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EM2 825188:>> Resilient Topologies: Artificial Natures and Extreme Habitats<<

UIBK Summer Semester 2025

Instructors: José Carlos López Cervantes/ Cynthia Sánchez Morales

Course meetings: Wednesdays 9:00 am

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Video presentation: https://youtu.be/RMWuwcX9SvY

This video was created using artificial intelligence, based on the narration of a utopian near future where cities are adapted to severe climate conditions.

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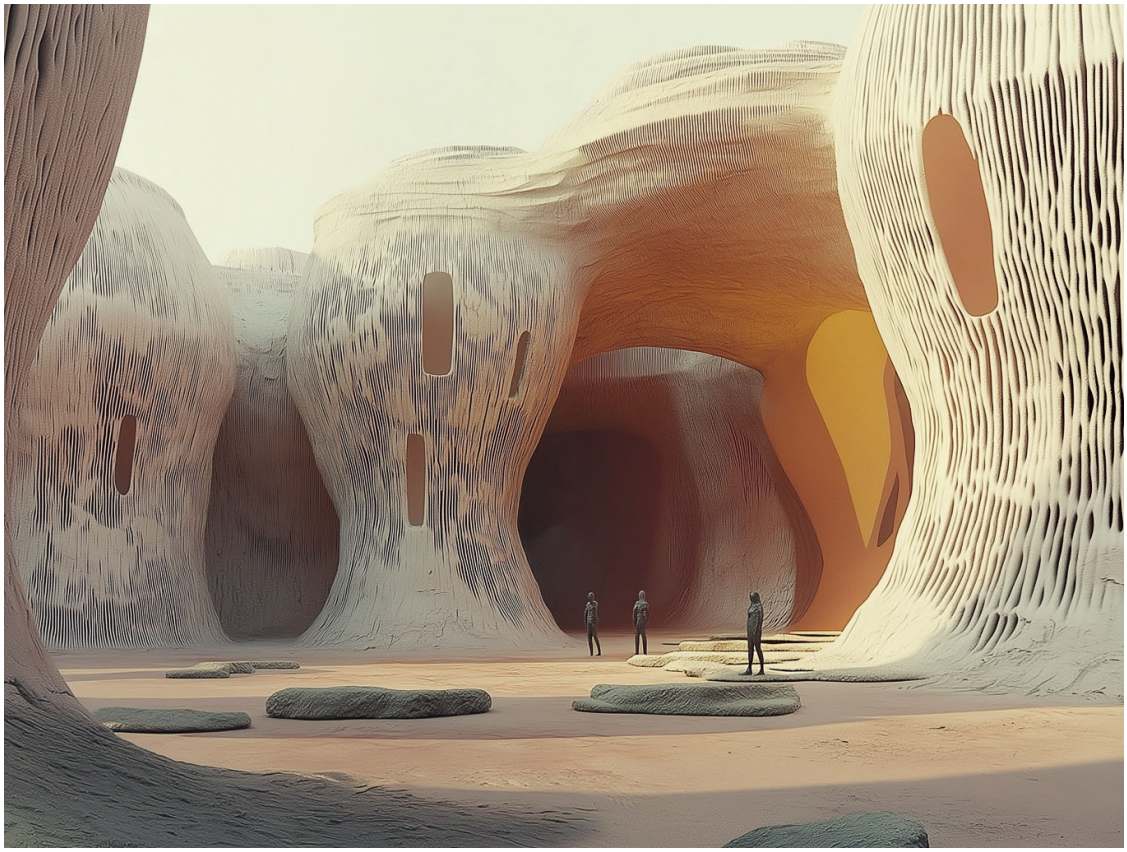
Learning Outcome

*This course explores **resilient habitat architecture** at the intersection of **artificial intelligence, computational design, and digital fabrication**. Within the course structure, students will take part in the **DAD W1 Workshop**, a **BIP Erasmus program** in collaboration with the **Universities of Granada and Bratislava**.*

Students will:

- ***Design resilient architecture for extreme climates**, exploring **glacial environments, artificial natures, and the fringes of the Technosphere** as sites of intervention.*
- ***Utilize AI as a speculative design tool**, generating non-anthropocentric forms and challenging typological conventions.*
- ***Develop 3D-printed clay prototypes**, testing fabrication strategies that respond to adverse weather conditions.*
- ***Investigate planetary interactions** by designing within the **five natural spheres** (Lithosphere, Atmosphere, Biosphere, Hydrosphere, and Cryosphere) and their tension with the **Technosphere** (Haff).*

*By the end of the semester, students will have **designed, digitally simulated, and physically prototyped** architectural solutions that engage with **planetary-scale systems and emergent materialities**.*



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Contents

As climate change destabilizes environmental conditions, architecture must ***move beyond traditional typologies*** *to develop* ***adaptive, performative, and symbiotic habitats****. This course treats* ***architecture as an emergent system****—one that negotiates between* ***artificial intelligence, planetary hyperobjects (Morton), and digital fabrication****.*

The ***DAD W1 Workshop*** *component (held in collaboration with* ***Granada and Bratislava****) will focus on* ***extreme climate resilience and 3D-printed clay architectures****, supporting the studio's broader research framework.*

The course will be structured around ***three thematic investigations****:*

1. AI-Driven Speculative Design: Beyond Typology

- ***AI-generated morphologies*** *→ Using MidJourney, RunwayML, and Stable Diffusion for speculative form-finding.*
- ***Generative AI as a non-anthropocentric tool*** *→ Producing architectures that do not rely on human-designed precedents.*
- ***Training AI on planetary datasets*** *→ Extracting forms and material strategies from* ***glacial movements, geological formations, and atmospheric phenomena****.*

2. Extreme Environments & Technosphere Fringes

- ***Designing for adverse weather conditions*** *→ Investigating resilient spatial configurations for* ***glaciers, permafrost, and post-industrial landscapes****.*
- ***Planetary material flows*** *→ How can architecture* ***mediate between natural and artificial systems****?*
- ***AI-driven tectonics*** *→ Speculating on new material assemblages* ***beyond conventional architectural construction****.*

3. Digital Fabrication and 3D-Printed Clay Structures

- ***Integration with the DAD W1 Workshop*** *→ Developing modular* ***3D-printed prototypes in clay****.*
- ***Computationally optimized material performance*** *→ Testing* ***porosity, thermal insulation, and structural stability*** *in extreme weather.*
- ***Prototyping adaptive morphologies*** *→ Fabricating* ***climate-responsive shelter systems*** *through digital design.*

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*The course follows a **three-block structure**, transitioning from conceptual exploration to **AI-driven material testing** and **full-scale prototyping.***

BLOCK 1: Conceptual Knowledge – Artificial Morphologies

- ***AI as an autonomous form generator** → Exploring abstract morphologies beyond typology.*
- ***Planetary intelligence in architecture** → Extracting spatial configurations from **non-human datasets.***

BLOCK 2: Procedural Knowledge – AI and Speculative Urban Systems

- ***Computational strategies for environmental resilience** → Developing **adaptive morphologies for extreme climates.***
- ***Negotiating abstraction vs. functionality** → How much **interpretation is needed** to translate AI outputs into built structures?*

BLOCK 3: Practical Knowledge – AI-Driven Materialization

- ***Material agency in AI-generated designs** → Prototyping speculative structures through **3D-printed clay technologies.***
- ***Digital simulation of resilience strategies** → Testing structural **integrity, material efficiency, and climatic adaptation.***

Methodology

*The course employs an **iterative, research-driven methodology**, integrating **speculative AI design, computational modeling, and experimental material prototyping**.*

1. ***Research & Theoretical Framework***
   - ***Climate change as a hyperobject (Morton)** → Architecture as an agent within planetary-scale systems.*
   - ***The Technosphere (Haff)** → Examining architecture's entanglement with human-made material flows.*
2. ***AI as a Generative Design Tool***
   - ***AI-assisted design workshops** → Using **MidJourney, RunwayML, and Stable Diffusion**.*
   - ***Cross-disciplinary training datasets** → AI models informed by **geomorphology, biological adaptation, and atmospheric science**.*
3. ***Digital Fabrication & Material Experimentation***
   - ***3D printing with clay in extreme climates** → Testing material performance in **cold and humid environments**.*
   - ***Developing modular prototypes** → Investigating **porous geometries, biodegradable composites, and structural optimization**.*
4. ***DAD W1 Workshop Integration***
   - ***Hands-on experience in digital fabrication** → Participants engage in **real-world prototyping of climate-adaptive structures**.*
   - ***Collaboration with Granada & Bratislava teams** → Multi-university peer learning and exchange of computational strategies.*
5. ***Final Presentation & Exhibition***
   - ***AI-generated speculative architectures** → Digital models and AI-trained visualizations.*
   - ***Fabricated prototypes** → 3D-printed modules demonstrating AI-driven **material agency**.*

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Course Structure & Organization

Students will work individually. Each session will contain a theoretical lesson, deskcrits and specific software tutorials needed for developing the project. Progress will be reviewed weekly at the studio.

NEEDS:

Material Requirements:

Students need to bring their own laptops. Software will be accessible through educational licenses.

Tools and Techniques:

In order to apply this specific methodology, students will be instructed in specific software. No previous experience on the software will be required.

Final Deliverables & Requirements & Assessment (OLAT):

Complete graphic description of the project is expected, including visualizations, drawings, diagrams, research material, and any kind of visual information that support the entire comprehension of it.

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SUBMISSION

Grading Procedures:

Grades are determined based on the quality of work produced, progress and improvement over the course of the semester, completion of project requirements, quality of participation, attendance, attitude, and ethical conduct. Grading policies will be discussed during the first weeks of the studio, and any questions regarding grades or policies should be directed to the instructors. A passing grade in the course requires committed completion of all projects, including the institute archive in proper formats. Incomplete work will not be evaluated until the submission is completed. A failing grade is given whenever cumulative work, final work, and/or attendance are unsatisfactory. It is also given when a student fails to submit a final project or fails to take a final examination without prior approval from the instructor.

Academic Integrity:

The integrity of the work of individuals is first and foremost a grading milestone. Student work that delivers the ideas or words of others as the student's own adversely impacts the whole faculty. Academic dishonesty, including cheating, plagiarism, commissioning academic work by others, or performing academic work on behalf of another student, is strictly prohibited and would result in a negative grade.

Plagiarism:

This includes but is not limited to; copying words, images, or other material from a source without using appropriate citation rules such as quotation marks, footnotes, references, or other indications of the original source, paraphrasing another person's ideas in your own words without crediting the original source, taking sole credit for assignments without giving credit to those who worked with you, submitting work for a course that has already/also been submitted for another course or internet plagiarism, such as submitting work either found or paid for online, failing to cite any internet sources used, or cutting and pasting sentences from various websites to create a collage of uncited words.

Incomplete Work & Extension of time:

A student may receive a negative grade or no grade when the work is incomplete at the evaluation date by the end of the semester. By requesting permission from the instructor in good time prior to the date of the final examination or presentation, this can be avoided. Permission will be granted only under extraordinary circumstances and usually for medical reasons, requiring a medical document proving the situation. Incompleteness must be fulfilled to the instructor's satisfaction no later than two weeks after the end of the term.

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Archiving:

Students are required to submit physical examples of their work or digital examples no later than one week after the end of the term to their instructors or administration for archiving. This is a chance for students to have their work displayed or exhibited online and potentially featured in future institute publications or research projects. The instructors will provide a document titled the Einwilligungsformular that allows the institute to keep track of the agreement; if you wish not to permit this archival material to be published, please contact the institute secretary in good time.

Learning Policy (Studios and Seminars):

Attendance is mandatory at critiques, pin-ups, and reviews. If you do not present your work regularly, you will not receive a passing grade for the course. Students must have all required work related to the course during course hours (not at another location or other time). Students should not use course time to leave school to procure materials, run errands, etc. All activities that require one to be away should be scheduled to occur outside of course hours. Leaving in the middle of or before the end of regularly scheduled course times will result in an absence unless discussed with the instructors. Grades will be determined by the quality of work produced, an improvement over the course of the semester, completion of project requirements, quality of participation, and attendance.

All electronic recordings, image captures/screenshots (during zoom meetings), or audio recordings are strictly prohibited unless agreed upon or discussed beforehand with the instructors and participants.

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Bibliography

1. Theoretical Framework: Hyperobjects, the Technosphere, and Planetary Thinking

- ***Morton, Timothy.*** *Hyperobjects: Philosophy and Ecology after the End of the World. Minneapolis: University of Minnesota Press, 2013.*
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- ***Haff, Peter K.*** *Technosphere: The Emergence of an Artificial Earth System. In Anthropocene Review, 2014.*
- ***Clark, Nigel, and Yusoff, Kathryn.*** *Geosocial Formations and the Anthropocene. Theory, Culture & Society, 2017.*

2. AI, Speculative Architecture, and Post-Typological Design

- ***Log Issue 60 – AI & Architecture.*** *New York: Anyone Corporation, 2024.*
- ***Menges, Achim, Sheil, Bob, Glynn, Ruairi, Skavara, Marilena.*** *Fabricate: Making Resilient Architecture. UCL Press, 2017.*
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- ***Gage, Mark Foster.*** *Aesthetic Theory: Essential Texts for Architecture and Design. New York: W.W. Norton & Company, 2011.*

3. Climate Resilience, Materiality, and Digital Fabrication

- ***Kolarevic, Branko & Klinger, Kevin.*** *Manufacturing Material Effects: Rethinking Design and Making in Architecture. New York: Routledge, 2008.*
- ***Lloyd Thomas, Katie.*** *Material Matters: Architecture and Material Practice. London: Routledge, 2007.*
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4. AI and Digital Design in Extreme Environments

- ***Negarestani, Reza.*** *Cyclonopedia: Complicity with Anonymous Materials. Melbourne: re.press, 2008.*
- ***Gandy, Matthew.*** *Natura Urbana: Ecological Constellations in Urban Space. Cambridge: MIT Press, 2022.*
- ***Benyus, Janine M.*** *Biomimicry: Innovation Inspired by Nature. New York: HarperCollins, 1997.*
- ***Kwinter, Sanford.*** *Far From Equilibrium: Essays on Technology and Design Culture. Barcelona: Actar, 2008.*