Abdelkader Elkounni

PhD Candidate — MuSIC Doctoral Network, La Rochelle University

Academic Portfolio

Research · Education · Experience

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ResearchGate profile

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Contents

1. Overview

1.1 Short Bio

Abdelkader Elkounni is a Doctoral Candidate in the MuSIC Marie Skłodowska-Curie Doctoral Network (Horizon Europe), hosted at La Rochelle University, France. He holds a Bachelor of Technology in Renewable Energies and Sustainable Development from Cadi Ayyad University (2019) and a Master of Engineering in Green Buildings and Energy Efficiency from Mohammed VI Polytechnic University (2022), where his thesis introduced a novel multi-objective optimisation framework for building energy model calibration. His doctoral research investigates the acute effects of light intensity and time of day on thermal perception, thermoregulatory physiology, and thermal behaviour in indoor environments, combining chronobiology, human physiology, and building science within controlled human-subjects experiments. He has conducted research secondments at RWTH Aachen University and the Polytechnic University of Cartagena, and has published in peer-reviewed journals including *Scientific Reports* and *Energy and Buildings*.

1.2 Professional Goals

Short-term

- Complete the doctoral thesis and research programme by the expected date of July 2026.
- Pursue a postdoctoral position in thermal comfort research with a focus on human-subjects physiological experimentation.

Medium-term (3–5 years post-PhD)

- Apply for independent postdoctoral research funding to design and lead large-scale epidemiological studies on human thermal experience across diverse populations and climate contexts.
- Develop an interdisciplinary research programme integrating thermophysiology, wearable sensing, and building performance.

Long-term

- Join a university faculty as a professor and establish a dedicated research laboratory focused on human heat exposure risk, thermoregulatory health, and human-centric building design.

1.3 Vision Statement on Science and Technology

A central challenge in built environment research is the absence of a coherent framework explaining how non-thermal stimuli and light in particular interact with the circadian

system to shape the way people perceive, respond to, and regulate their thermal environment. Much of the existing literature on thermal comfort has treated human experience as a largely static phenomenon, driven by environmental parameters alone, while systematically underweighting the role of time-of-day and the physiological state of the occupant at the moment of exposure.

This matters because thermal comfort is not a fixed state it is a physiologically regulated, temporally variable experience. Buildings designed and controlled without accounting for circadian variability will systematically fail to provide comfort when it is most needed, and will waste energy pursuing targets that do not reflect actual human physiology. Better integration of chronobiological knowledge into thermal comfort theory and building control has the potential to improve both occupant wellbeing and energy efficiency.

The goal is to contribute a physiology-based, temporally informed framework that links light exposure, circadian regulation, physiological markers, and subjective thermal responses in a way that is both scientifically rigorous and practically applicable. This means developing research tools experimental protocols, preprocessing pipelines, statistical models that can translate laboratory findings into actionable guidance for building design and intelligent environmental control systems. In the longer term, the ambition is to build a research environment in which human heat exposure risk, circadian health, and built environment design are studied together, rather than in disciplinary isolation.

2. Studies and Qualifications

2.1 Bachelor's Degree

Bachelor of Technology in Renewable Energies and Sustainable Development — **2019**
Cadi Ayyad University, Essaouira, Morocco

2.2 Master's Degree

Master of Engineering in Green Buildings and Energy Efficiency — **2022**
Mohammed VI Polytechnic University (UM6P), Benguerir, Morocco

Thesis: *CSA-MOO: A Novel Framework for Building Energy Performance*

2.3 PhD (In Progress)

PhD in Thermal and Energy Engineering — **Expected July 2026**
La Rochelle University, La Rochelle, France

2.4 Other Certifications and Language Qualifications

Test de Connaissance du Français (TCF) — Campus France / France Éducation International — Level B2 — 2022

3. MuSIC Project Overview

3.1 MuSIC Doctoral Network

MuSIC is a Marie Skłodowska-Curie Actions (MSCA) Doctoral Network funded under the European Union's Horizon Europe research and innovation programme (Grant Agreement No. 101073357). The network trains ten early-career researchers across European institutions in human physiology, multisensory perception, building design, and energy performance simulation. Its overarching mission is to develop multi-sensory solutions for increasing human–building resilience in the face of climate change, and to train a new generation of professionals capable of delivering liveable, sustainable, and health-promoting indoor and outdoor environments.

Funded by	European Union, Horizon Europe — Marie Skłodowska-Curie Actions
Grant No.	101073357
Researchers	10 Doctoral Candidates
Website	music-dn.com
Duration	1 December 2022 — 30 November 2026

3.2 Individual Research Project

Project reference: DC 2 — Acute Dynamic Physiological Reaction and Perception

Host Institution: La Rochelle University, La Rochelle, France

Main Supervisor: Dr. Marika Vellei, Researcher
Univ. Bordeaux, CNRS, Bordeaux INP, Arts et Métiers Institute of Technology, I2M, UMR 5295, Talence, France

Co-Supervisor: Prof. Jérôme Le Dréau
Laboratory of Engineering Sciences for the Environment (LaSIE, UMR CNRS 7356), La Rochelle University, France

Co-Supervisor: Prof. Christian Inard
Laboratory of Engineering Sciences for the Environment (LaSIE, UMR CNRS 7356), La Rochelle University, France

Duration: May 2023 — July 2026 (expected)

3.3 Research Abstract

Research Abstract

This project investigates how light intensity interacts with time of day to shape subjective thermal assessment, thermoregulatory physiology, and thermal behaviour in indoor environments. While previous thermal comfort research has largely emphasised the hue-heat hypothesis, it has often overlooked the circadian timing of exposure and the physiological pathways through which light may alter thermal experience. Building on chronobiology, thermoregulation, and building science, this work asks whether the effect of light on thermal sensation depends on when exposure occurs, and whether any perceptual shift is accompanied by coherent physiological change.

To address this question, the study employed a controlled 2×2 repeated-measures design crossing light intensity (bright vs. dim) with time of day (morning vs. midday). Twenty healthy young adults completed all four conditions in a climate chamber under tightly regulated warm exposure. The visual intervention was designed to isolate light intensity while maintaining the same spectral composition across conditions. The protocol incorporated both steady-state and dynamic thermal phases, including fan-induced cooling and passive rewarming, to test whether light effects persist across distinct thermoregulatory states. Subjective thermal votes, behavioural adjustment, and continuous physiological recordings were collected simultaneously. The physiological dataset included skin temperature, photoplethysmography, laser Doppler flowmetry, and electrodermal activity. Dedicated preprocessing pipelines quality-checked, corrected, and aggregated these multimodal signals into analysis-ready predictors. Statistical inference was structured through a hierarchical mixed-effects framework combining cumulative link mixed models for ordinal thermal sensation and generalised linear mixed models for physiological and behavioural outcomes.

The expected contribution of this thesis is to provide a physiology-grounded account of thermo-photometric interaction that integrates circadian timing into thermal comfort research. More broadly, the project supports the development of human-centric building control strategies that combine lighting and thermal regulation to improve occupant comfort, inform the interpretation of wearable physiological signals, and potentially improve building energy efficiency.

4. Professional Experience

4.1 Positions Held

PhD Candidate (MuSIC Doctoral Network) **May 2023 — present**
La Rochelle University, LaSIE UMR CNRS 7356, La Rochelle, France

Conducting original doctoral research on the acute effects of light and time of day on thermal perception and physiology. Responsibilities include experimental design and execution, laboratory instrumentation, physiological data acquisition and preprocessing, and statistical modelling. Member of the MuSIC Marie Skłodowska-Curie Doctoral Network (Grant No. 101073357).

Research Intern **Jan 2022 — Jul 2022**
Laboratory of Materials, Energy and Environment, Marrakech, Morocco

Evaluated evolutionary algorithms (NSGA-II, NSGA-III, MOEA/D) for the calibration and multi-objective optimisation of building energy models, and investigated surrogate model accuracy using a novel sampling strategy. Work led to a publication in *Energy and Buildings* (2023).

Teaching Assistant — Optimisation (Master level) **2025 — 2026**
La Rochelle University, Department of Civil Engineering, La Rochelle, France

Delivered tutorial sessions in optimisation methods to Master-level students.

Specialized Technician Intern **Apr 2019 — Jun 2019**
Direction de la Météorologie Nationale (DMN), Essaouira, Morocco

Sized a standalone photovoltaic power plant to supply an automatic weather monitoring station at Essaouira Airport. Conducted a techno-economic analysis of the solar PV installation and developed a VBA application to automate the sizing procedure for standalone PV systems.

4.2 Research Exchanges and Secondments

Polytechnic University of Cartagena — Department of Electrical Engineering, Cartagena, Spain Apr 2025 — Jun 2025

Secondment within the MuSIC Doctoral Network. Developed signal processing and artefact correction algorithms for photoplethysmography (PPG), laser Doppler flowmetry (LDF), and electrodermal activity (EDA) signals collected during the human-subjects experiments.

RWTH Aachen University — Chair of Healthy Living Spaces, Aachen, Germany Sep 2024 — Dec 2024

Secondment within the MuSIC Doctoral Network. Conducted data mining and advanced statistical analysis on physiological, environmental, and subjective data collected from human-subject experiments in controlled laboratory conditions.

4.3 Conference Presentations

All presentations listed below were delivered as oral talks by the author.

[1] Elkounni, A., Vellei, M., Le Dréau, J., and Inard, C. "A Circadian Influence on Short-Term Warmth Adaptation." *REHVA HVAC World Congress*, Springer, 2025. (pp. 45–55)

[2] Er-retby, H., El Kounni, A., Gartoumi, B.I., Mastouri, H., Benhamou, B., Radoine, H., and Silva, M.C.G. "Assessment of the Indoor Environment Quality in UM6P Classrooms." *CLIMA 2022 Conference*, Delft, Netherlands, May 2022. DOI: 10.34641/clima.2022.272

[3] El Kounni, A., Radoine, H., Mastouri, H., Bahi, H., and Outzourhit, A. "Solar Power Output Forecasting Using Artificial Neural Network." *9th International Renewable and Sustainable Energy Conference (IRSEC)*, IEEE, 2021. (pp. 1–7)

4.4 Equipment and Software Proficiency

4.4.1 Laboratory Instrumentation

Designed, deployed, and operated an integrated experimental laboratory platform for building science and thermal comfort research, combining controlled thermal environments, programmable lighting, physiological monitoring, wearable sensing, and environmental metrology. Responsibilities included instrumentation setup, signal acquisition, calibration, and verification across multimodal systems.

Thermal environment & climate control
Climate chamber experimental platform; Type T and Type K thermocouples; HMP110 humidity probe; Vaisala GMP222 CO_2 sensor; hot-wire anemometers.

Lighting
Philips Hue Surimu programmable LED panels; PSR+ spectroradiometer with right-angle diffuser; HD2021T illuminance transmitter; IHM8850 sound level meter.

Physiological monitoring
BIOPAC MP160 data acquisition system; BioNomadix BN-PPGED and BN-SKT2 modules; BN-PULSE-XDCR and BN-TEMP-A-XDCR sensors; LDF100C Laser Doppler Flowmetry with TSD140 surface probe; Empatica Embrace Plus wearable device.

Data acquisition & calibration
Keysight 34980A DAQ with 34921A multiplexer modules; calibration bath; Pt100

sensors; traceable reference thermometer.

4.4.2 Simulation Software

- Building performance simulation: TRNSYS, EnergyPlus, OpenStudio

4.4.3 Programming and Data Analysis

- Languages: Python, R, MATLAB, Fortran, C, VBA, LaTeX
- Methods: Machine Learning, Generalised Linear Mixed Models (GLMM), Causal Inference, Signal Processing, Sensitivity Analysis, Multi-Objective Optimisation, Experimental Design

5. Publications and Research Results

5.1 Journal Articles

[1] A. Elkounni, M. Vellei, J. Le Dréau, M. Schweiker, and C. Inard, "Acute effect of light and time of day on thermal physiology, perception, and behavior," Scientific Reports, vol. 15, no. 1, p. 38640, 2025.

[2] A. El Kounni, A. Outzourhit, H. Mastouri, and H. Radoine, "Building energy model automated calibration using pymoo," Energy and Buildings, vol. 298, p. 113524, 2023.

5.2 Conference Papers and Proceedings

[1] A. Elkounni, M. Vellei, J. Le Dréau, and C. Inard, "A circadian influence on short-term warmth adaptation," in REHVA HVAC World Congress, pp. 45–55, Springer, 2025.

[2] H. Er-retby, A. E. Kounni, B. I. Gartoumi, H. Mastouri, B. Benhamou, H. Radoine, and M. C. G. d. Silva, "Assessment of the indoor environment quality in UM6p classrooms,

[3] A. El Kounni, H. Radoine, H. Mastouri, H. Bahi, and A. Outzourhit, "Solar power output forecasting using artificial neural net- work," in 2021 9th International Renewable and Sustainable Energy Conference (IRSEC), pp. 1–7, IEEE, 2021.