Chris Hill

Ph.D. Student

Chris Hill is a Ph.D. student in Creative Technology and Design advised by Ann Eisenberg & Daniel Leithinger. He is a McNair Scholar, a Google CS Research Mentorship participant, and he received honorable mention in the 2020 Computing Research Association Outstanding Undergraduate Researcher awards. His research interests lie in human augmentation, sensory extension, transhumanism, biohacking, and educational technology. These interests have led to the development of open-source sensory extension and augmentation devices that he hopes will be replicated, accelerating scientific discovery and building stronger development communities in the field.

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EDUCATION

Ph.D. Student in Creative Technology & Design at the ATLAS Institute

University of Colorado, Boulder

08/2020 - Present

B.A. Computer Science

University of Colorado, Boulder

08/2016 - 07/2020

PUBLICATIONS

Paper

The ThreadBoard: Designing an E-Textile Rapid Prototyping Board

Author(s)

Chris Hill, Michael Schneider, Ann Eisenberg, Mark D Gross.

In Proceedings of TEI '21: ACM International Conference on Tangible, Embedded and Embodied Interaction. New York, NY. February 14-17, 2021.

Paper

A Wearable Meter That Actively Monitors the Continuity of E-Textile Circuits as They Are Sewn

Author(s)

Chris Hill, Michael Schneider, Mark D Gross, Ann Eisenberg, Arielle Blum.

In Proceedings of FabLearn 2020. New York, NY. October 10-11, 2020.

Paper

A Software Debugger for E-textiles and Arduino Microcontrollers

Author(s)

Michael Schneider, Chris Hill, Mark D Gross, Ann Eisenberg, Arielle Blum.

In Proceedings of FabLearn 2020. New York, NY. October 10-11, 2020.

Paper

"Our Dog Probably Thinks Christmas Is Really Boring": Re-mediating Science Education for Feminist-inspired Inquiry

Author(s)

Annie Kelly, Christine Chang, Chris Hill, Mary West, Mary Yoder, Joe Polman, Shaun Kane, Michael Eisenberg, R. Ben Shapiro.

In Proceedings of the International Conference of the Learning Sciences. Nashville, TN. June 19-23, 2020.

PUBLICATIONS

Paper

Development and Preliminary Testing of an Augmented Reality System For Extravehicular Activity Operation.

Author(s)

Carlos Pinedo, Jordan Dixon, Christine Chang, Donna Auguste, Mckenna Brewer, Cassidy Jensen, Chris Hill, Devin Desilva, Amanda Jones, Jim Voss, Allison Anderson.

In Proceedings of International Conference on Environmental Systems (ICES 2019), Boston, MA. June 15-18, 2019.

HONORS AND AWARDS

2020 Graduate School Diversity Recruitment Fellowship (2020)

University of Colorado, Boulder

- Award Amount: 10,000

Computing Research Association: Outstanding Undergraduate Researcher - Honorable Mention (2019)

Computing Research Association

McNair Scholar Recipient (2018 - 2020)

University of Colorado, Boulder

2020 NASA SUITS Challenge

National Aeronautics and Space Administration (NASA)

- Main Author of Proposal: *CU Technology for Extreme Environments,* Accepted by NASA

2019 Google CS Research Mentorship Program Recipient (2019)

Google

Undergraduate Research Opportunities Program (UROP) - Individual Grant (2019)

University of Colorado, Boulder

- Award Amount: 3,000

McNair Research Grant (2018 - 2020)

McNair Scholars Program

- Award Amount: 3,000 x each year in the program

2019 NASA SUITS Challenge

National Aeronautics and Space Administration (NASA)

- Co-Author of Proposal: *Multisensory Augmented Reality System for Spacesuit heads-Up Informatics Technologies: MARS SUITS,* Accepted by NASA

RESEARCH EXPERIENCE

Research Assistant - Debugging by Design (NSF funded, award #1742081)

Craft Tech Lab - University of Colorado, Boulder

07/2019 - Present *Boulder, Colorado*

We are developing hardware and software tools to assist in the process of "debugging" e-textile circuits. E-textile debugging presents a unique set of constraints due to the flexible and fabric-based nature of project materials. In collaboration with teams headed by Yasmin Kafai (U. Pennsylvania) and Deborah Fields (Utah State University), we study the way that students use these tools to debug their textile projects, their cognitive models of e-textile troubleshooting, and the educational implications of these activities.

Achievements/Tasks

- Develop and design several novel tools that aid makers in designing and debugging e-textiles.
- Created the ThreadBoard, a magnetic e-textile rapid prototyping board.
- Created the wearable wrist meter, a tool that alerts the user if they've created a bug (loss of continuity) as they stitch their e-textile circuitry.
- Co-designed a web based tool called Circuit Check that communicates with microcontrollers through serial communication and presents sensor and pin data to the user.
- Main author and co-author of several accepted papers on the design and development of the tools.
- Work featured in press - Instructables, Hackaday, Loomia.

Mentors: Dr. Ann Eisenberg (CU), Dr. Mark D Gross (CU).

RESEARCH EXPERIENCE

Research Internship (CS Research Mentorship Program)

Google

09/2019 - 07/2020 *Mountain View, California*

I work for Google as a research intern in their CSRMP program – As part of our efforts to broaden participation in CS research careers and make them more accessible to everyone, we accepted 37 outstanding undergraduates to Google's CS Research Mentorship Program (CSRMP) this fall (2019). The program encourages students to pursue graduate and doctorate-level CS studies by matching them with Google mentors. As the students work toward their goals, they attend a CS research conference and travel to Mountain View as guests for the PhD Fellowship Summit.

Achievements/Tasks

- 1 out of 37 students chosen for the program.
- Presented research work at Google's CSRMP/Ph.D. Summit.
- Participated in several Google workshops related to skill and research development.
- Worked with mentor to set career and academic goals for the year.

Mentors: Dr. Huisheng Wang (Google).

President & Project Manager

(NASA SUITS) CU Technology for Extreme Environments Club - Johnson Space Center & University of Colorado, Boulder

08/2018 - 08/2020 *Boulder, Colorado*

The NASA SUITS design challenge (https://microgravityuniversity.jsc.nasa.gov/nasasuits.cfm) is a challenge posed to college students to create, design, and present novel solutions with displaying space suit information within an augmented reality environment (HoloLens).

Achievements/Tasks

- Main author and co-author of several NASA accepted proposals where my team represented CU Boulder. The proposals were submitted to the NASA SUITS Design Challenge with a team of CU Boulder faculty and students that described our programming, hardware, design, and outreach components of our NASA SUITS project.
- 1 out of 10 universities selected to participate in the challenge (2019 & 2020).
- As outreach team lead, I coordinated multiple outreach events throughout the state of Colorado directly impacting 1,000+ students.
- As the programming team co-lead, I programmed object recognition, electromyography (EMG) peripheral device, telestrator, and telemetry components.
- As the hardware team lead, I designed and fabricated several HCI devices that interfaced with the Microsoft HoloLens.
- Presented the team's work to a panel of Microsoft executives and NASA staff at NASA's Johnson Space Center (2019).
- Presented the team's work (remotely) to a panel of NASA architects and NASA astronaut, Nick Hague (2020).

Mentors: Dr. Allison Anderson (CU), Col. James Voss (CU), Dr. Bradley Hayes (CU), Dr. Aaron Johnson (CU), & Angelica Garcia (NASA).

Undergraduate Research Assistant - Pet Project (NSF funded, award #1736051)

Laboratory for Playful Computation - University of Colorado, Boulder

08/2018 - 07/2019 *Boulder, Colorado*

A multi-disciplinary research project that develops, tests, and researches physical computing. Specifically, a new genre of educational technology —wearable devices for trans-species sensation that fuel students' curiosity and leads them to design and conduct investigations into pet behavior and biology.

Achievements/Tasks

- Designed and created wearable HCI and home-installable technologies that enable youth and their families to investigate animal behavior and biology.
- Developed devices using C, Arduino libraries, and Python.
- Employed electrical engineering skills when fabricating the devices.
- Used an iterative design process that took feedback from testers to improve our devices and implementations.
- Wrote documentation on methods, tools used, and Instructables to recreate devices created.
- Revise and have a proficient understanding of human research subject testing, IRB, and procedures for the project.
- Work featured in press - Instructables, Colorado Engineer Magazine, Gizmodo, Arduino, Hackster, A Broad View of Wearables as Learning Technologies: Current and Emerging Applications (book).

Mentors: Dr. Ben Shapiro (Apple & CU), Dr. Mike Eisenberg (CU), Dr. Joe Polman (CU).

RESEARCH EXPERIENCE

Independent Research - NSF, UROP, & McNair Funded

Craft Tech Lab - University of Colorado Boulder

04/2016 - Present *Boulder, Colorado*

My own research focuses on the creation of novel, computationally-enriched "sensory extensions" for students of science and engineering. Targeting my efforts towards children education through making devices and curriculum that can both explain/teach about our natural world and computer science concurrently.

Achievements/Tasks

- Independently designed and created HCI devices, and research agendas, where I authored several school and department accepted proposals.
- Presented my research at several different institutions and universities.
- Research featured in several online and print publications.
- Wrote documentation on methods, tools used, and Instructables to recreate devices created.
- Designed and implemented circuit designs and other engineering tasks such as programming, 3D printing, 3D modeling, laser cutting, creating physical models, user testing, and rapid prototyping.

Mentors: Dr. Ann Eisenberg (CU), Dr. Mike Eisenberg (CU).

MENTORSHIP/TEACHING EXPERIENCE

Mentor - McNair Scholars Program

University of Colorado, Boulder

10/2020 - Present

Tasks/Achievements

- Currently, I mentor underrepresented students in the McNair Scholars program at the University of Colorado, Boulder. My duties in the program are to help guide and provide support to students through several semesters of their undergrad. I will accomplish this by having scheduled meetings with my mentee, help them identify research goals/interest, provide opportunities for the student to develop research skills, and help the student identify research projects on campus that they could apply to.

Teaching Assistant

University of Colorado, Boulder

08/2019 - Present *Boulder, Colorado*

Tasks/Achievements

- Teaching assistant for Wearable Technologies Spring 2020 & spring 2021 - The class introduces participants to basic elements of embedding electronic and computational behaviors into clothing and accoutrements such as watches, handbags, etc. The first two thirds of the class (roughly ten weeks) comprises weekly "lab" exercises as well as associated readings and video viewings. In each exercise participants build one of the "canonical" wearable projects (e.g., an LED-infested wearable, a glove controller, a wearable to provide navigation support for the blind and visually impaired). Readings and video viewings ensure that participants are aware of past and current trends in wearable technologies, ranging from materials, components, fashion and social acceptability, and more. The final third of the class is devoted to designing, developing, debugging and documenting a wearable technology project — developing one of the weekly exercises or inventing a new project. We'll also have a couple of guest talks by faculty / friends working on wearable technologies.

Mentor

Boulder Valley School District

10/2019 - 05/2020 *Boulder, Colorado*

Tasks/Achievements

- During the spring 2020 semester, I mentored a underrepresented STEM Boulder Valley School District high school student. The purpose of this mentorship was to help the student prepare for college applications and how to succeed once enrolled. My role was to also help the students gain experience working on a college-level research project, the end goal of this experience was to have the student present their research at the Boulder county science fair.

MENTORSHIP/TEACHING EXPERIENCE

Mentor

University of Colorado, Boulder

07/2019 - 05/2020 *Boulder, Colorado*

Tasks/Achievements

- Mentor for freshman electrical and computer engineering students (ECEN 1100) - I mentored a group of 5 freshman engineering students for their first semester of college. During my mentorship, I advised the students on college life as well as helped to facilitate communication between each member of the group.

Organizing Committee Member and Mentor

STEMrev

06/2019 - 07/2019 *Boulder, Colorado*

Tasks/Achievements

- STEMrev was founded in 2016 by an engineer and an educator with the purpose of bringing to life the adventure and possibilities of science, technology, engineering and math for middle school aged kids – specifically kids who might not otherwise be given the opportunity to explore these disciplines and discover the possibilities of further education and careers in STEM. With a strong desire to "payback and pay forward" the encouragement and opportunities they had received in their teenage years as well as identifying a need for this type of program for middle school age kids, the founders developed the STEMrev concept with input from kids and their parents. The founders knew, that above all else, the projects needed to be hands-on, fun, and engaging in order to capture the imaginations of middle school age kids. My role on the committee is to help recruit and design curriculum with this non-profit group. STEMrev originally reached out to me due to my experience both in conducting outreach events throughout Colorado and educational research. I will also be a mentor to a 3-student team that will be conducting individual projects with the goal of presenting at the Boulder county science fair next year.

SERVICE

Reviewer

- FabLearn ACM 2020

Reviewer

- CHI 2021 - Interactivity

PRESENTATIONS

The ThreadBoard: Designing an E-Textile Rapid Prototyping Board

Presented (virtual) at TEI 2021 (02/2021)

The ThreadBoard: Designing an E-Textile Rapid Prototyping Board

Presented (virtual) at Google CSRMP/Ph.D. Research Summit (07/2020).

Multisensory Augmented Reality System for Spacesuit Heads-Up Informatics Technologies

Presented At NASA Johnson Space Center, Huston, TX (04/2019).

The Electronette: An HCI Device for Controlling the Human Arm Using Electrical Stimuli

Presented at UNM McNair Scholar Research Conference, Albuquerque, NM (08/2018); SASC STEM Symposium, Boulder, CO (10/2018); & 2018 UROP Sidewalk Symposium, Boulder, CO (11/2018).

A Wearable Meter That Actively Monitors the Continuity of E- Textile Circuits as They Are Sewn

Presented (virtual) at FabLearn 2020 (10/20)

CU Technology for Extreme Enviroments

Presented (virtual) At NASA Johnson Space Center, Huston, TX (04/2020).

Artificial Skin: The Creation of Low-Cost, Replicable Polymer Sensors for Touch Augmentation

Presented at 2019 UMBC McNair Scholars Research Conference, Baltimore, MD (08/2019).

POPULAR PRESS

Make: Magazine, Volume 76 (Print & Digital) [2021] "New From Make: Projects"

Computer Research Association [2021] "Reimagining Human Sensation"
https://conquer.cra.org/undergrad-research-highlights/reimagining-human-sensation

HACKADAY [2020] "MAGNETS MAKE PROTOTYPING E-TEXTILES A SNAP"
https://hackaday.com/2020/02/26/magnets-make-prototyping-e-textiles-a-snap/

Loomia [2020] "A Buyer's Guide to Prototyping at Home"
https://www.loomia.com/blog/buyers-guide-to-prototyping-at-home

Colorado Engineer Magazine [2020] "FALL 2019: THE CHANGE ISSUE"
https://www.colorado.edu/studentgroups/colorado-engineer/content/fall-2019

Jeff Zehnder [2020] "CU Boulder team advances in NASA tech competition"

Amanda Jones [2020] "The Future of AR VR, Personal Identities, and Accessibility"
https://aaayejaaaye.com/2020/03/20/The-Future-of-AR-VR-Personal-Identities-and-Accessibility.html

Amanda Jones [2020] "Christian Hill on Transhumanism"
https://aaayejaaaye.com/2020/02/24/Chris-EMG-Interview.html

Gizmodo - Gen Okamoto [2019] “猫のきもちがわかる？コロラド大学でウェアラブル猫ヒゲが作られる.”
https://www.gizmodo.jp/2019/07/cat-whisker-sensory-extension-wearable.html

Victor Lee, R. Benjamin Shapiro [2019] “Learning in a digital world - perspectives on interactive technologies for formal and informal education.” A Broad View of Wearables as Learning Technologies: Current and Emerging Applications, pp. 15 - 17.
https://www.springer.com/gp/book/9789811382642

Office of Undergraduate Education in Academic Affairs for faculty and staff [2019] “Undergraduate Education News at the University of Colorado Boulder: McNair Scholar Chris Hill's research cited in forthcoming book.”

University of Colorado Boulder Department of Computer Science [2019] “Mentorship, research opportunities augment CS student’s undergrad experience.” colorado.edu.

ARDUINO TEAM [2019] “Experience the world like a cat with this whisker-style sensory extension.” blog.arduino.cc.
https://blog.arduino.cc/2019/07/02/experience-the-world-like-a-cat-with-this-whisker-style-sensory-extension/

Office of Undergraduate Education in Academic Affairs for faculty and staff [2019] “Undergraduate Education News at the University of Colorado Boulder: invited talk at the Interaction, Design, and Children (IDC) conference.”

Cameron Coward [2019] “Build Your Own Cat Whisker Body Augmentation Wearable.” Hackster.io.
https://www.hackster.io/news/build-your-own-cat-whisker-body-augmentation-wearable-4f2f8535c573

University of Colorado Boulder Institute of Cognitive Science [2019] “Christian Hill, Computer Science & ICS Undergraduate Student Awarded Google Mentorship Award."