processing, Mobile Robotics, Logic Design, etc.

Patents

Collaboratively Processing Audio between Headset and Source to Mask Distracting Noise.
D. Gauger Jr., C. Ickler, D.B. Ramsay. US 20150281829 A1. Filed March 26, 2014. Pub. Oct 1, 2015.

Publications and Conference Presentations

Captivates: A Smart Eyeglass Platform for Across-Context Physiological Measurement. Chwalek, P, Ramsay, DB, and Paradiso, J. IMWUT 2021.

Cognitive Audio Interfaces: Mediating Sonic Information with an Understanding of How We Hear. Ananthabhotla, I, Ramsay, DB, et al. IEEE Pervasive 2021.

Towards Causal Psychophysiology in the Wild: Probabilistic Programs for Skin Conductance Analysis. Ramsay, DB et al. PROBPROG 2020.

Huxley: Intelligent Book as Essentialist Artefact. Ramsay, DB and Paradiso, J. DeSForM 2019.

HCU400: An Annotated Dataset for exploring aural phenomenology through causal uncertainty. Ramsay DB et al., IEEE ICASSP 2019.

Low-Dimensional Bottleneck Features for On-Device Continuous Speech Recognition. Ramsay, DB et al. Interspeech 2019.

The Intrinsic Memorability of Everyday Sounds. Ramsay, DB et al. AES Immersive and Interactive Audio 2018.

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YourAd: A User-Aligned, Personal Advertising System. Ramsay, DB and Paradiso, J. CHI, 2019.

The LearnAir Network. Ramsay, DB and Paradiso, J. IEEE Pervasive, 2019.

Making Air (Quality) Visible: Exploiting new technologies to dramatically improve atmospheric monitoring. Ramsay, DB et al. IEEE Pervasive, 2018.

Automated Characterization of Consumer Grade Sensor Accuracy from Supporting Data in Heterogeneous Air Quality Monitoring Networks. (Conference presentation). Ramsay, DB and Paradiso, J. NEMC, 2016.

LearnAir: towards Intelligent, Personal Air Quality Monitoring. (Master's Thesis). Ramsay, DB. MIT Media Lab, 2016.

GroupLoop: A Collaborative, Network-Enabled Audio Feedback Instrument. Ramsay, DB and Paradiso, J. NIME, 2015.

A Novel Fourier Approach to Guitar String Separation. Ramsay, DB, et al. ISSC, 2011.

Base plate mechanics of the barnacle *Balanus Amphitrite*. Ramsay, DB, et al. Biofouling, 2008.

Leadership and Entrepreneurship

Graduate Resident Advisor, East Campus

-Mentor and Advisor to forty-five MIT electrical engineering and math majors in MIT's famous 'East Campus' dorm, on floor 3W 'Floorpi'.

Undergraduate Research Mentor

-Supervised five MIT undergraduate researchers on a variety of projects

Leader in Bose Young Professional Culture

-Creator of Bose Young Professionals ~4 years ago. The group still has regular events and >100 active members.
-Creator of 'Bose Knows' onboarding process for college recruits; still a primary onboarding initiative for new hires.
-Representative of young professionals in executive level meetings across the organization. College recruiter.

CTO of 'Mindsprout'

Led product development efforts and in-person user testing. Accepted to Competitive Harvard Innovation Lab Incubator for three semesters. Four entrepreneurship classes with team: Nuts and Bolts of Entrepreneurship, New Enterprises, Money for Startups, and Advanced Entrepreneurial Tools and Techniques.

MIT Global Startup Workshop Organizational Team

-Panel organization lead for the 2016 India Workshop (panel topic: Manufacturing in India).
-Web development lead for the 2015 Guatemala Workshop.