

Antonin Brun

Ph.D. Student – Research & Teaching Assistant

Sonny Astani Department of Civil and Environmental Engineering
Viterbi School of Engineering
University of Southern California (USC)
3620 S Vermont Ave, KAP 217, Los Angeles, CA 90089
abrun@usc.edu | +1 (650) 248-7776

EDUCATION

[†] Indicates expected.

Ph.D., Civil Engineering University of Southern California (USC), Los Angeles, CA Advisor: Prof. Burçin Becerik-Gerber	2023—2028[†]
M.Sc., Civil and Environmental Engineering Stanford University, Palo Alto, CA Sustainable Design and Construction	2021—2023
B.Eng., Bioresource Engineering McGill University, Montréal, QC	2016—2020

RESEARCH EXPERIENCE

Research Interests

- Human-Building Interaction
- Interaction Design & Data Physicalization
- Intelligent Adaptive Environments
- Building Energy Efficiency & Building Energy Modeling

Research Projects

Examining the Interplay of Occupant Health, Comfort and Building Energy Consumption PI: Prof. Burçin Becerik-Gerber.	2023—present
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This research builds on a study developed by Prof. Mohamad Awada which aims to assess office workers comfort, health, stress and productivity through a longitudinal data collection. We employ the Awair sensor to measure indoor environmental quality (IEQ) factors, as well as the Empatica EmbracePlus to measure the workers physiological data. We use ecological momentary assessments (EMAs) to capture the workers comfort, stress, productivity, and work activity in real-time. We identify healthy temperature ranges that support worker's health, stress, and productivity, and we then evaluate the impacts of these setpoints on energy consumption. Preliminary insights from this research will be submitted to ASCE International Conference on Computing in Civil Engineering (i3CE), 2024.

Funding Source: NSF Grant No. 2204942.

Investigating Energy and Water Saving Habits of Californian Low-Income Housing Residents

2023—2024

PIs: Prof. Burçin Becerik-Gerber, Tim Kohult.

In collaboration with Mirmahdi Seyedrezaei, we conducted interviews with more than 20 low-income housing residents in Southern California to gain insights into their water and energy saving habits, as well as their opinions on smart home technologies. I co-conducted 12 one-hour interviews out of 22, and coded half of the transcripts for future data analyses.

Funding Source: CEC Grant 2022050216.

Developing A Framework for Enhancing Office Workers' Wellbeing and Building Energy Efficiency using Virtual Agents

2023—present

PIs: Profs. Burçin Becerik-Gerber, Gale Lucas.

This research aims to define a framework for designing occupant-centric virtual agents that support occupant wellbeing and building energy efficiency. We collected data from seven office workers over 6 months through four different data streams: perceived physical and mental health symptoms, stress, mood, and productivity levels through hourly Ecological Momentary Assessments (EMAs), physiological data, levels of social interaction, and continuous IEQ measurements of the workers' office spaces. Through a set of focus groups, we identified ways workers would benefit from their data, as well as different means to present their data and how they relate. We discuss these insights and provide design recommendations for occupant-centric virtual agent applications. High-level insights include **real-time personalized occupant feedback** as a key factor in connecting occupants with their surrounding space and their

data. We also discuss designing virtual agents that promote social interaction (occupant-agent rapport) and then need for extensive qualitative and quantitative data for the agents to cater to the specific needs of the occupants. Preliminary insights from this research will be submitted to European Group for Intelligent Computing in Engineering (EG-ICE) conference, 2024.

Funding source: NSF Grant No. 2204942.

Promoting the use of natural ventilation in urban communities

June 2021—2022

PIs: Profs. Catherine Gorré, Sarah Billington, Rishie Jain, and Gabrielle Wong-Parodi.

This exploratory project aimed to estimate the potential for promoting the use of natural ventilation in Californian urban communities. As the sole research assistant, I first led interviews with architects, building designers, building owners, and natural ventilation modelling specialists to identify the challenges with the integration of natural ventilation design. We identify key areas or improvement to accelerate the uptake of natural ventilation centric design. I then developed a natural ventilation potential model (using MatLab), considering past, present, and future climatic trends, as well as building stock. I used this model to evaluate the potential for impact of the project in California through a landscape analysis. From open access air temperature, air pollution, and building stock data, I was able to identify key regions with the most potential for natural ventilation with existing building stock and through retrofits.

Funding source: Stanford School of Sustainability Accelerator – Small Seed.

Proposal Writing Experience

Adaptive Intelligent Spaces for Reduced Worker Stress through Bidirectional Sensorimotor Interactions and Embodied Reasoning (In preparation)

2023—present

Sponsor: NSF's Mind, Machine and Motor Nexus (M3X) Program – EARly-concept Grants for Exploratory Research (EAGER).

Role: I contributed to generating ideas, literature review, defining the scope, objectives, tasks, and timeline. I contributed to writing the proposal in collaboration with experts from Psychology and Human-Computer-Interaction.

PUBLICATIONS

Conferences (submitted)

- [1] **Brun, A.**, Becerik-Gerber, B., & Lucas, G. M. (2024). Toward Occupant-Centric Virtual Agents: A Framework for Enhancing Office Workers' Wellbeing and Building Energy Efficiency. European Group for Intelligent Computing in Engineering (EG-ICE).
- [2] **Brun, A.**, Awada, M., & Becerik-Gerber, B. (2024). Towards Unveiling the Interplay of Occupant Health, Comfort and Building Energy Consumption. ASCE International Conference on Computing in Civil Engineering (i3CE).

TEACHING

CE 578 - Technology-Enabled AEC Projects

Spring 2024

USC, Los Angeles, CA

Course description: This course simulates the working practices in the architecture, engineering and construction (AEC) industry. Students will work individually and in teams and be responsible for designing, developing, estimating, scheduling, and administering the work for a small commercial or residential project emphasizing industrialized construction. Each student in a team will assume an AEC role such as the designer, scheduler, structural engineer, cost engineer, etc. An important instrument to facilitate the collaboration will be the use of technology. In this course, technology is explored as a catalyst for change, poised to reduce the industry's fragmentation, improve its efficiency, and increase effectiveness and as a key driver to increase productivity. The emphasis is on understanding the capabilities of methods and technologies so that the appropriate tools, systems, and equipment can be implemented for an AEC project. The course is not intended to teach the skills required to design, engineer, construct, and manage but to cover topics that aid in the demonstration of these previously acquired skills in the program and the integration and decision making that must be made in the development of a construction project.

Responsibilities: I led 2-hour weekly tutorial sessions to help students learn a new skill/concept with Dassault Systèmes' 3dExperience Suite. I also coordinated class sessions and invite guest speakers. I also helped students trouble shoot program-related issues and advise them with their design decisions. Finally, I supported the professor with grading and judging final student design submissions.

CE 573 - Advanced Technologies in AEC Practices

Fall 2023

USC, Los Angeles, CA

Course description: The architecture, engineering, and construction (AEC) industry is facing enormous technological and institutional changes and challenges. One very important instrument to facilitate these changes and the digital transformation of the AEC industry is the use of technology. The 21st century designers, architects, engineers, and construction managers must be able to manage and harness the rapid pace of technological change, a highly interconnected world, and complex projects that require creative and technologically enabled solutions. In this course technology is argued to be a catalyst for change, poised to reduce the industry's fragmentation, improve its' efficiency, effectiveness and as a key catalyst to increase productivity. Students will learn about a series of state-of-the-art technologies and their applications in design, architecture, engineering, and construction management functions including for example advanced modeling and analysis technologies and techniques, automation technologies, optimization, visualization, integration platforms, management systems, foresight techniques, AI and machine learning in the AEC and design thinking and innovation strategies and methodologies. The emphasis is on understanding the capabilities of available and developing technologies so that the appropriate tools, systems, equipment, and methods can be implemented for a particular AEC function, project, or challenge.

Responsibilities: I helped coordinate class sessions and invite guest speakers to cater a rich experience for the students to learn from industry experts.

ENGR 103 - Public Speaking

Fall 2022—Spring 2023

Stanford University, Palo Alto, CA

Introduction to speaking activities, from impromptu talks to rehearsed formal professional presentations. How to organize and write speeches, analyze audiences, create and use visual aids, combat nervousness, and deliver informative and persuasive speeches effectively. Weekly class practice, rehearsals in one-on-one tutorials, videotaped feedback.

Responsibilities: I have co-led a section of 8 students, provided them with feedback on their public speech capabilities, and graded their deliveries. I established close connections with the students by promoting an inclusive environment and encouraging active participation in the class. I have also held weekly office hours to help students identify strengths of their speech, but also help them refine areas of improvement. I ensured

all students had a comparable rate of improvement in the class regardless of their abilities before joining the class.

SELECTED HONORS AND AWARDS

Annenberg Fellowship

2023—2024

USC, Los Angeles, CA

Undergraduate Thesis Award

2020

The Canadian Society for Bioengineering

Thesis: "Food Waste Fermentation". Awarded **\$250CAD** to use toward academic expenses.

Murray & Eleanor McEwen Clean Water Scholarship

2020

McGill University, Montréal, QC

Established in 2010 by Murray McEwen, B.Sc.(Agr.) 1952, D.Sc. 1993, for outstanding undergraduate students who have completed at least one year in the B.Sc.(Ag.Env.Sc.) or the B.Eng. (Bioresource) program in the Faculty of Agricultural and Environmental Sciences. Awarded by the Faculty of Agricultural and Environmental Sciences Scholarships Committee on the basis of academic merit to students who have a strong interest in the protection, development or restoration of clean water resources. Preference will be given to, but not limited to, students whose work and studies are carried out in a Canadian context, especially in Canada's northern lands, and/or are of direct benefit to Canada's First Nations. Awarded **\$3,000CAD** to use toward academic expenses.

Dean's Honour List

2019—2020

McGill University, Montréal, QC

A maximum of the top 10% of the students in each faculty based on the combined GPA for the Fall and Winter terms are named to the Dean's Honour List. This designation, while carrying no monetary reward, is an official University recognition of the student's achievements and is recorded on the transcript. Individual faculties should be consulted regarding any additional criteria which may be used.

ACADEMIC SERVICES

Reviewer

- ASCE International Conference on Computing in Civil Engineering (i3CE), 2024.

COMMUNITY SERVICES

- Vice-President of the Leaders of the Built Environment (student association), 2021—2022, Stanford University.
- Member of the winning team (7 students) at the ASC Student Construction Competition in Reno, Open Category - Integrated Project Delivery, February 2022, Stanford University.
- Orientation Leader, 2017—2019, McGill University.