ABSTRACTIONS

PHD SYMPOSIUM 2025, FACULTY OF ARCHITECTURE, UIBK, universität innsbruck 27 NOVEMBER

ABSTRACTIONS

PHD SYMPOSIUM 2025, FACULTY OF ARCHITECTURE, UIBK, universität innsbruck 27 NOVEMBER

27.11.2025 STUDIO2 FOYER @ FACULTY OF ARCHITECTURE

PhD supervisors: Kathrin Aste, Marjan Colletti, Günther H. Filz, Andreas Flora, Olaf Gipser, Barbara Imhof, Claudia Pasquero, Marco Poletto, Miro Roman, Stefan Rutzinger, Kristina Schinegger, Karolin Schmidbaur, Peter Trummer

ORGANIZED BY: MIRO ROMAN, BARBARA IMHOF, KAROLIN SCHMIDBAUR

guests:
Prof. Dr. Ludger Hovestadt (ETH Zurich)
Prof. Dr. Philippe Morel (UCL London)

10.00 - 10.30 Introduction

10.30 - 11.30 Vadim Smakhtin: Aesthetics as a Protocol
11.30 - 12.30 Nur Esin Karaosman: Architect as Speculative Archaeologist

13.30 - 14.30 Natalia Piorecka: Advancing Mycelium-Based Materials
14.30 - 15.30 Muchen Yan: A Data-Driven Framework for the High-Value Upcycling of Irregular Concrete Waste

16.00 - 17.00 Ugochukwu Eze: Citiness of Lagos
17.00 - 18.00 Simon Oberhammer: Principles of Plasticity

Aesthetics as a Protocol

Name: Vadim Smakhtin

Title: Aesthetics as a Protocol

Subtitle: Using patterns and aesthetics to perceive and understand ecology

Keywords: art, ecology, data, patterns, cybernetics

Affiliation: UIBK, IOUD, Synthetic Landscape Lab

Supervisors: Prof. Claudia Pasquero, Dr. Marco Poletto

Abstract

Contemporary approaches to ecological valuation, driven by systems like carbon credits, are fundamentally reductionist. By attempting to index complex, living systems into quantifiable units, they fail to capture the state of modern ecological relationships. “Aesthetic as a Protocol” challenges such paradigms by proposing a novel framework for understanding and representing ecological value through visual patterns, using 3D scanned landscapes as a medium for ecological communication.

Aesthetics becomes a joining force between material, technological, and economical layers of ecology. Whereas formal ecological evaluation models impose rigid boundaries that artificially narrow the “surface of interaction” between these domains, an aesthetic approach imposes a more fluid form of a dialogue. It bypasses restrictive formalisms, allowing the visual and structural complexity of the ecological environment itself to become the medium for revealing and negotiating systemic interdependences.

By treating the 3D scan not as a static dataset but as a dynamic symbolic object, this research develops an interdisciplinary methodology that blends environmentalism, digital media theory, and computational design. It provides a new “lingua franca” of the modern ecological understanding — a powerful visual and conceptual lexicon for articulating, communicating, and ultimately, valuing the ecology that surrounds us.

Figure 1 3d scan of a tree bark

Bio

Vadim Smakhtin is a creative technologist whose work bridges art, data analytics, and architecture. As a PhD candidate at the University of Innsbruck's Synthetic Landscape Lab (supervised by Prof. Claudia Pasquero and Dr. Marco Poletto), he explores the convergence of technological and ecological layers.

His practice centres on distributed computing, extended reality, and data visualization, consistently examining technology's social, political, and economic dimensions within ecological contexts. Early in his career, he worked in big data for urban analytics startup, before taking on the role of Head of Product & Tech at the Sovereign Nature Initiative.

At the Sovereign Nature Initiative, Smakhtin helped reimagine ecological economics through novel funding mechanisms. His notable contributions include the Decentralized Ecological Economics Protocol (DEEP), which connects ecological data with digital systems to generate conservation funding, and Nature Cognita, a project investigating how non-human entities can be represented digitally.

Throughout his career, Smakhtin has maintained a critical perspective on technology's relationship with society and ecology, working to create systems that bridge physical and digital worlds for environmental benefit.

Conducting Field Research at the Edge Zone: Architect as Speculative Archaeologist

Nur Esin Karaosman
Affiliation: University of Innsbruck, Institute of Urban Design (IOUD)
Supervisor: Peter Trummer

Keywords: Speculative Archaeology, Edge Zone, Field Research, Epistemology, Ontology, Pedagogy

Abstract:

To investigate the future of the architectural discipline, we must first acknowledge something about disciplines in general. Architecture is one among many disciplines, and none of them are natural. They do not emerge directly out of states of being — disciplines are social constructions. Everything that is socially constructed maintains a boundary for the obvious need to differentiate itself from others. But society itself is not static, as it is subject to historical transformations. The boundaries need to be constantly renegotiated. What's understood as a discipline is primarily the result of how these boundaries are understood.

Recognizing that the discipline of architecture is a social construction, the challenge we face today is to venture out into the edge zones to establish new boundaries. This research shifts the focus from the canonical to the unsanctioned, to the hazy frontier zones, examining them not as a geographic problem but as epistemological, ontological, and pedagogical ones where disciplinary knowledge is most unstable.

The insight at the heart of this research is the unexpected realization that the field of archaeology has quietly established during the Enlightenment period a mode of investigation for exploring the frontier zones of social constructions. Would it be possible to use the epistemological procedures of archaeology but reverse the temporality of its subject matter? This research introduces the term *speculative archaeology* for this exploration. In doing so, it examines ways of knowing as forms of speculation, investigating them within the depths and the convergences of the realities that we inhabit. Even though the focus of this research is on architecture, there is also an emphasis that it may be applied more broadly to other humanities disciplines.

Archaeology is not motivated by a desire to reinforce what is already known. It aims to discover new realities by turning existing ways of knowing into active sites of construction. Archaeology constructs views of the past, ways of thinking, stories, and theories through artifacts, material remains that reveal incomplete knowledge and require interpretation. This research argues that speculative archaeology can reverse this temporality to stage our encounters with the other possible worlds within the present and future realities. Archaeological methods of understanding, close observation, and meticulous documentation, though traditionally understood as procedures for uncovering facts, quickly become provocative design problems for exploring alternative ways of knowing the world, the moment the polarity is shifted to the future.

From a certain perspective, we can observe that the architect's studio has always been a place of speculative archaeology. As a resident of the humanities, architects have always been trying to understand inhabited worlds, have documented them, and in doing so have brought worlds into existence as much as discover them. Although creativity remains a primary concern, we rarely acknowledge what we do not yet know and question our assumptions about realities, which is necessary for transformation. As architecture is ultimately about the composition of reality, can an architect become a speculative archaeologist to unravel the other possible ways of being for the realities, within their depths and beneath their surfaces?

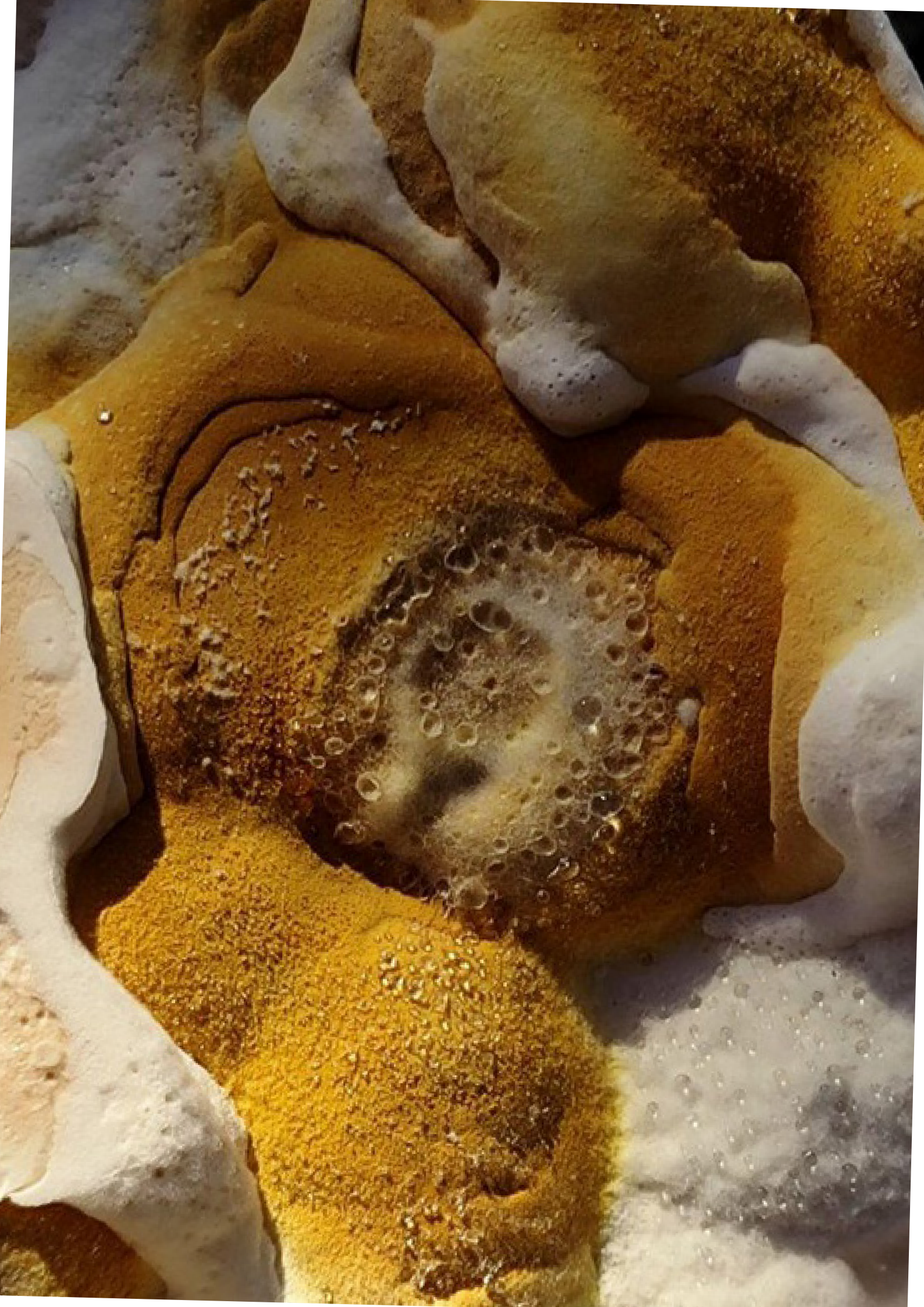
Short Bio:

Nur Esin Karaosman is currently pursuing her doctoral studies under Peter Trummer's supervision at the University of Innsbruck, Austria. Her research brings the focus to the edge zones of disciplines—ontological, epistemological, and pedagogical zones where knowledge becomes most unstable. By introducing the term speculative archaeology for the exploration of these zones, she examines ways of knowing as forms of speculation, investigating them within the depths and the convergences of the realities we inhabit.

She graduated from Southern California Institute of Architecture, SCI-Arc, with a B. Arch in 2022, receiving the *Blythe and Thom Mayne Undergraduate Thesis Award*, and a Master of Science in Design Theory and Pedagogy in 2024 with the *Hsinming Fung and Craig Hodgetts Postgraduate Thesis Award* for her project "*The Pleasure of an Unknown Navigation*".

She has taught as an Assistant Teacher at SCI-Arc's postgraduate program, Synthetic Landscapes, with David Ruy, and also taught at James Madison University. She has worked and collaborated with architects such as Maxi Spina, Jia Gu, Mark Foster Gage and Ferda Kolatan.

Nur Esin Karaosman, *"The Pleasure of an Unknown Navigation"*, SCI-Arc, 2024.



Advancing Mycelium-Based Materials: Species, Substrates, and Symbiotic Strategies for Biofabricated Architecture

Applicant: Natalia Beata Piórecka
Supervisor: Prof. Barbara Imhof (Integrative Design / EXTREMES)

Abstract

The construction industry is among the largest contributors to energy consumption and CO_2 emissions. Materials such as concrete, steel, and plastics continue to dominate the sector, despite the significant environmental impact associated with their production. To create climate-neutral and future-oriented cities, new material systems are needed that incorporate ecological cycles and rely on renewable, living resources.

Mycelium-based composites - materials grown from the root-like network of fungi - offer remarkable potential for sustainable design. Acting as a natural binder, mycelium interweaves agricultural residues into lightweight, biodegradable, and fire-retardant structures. Since they can be cultivated using waste materials, these composites naturally embody principles of circular design. Despite their promise, however, the scope of current applications remains very limited. Out of an estimated 2.2 to 3.8 million fungal species existing globally, only about 150,000 have been formally identified. In practice, the material production in both research and industry relies primarily on very few species. This narrow focus restricts the exploration of the immense biological and material diversity that fungi can offer, constraining both performance and design innovation.

This dissertation explores ways to overcome these limitations by: expanding the current mycelium-based library through:

(1) Testing understudied and local fungal species with distinct structural and aesthetic qualities, seeking development in new material properties such as mechanical strength & performance, biological surface formation and pigmentation.

(2) Developing substrate mixtures - both organic (such as hemp fibres, shives, and stems) - as well as inorganic to create graded and diverse material properties.

(3) Developing symbiotic material systems in which multiple materials or organisms work together as collaborators, offering complementary performance or functional or aesthetic material enhancement.

Through experimental and design-based research, the project will result in a material library and a series of prototypes demonstrating how biological diversity can lead to new architectural qualities. The aim is to establish mycelium not only as a sustainable functional material but as a dynamic platform for a circular and future-oriented architecture with real-life applications. In doing so, the project directly contributes to European climate goals and the development of resilient cities.

Fig 1. Mycelium-based material variety of finishes achieved through natural processes - expressing a variety of material properties in the surface expression, texture and colouration

Short bio:

Natalia Piórecka is an interdisciplinary designer with an architectural background. She holds a Bachelor's degree in Architecture from Newcastle University and a Master's degree in Bio-Integrated Design from The Bartlett School of Architecture, UCL, where she received the Bartlett's Best MArch Award. Currently, she is a PhD researcher at the University of Innsbruck within the Integrative Design / EXTREMES group. Her doctoral research explores fungal and bacterial material systems, focusing on mycelium-based materials and their advancement and integration into architecture and design. She leads the MUSE - MyceliUm SEat project, developing grown furniture prototypes and hybrid biomaterials that challenge conventional notions of durability, production, and temporality. Her work bridges architecture, biology, and fabrication to advance living, regenerative material practices.

A Data-Driven Framework for the High-Value Upcycling of Irregular Concrete Waste

Keywords: Concrete Reuse, Data-driven Computational design, Material Aesthetics, Circularity

Muchen Yan

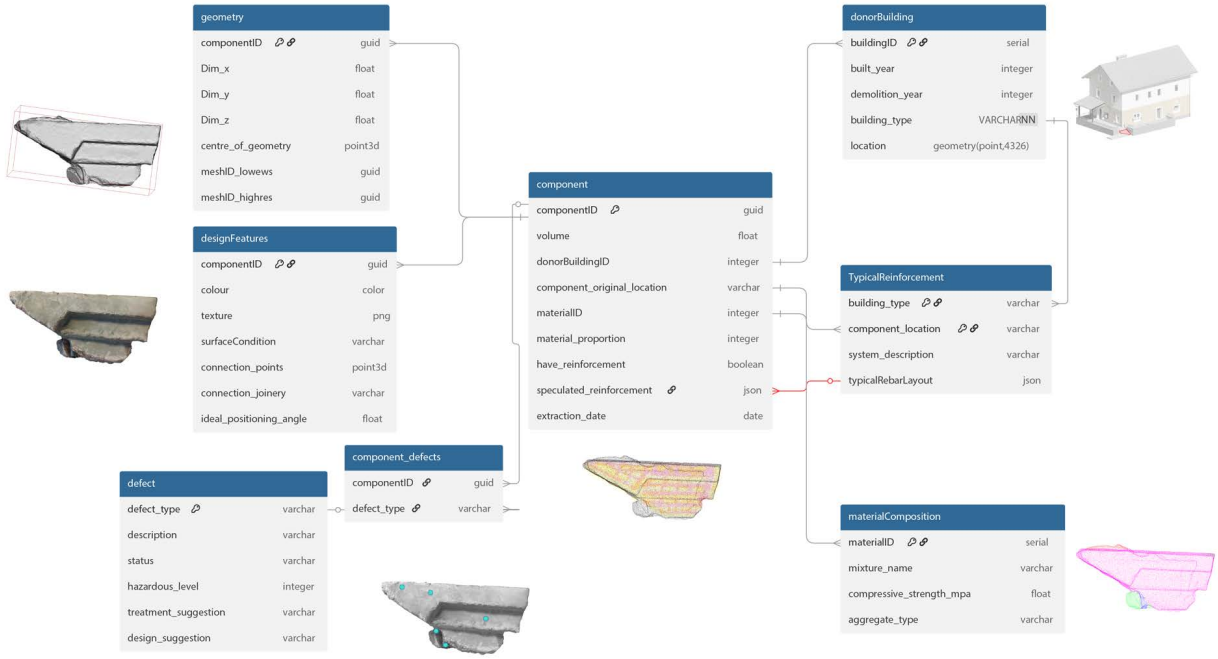
The escalation of construction and demolition waste (CDW), dominated by concrete, represents a critical failure in the transition to a circular economy. Current recycling practices are predominantly low-grade, crushing concrete into aggregate, which overlooks the material's inherent potential. While high-value reuse has been demonstrated in bespoke projects, a scalable methodology for the vast quantities of *irregular* concrete rubble from in-situ demolition remains elusive. The primary barrier is not material, but a systemic lack of integrated workflows that bridge computational design, material characterization, and on-site logistics.

This doctoral research builds upon preliminary investigations that validated a digital-physical workflow for upcycling concrete rubble into public furniture. This foundational case study, integrating 3D scanning, augmented reality (AR), and parametric adaptation, successfully demonstrated the potential to create high-value objects that leverage specific aesthetic principles. However, the study also revealed a critical bottleneck that prevents scalability: a profound lack of accessible, multi-dimensional information available to designers during the creative process. The manual selection of components in the case study is infeasible at an industrial scale. Effective upcycling demands a holistic understanding of each fragment, including not only its geometry but its source structure, material properties, aesthetic features, and critically, its internal reinforcement.

This research aims to bridge this information gap by developing and testing a framework for the scalable, informed, and design-driven upcycling of irregular concrete waste. The central objective is to move beyond bespoke prototypes by creating a system that provides designers with the data necessary for rapid, high-value component matching and assembly.

The core methodological contribution will be the development of a novel, rapid assessment methodology termed "Rubble Archaeology." This approach directly addresses the critical information gap regarding undocumented internal reinforcement. Given that the vast mid-20th-century building stock lacks accurate documentation and current non-destructive testing (NDT) methods like GPR are too slow and costly for demolition sites, this research proposes a probabilistic inference model. This model will be trained on a synthetic dataset generated from historical building codes and structural typologies (e.g., typical rebar layouts from 1950-1980). By taking a fragment's 3D geometry and fragmentary evidence (such as visible rebar ends) as input, the model will be developed to infer the probability distribution of the internal rebar layout.

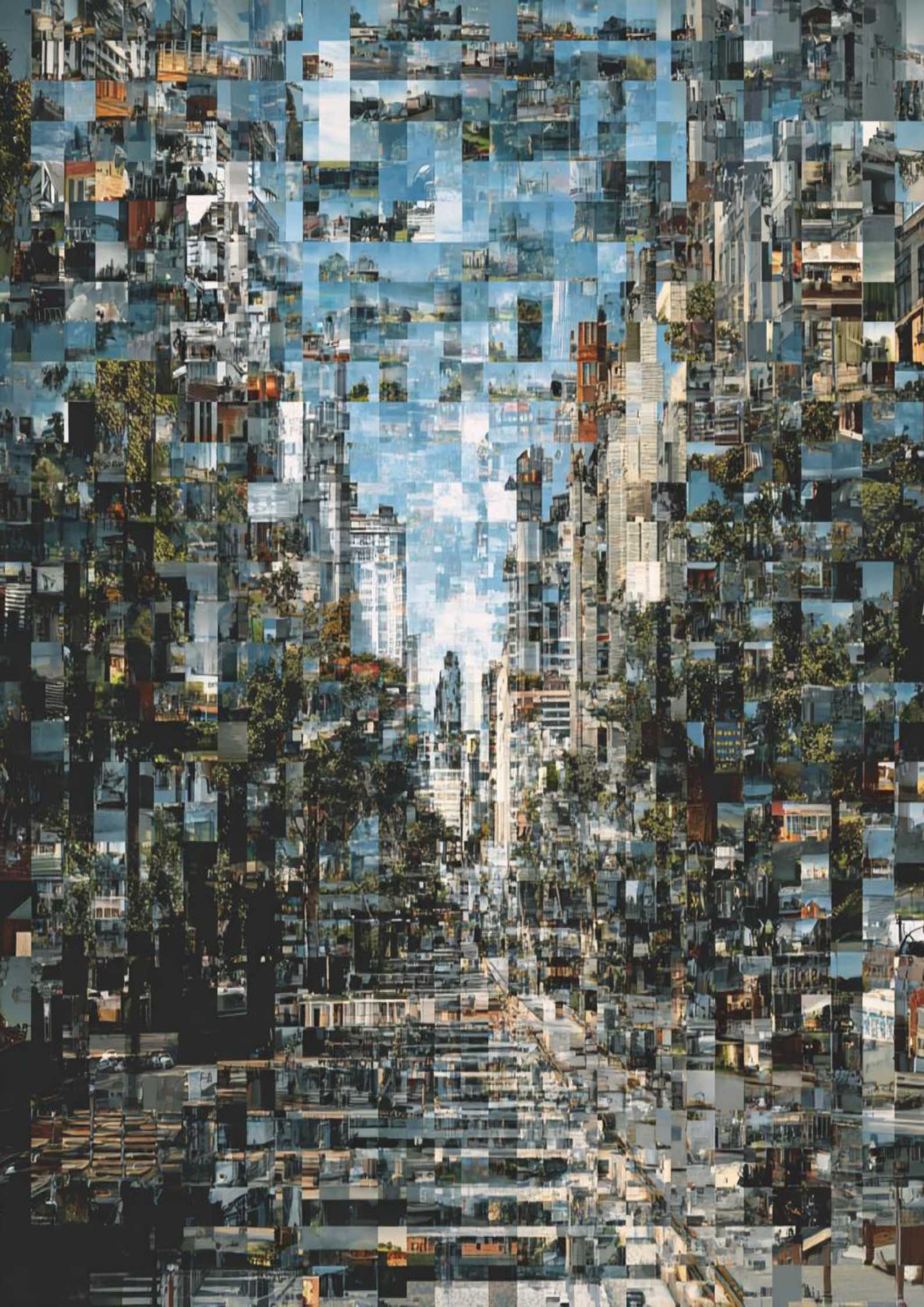
This 'Rubble Archaeology' method will form the backbone of a proposed CAD-integrated, multi-dimensional database. This database framework will be designed to manage reclaimed components, holistically capturing their geometric, aesthetic, and newly inferred structural properties. By validating this framework through advanced computational simulations and further design-build case studies, this PhD will provide a scalable and holistic methodology that empowers designers to unlock the latent value in concrete rubble, fostering the industrial and societal acceptance required for a truly circular construction sector.



Supervisors: Stefan Rutzinger, Kristina Schinegger

Institute of Design, structure and design research group i.sd

Bio: Muchen Yan is a PhD student and University assistant in the University of Innsbruck, structure and design research group. Her research focuses on circular design strategies, robotic fabrication, and human-robot collaboration. She holds degrees from the Royal Danish Academy in Denmark and the University of Melbourne, Australia, where she engaged in a variety of digital design and fabrication projects utilizing emerging technologies. Her work aims to bridge computational design processes with sustainable construction practices.



Citiness of Lagos:

AI-Driven Emotional Cartographies for Urban Futures in Lagos.

Eze Ugochukwu Franklin MSc

Abstract

This paper demonstrates The Citiness Experiment, an AI-driven methodology that redefines how cities are understood, sensed, and designed. Moving beyond analytical mapping or predictive planning, it proposes a synthetic mode of listening, where emotion, data, and spatial experience converge into an affective computation of the city. Lagos, with over 24 million inhabitants and an annual growth rate of 6%, demands such a rethinking: its urbanism emerges not from order but from improvisation, informality, and collective intelligence.

By integrating geospatial sentiment data, multimodal image-text fusion, and probabilistic modeling on thousands of texts and images crawled from twitter, the experiment treats Lagos as a living system, a field of resonances where culture and computation co-produce meaning. The methodology employs Geospatial Sentiment Mapping, Mood Density Visualization, and Feature Space Clustering to synthesize emotional patterns rather than merely measure them.

The result is the Citiness Index, a framework for understanding urban sentience and cultural embeddedness through computational empathy. Rather than imposing a masterplan, this research listens to the city's moods, asking: *If one seeks joy, where in Lagos should they go? If they seek silence, where does neutrality reside? And where does frustration thicken like traffic fumes?*

Lagos thus becomes not a case study but a prototype for a new epistemology of urban design, where architecture, data, and emotion converge to imagine the futures of the Global South.

Keywords

Geospatial Sentiment Analysis, Image-Text Fusion, Computational Urbanism, Multimodal AI, Feature Space Visualization, Citiness Index

Ugochukwu Franklin Eze, MSc

Doctoral Researcher | Lecturer (EX847156)
Ugochukwu.Eze@uibk.ac.at

Institute of Design, Gestaltung1

Faculty of Architecture,
University of Innsbruck,
Technikerstr. 21, A-6020 Innsbruck, Austria.

Bio.

Doctoral Candidate and External Lecturer at the University of Innsbruck's Faculty of Architecture, investigating computational and probabilistic urbanism in rapidly evolving African cities.
My doctoral research, The Citiness of Lagos: Listening to the Probabilistic City, explores how Lagos generates urban intelligence through rhythm, improvisation, and digital participation rather than through planning or order.

Using AI-driven sentiment mapping, multimodal data fusion, and geospatial visualization, my research transforms these emotional inquiries into spatial, probabilistic structures emotional cartographies that reveal how cities feel as much as how they function.

Currently teaching under Course Code **EX847156** (Feb – Aug 2025), lead the collaborative field excursion *Lagos: Listening to the Probabilistic City* and co-develop new frameworks for computational urban empathy.


859
wax; capable of shaping or
plastic, supple, flexible.
II. In neuter and passive sense.
4. Pertaining to, connected with, or characteristic of moulding or modelling; produced by moulding, modelling, or sculpture, as distinguished from that which is drawn on a surface. Plastic merit, merit as a piece of moulding or sculpture.
5. Susceptible of being moulded or shaped; capable of taking a new form when subjected to pressure (as clay); readily assuming a new shape.
Plastic crystal, a variety of Portland cement of remarkable plasticity. Plastic sulphur, an allotropic form of sulphur: see quot. 1808.
Pla·stical

Principles of Plasticity
towards a substance of architecture

Simon Oberhammer

Supervisor: Prof Karolin Schmidbaur
Institute experimental architecture.hochbau
University of Innsbruck

Abstract

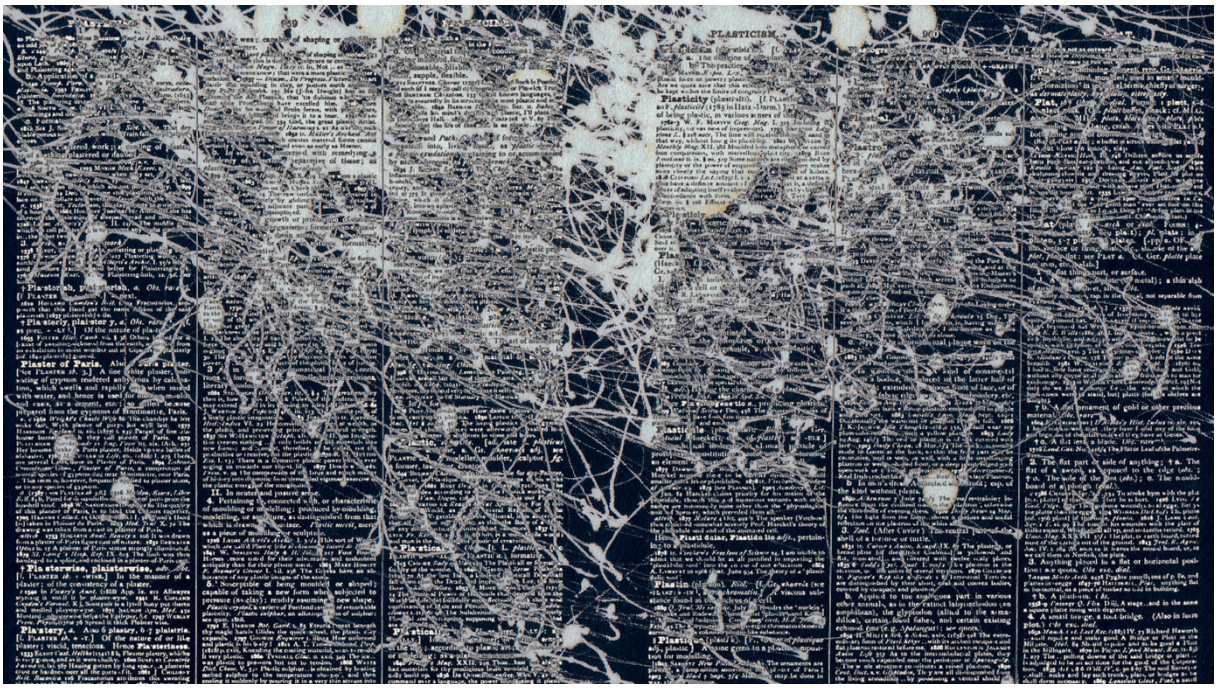
Principles of Plasticity investigates the ability of architecture to adaption from within. Therefore it adresses plasticity as a conceptual and practical mediator to reformulate architecture as a dynamic, adaptive, performative and aesthetic capacity. I argue that a principle of plasticity – in german „Plastizitätsprinzip“ – exists in architecture as it exists in our brain, in our body or in our environment and further that it is time to re-conceptualize this principle in architecture to bridge the gap between permanence and adability offering a framework to allow architecture to adapt to and transform within changing environmental, technological and social contexts as a dialogical entity between form, matter, performance and aesthetics.

Architecture, at its core, is a discipline defined by its capacity to give form to a material and digital world while simultaneously absorbing and responding to the forces that shape it or even neglecting them. Especially in an era informed by digitalisation and automation parallel to rapid change it is of importance to consider it not as a discipline of static objects, fixed entities or rule-based systems but as a dynamic „substance“ capable of transformation, adaption and reconfiguration. Within this framework architecture is conceptualized as an joined agential, material, historical and plastic entity – one that is both shaped by and capable of shaping its environment by internalizing external conditions as intrinsic characteristics.
This two-handed performative ability of material action and conceptual mediation is paralleled by the traditional aesthetic category of plasticity as known in the Arts. Both have to be discussed and their relation to be reformulated in the contemporary discourse.

In a world marked by rapid technological advancements, environmental crises, and shifting social paradigms, these concepts within architecture as a discipline make possible to not only responds to change but actively participates in it. The principles of plasticity, as explored in neuroscience, philosophy and life and material sciences, offer a powerful lens through which to understand and articulate this transformative potential. What unites all these fields of research is a shared interest in the relationship between form and matter within a performative principle of continuity. What are the conditions to allow a situation or substance to be plastic and constantly change its structure and form? This occurs beyond pure systems theory or logical patterns as the reality of physicality is constructively utilized within its material context. Investigating these concepts in their historicity beyond their specialized fields adresses more questions regrading methods of translation and scalability.

The study aims to contribute a theoretical framework, historical analysis, and prototypical models that demonstrate plasticity’s potential to contribute to current architectural discourse and practice. Through this lens, architecture is reformulated as a substance of transformation within its own historicity.

Key Words: plasticity, architecture, adaptation, form, matter,



Curriculum Vitae

Simon Oberhammer is an austrian architect and researcher. He studied architecture at Leopold-Franzens-University Innsbruck and the University of Texas at Arlington, graduating with distinction under Prof. Kjetil Thorsen in May 2007.

Simon has held different academic roles at the Academy of Fine Arts Vienna (IKA) and the University of Innsbruck where he is a recent phd candidate at the Institute for experimental architecture.hochbau. He also served as a Research Fellow for the FWF PEEK project "Intra-space" at the Academy of Fine Arts Vienna (2015-2017) and has been invited as both a lecturer and guest critic over the past years continuously in both institutions.

Before establishing his own studio in Vienna in 2015, Simon has worked in various offices in Barcelona, Oslo and Vienna. He had the position as a project architect at Wolfgang Tschapeller's office (2010-2015) for the Center of Promotion of Science (Belgrade) and the contribution for the Austrian Pavilion of the Venice Biennale (2012) among others.

Simon has held lectures in Vienna, Graz, Weimar and recently at the aut in Innsbruck. His projects have been exhibited in Berlin, Innsbruck and Venice and he has been awarded the Schütte-Lihotzky Stipendium for his research for „Textiler Holzbau" among other regional recognitions.