Inert Chromatics

The architectural surface as a weathered interface.

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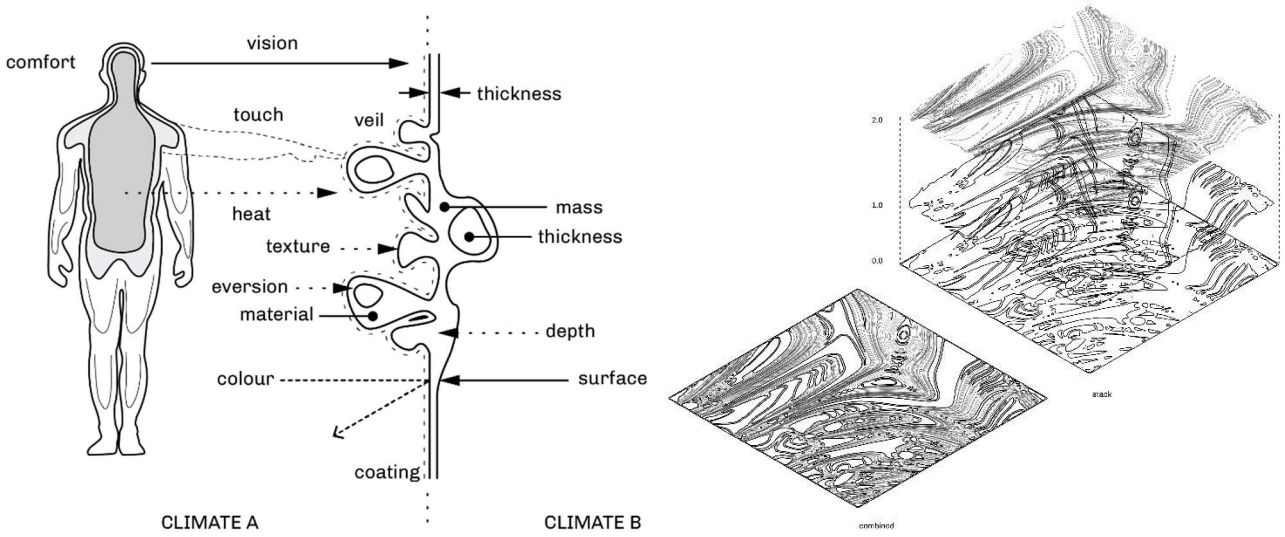
Keywords: Surfaces, Materials, Climate, Simulation, Digital Fabrication

DISSERTATION ABSTRACT: A part of architecture is the design of its surfaces. Those surfaces change their appearance over time. The dissertation with the working title *Inert Chromatics* interrogates possibilities to articulate thermal design parameters through architectural surfaces. The analyses of different notions of colour in historic and aesthetic terms help to recognise relationships between substrate, topology, and pigment in architecture. Today we can observe the resurfacing of ornament and materiality in (post)digital architecture. Notable factors are 1) the design of sustainable and 'natural' materials, 2) the use of digital environmental simulations, 3) procedural design, and 4) ubiquitous digital fabrication. An examination of these factors allows observing that, while the articulation of surfaces experiences a Renaissance with the emergence of responsive materials, the required ornamental meaning remains vastly undiscussed.

THERMOCHROMIC TOPOLOGIES: With increasing awareness of our environmental responsibilities, architects must seek out alternative solutions to mechanical heating and cooling where possible. The resulting shift in paradigm - from a demand of a homogeneously tempered indoor environment to a heterogeneous field of

varying comfort zones – requires new design tools to actively communicate qualities of space. Most thermal comfort parameters are invisible and hard to communicate across distances. This research aims to find solutions for this dilemma while exploring it from the architect's position. The design study *Thermochromic Topologies* pushes the boundaries of design thinking as well as finding new digital fabrication and design methodologies to generate intricate and sustainable ornament. Thermochromic materials change colour when the material's temperature exceeds a certain threshold. The effect can be a change in hue, saturation or transparency. The project focused on a change of transparency, where the disappearance of a coating layer reveals the underlying material above a temperature threshold of 27C – the same temperature above which a room's temperature is widely perceived as uncomfortable. Computational fluid dynamics simulations (CFD) were used to simulate changes in temperature and airflow along surfaces. The experiments were set up in a way that gave each surface distinct topological characters such as density, thickness, directionality, gradient. The results were used as an input for a digital generative design process. The geometries were fabricated using a cnc mill and coated with thermochromic ink. The prototypes were then exposed to heat in a series of experiments and the changing visual appearance is documented systematically using thermal imagery, photos and videos. The gained material was catalogued, compared and knowledge about the relationship between, simulation, prototype and performance was gained. There is a demand for innovative design solutions for communicating environmental conditions and parameters of indoor climate to inhabitants through smart materials and passive strategies. Existing research into thermochromic elements in architecture is often focussing on the technological aspects of surface actuation. This research project investigated the design consequences deriving from a generative design process, that uses invisible environmental parameters to drive performative reliefs.



ACKNOWLEDGMENTS: Catalina Tripolt (Research assistant, UIBK), Philipp Schwaderer & Jan Contala (cera.LAB, UIBK), Kilian Bauer & Julian Edelmann (REX|LAB, UIBK), Ernest Hager (UIBK)

FUNDING: Tiroler Wissenschaftsförderung (TWF, Land Tirol) & Researcch Enhancement Scholarship (UIBK)

Thermochromic Topologies, Climate-responsive relief, 2021.

Thermochromic Topologies, Close-up, 2021.