VARIEGATED FRINGES
Material Explorations of Heat and Colour
Andreas Körner

"So he made his choice
without even knowing he had made one."
(*Le Guin, 1976)*

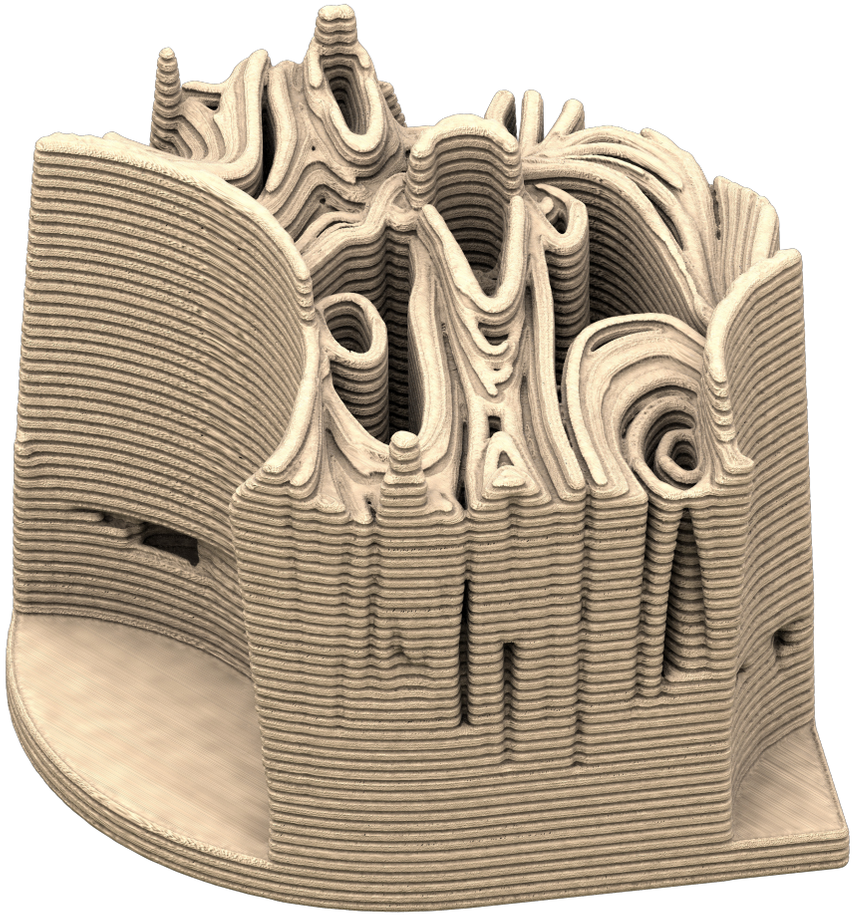
"Research proceeds by making choices."
(Stokes, 1997)

According to design researcher Nigel Cross (1999, 5), there are "forms of knowledge peculiar to the awareness and ability of a designer" similar to those "peculiar to [...] the scientist and the artist"; he refers to this as "design knowledge". Cross (1999, 6) further acknowledges that it resides in specific processes and methodologies. However, he also clarifies that method performs a different role in design than, for example, in science, where it validates results. Cross (2001, 51) highlights that in design practice, "results do not have to be repeatable, and in most cases, must not be repeated, or copied." Aware of Cross' traditional position, Dagmar Reinhardt (2008, 188) tells us about a different understanding, embracing serendipity: an explorative method is a strategy for "producing ideas" and not limited to the "enhancing of result variation". Regardless of Cross' approach of solution-focused thinking, both references tell us there is more to the method of experimentation than development or improvement. Cross and Reinhardt insist that exploration and experimentation are powerful methods for serendipitous insight, and their practice constitutes a specific form of knowledge. Exploration liberates the work from a rigorous matrix of aims, questions, and goals. As Bill Moggridge (2007) observed, creative processes are often non-cyclical. They oscillate between synthesis and evaluation, producing knowledge through uncertainty and making.

Variegated Fringes presents a research process resulting in nine ceramic objects, 3D-printed and coated with thermochromic ink (Körner 2021). This ink changes colour from black to white to transparent above 27°C, a threshold demarcating thermal discomfort. Thus, these chromatic changes expose one of our environment's otherwise invisible aspects: heat. Simultaneously, the chromatic flux (variegations) alludes to our constantly changing thermodynamic environment, embracing its capricious nature. The objects respond more immediately to touch than to changes in air temperature. Therefore, the photo series documents an investigation into how we can engage with *heat* visually and haptically.



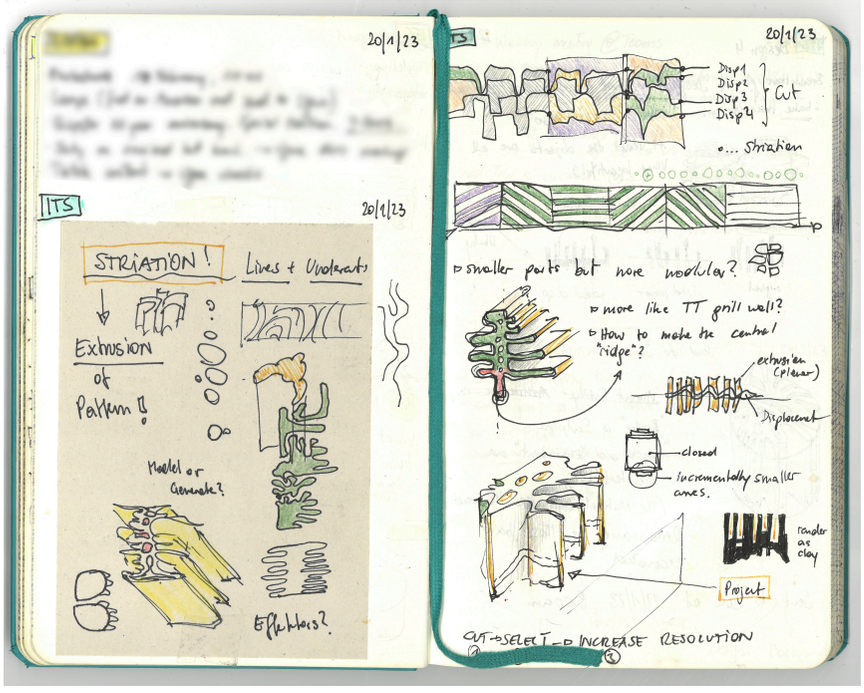
Although the effect of thermochromic ink is straightforward and known (Körner 2021), it facilitates a wide range of artistic speculations directly derived from the material. The initial inquiry focused on understanding the relationship between surface textures and temperature and how humans interact with these objects—specifically, the thermodynamic traces left through handling. When warmed up, the black coating disappears, revealing colourful dots and the fired clay's beige hue.

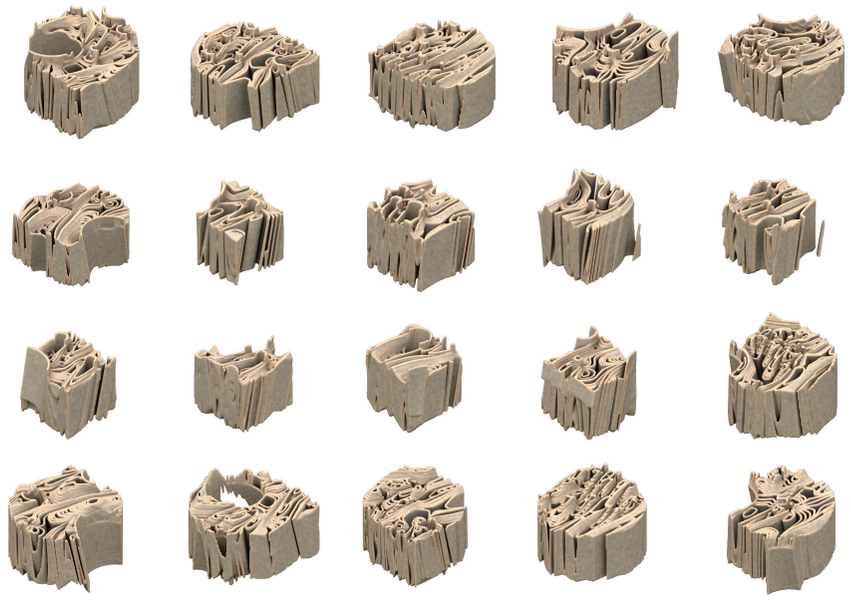


The method for creating these objects is fraught with risk, uncertainty, and capricious decision-making, defying conventional appropriateness. It involves various generative design tools, digital flow simulations, 3D printing, and manual coating. A wild, postdigital mix of precision and accident characterises the design process. While the overall shape is defined by a precise digital 3D model, factors such as the machine's tool path, material viscosity, firing, and coating introduce layers of complexity.



Qualitative evaluation—documenting the emerging patterns and colours with photos—was employed rather than quantitative assessment for each object's thermal performance. The rich textures from the fabrication process revealed surprising moments of beauty discovered through standard and thermal cameras. This shift in scale transformed small objects (30x30x30 cm) into landscapes, terrains, and terroirs with distinctive qualities.





This process transformed the researcher into an explorer, embracing ignorance and naivety. This approach allowed for direct material research, learning through both digital and manual methods, and artistic engagement with a crucial aspect of our changing natural environment: *heat.*

Generative digital tools—like procedural modelling in Cinema4D in this case—allow designers, artists, and researchers to investigate multiple options quickly. The project explored making and fabricating as evaluation methods. The process is the result, and decisions are made step by step—back and forth—rather than cyclically and predeterminedly. The technique produced varied options as well as ideas.



With each step of the process, translations between digital and material domains changed the surface of each fragment. The 3D-printed layers added a textural quality the smooth digital model did not possess. When touched or otherwise warmed up after coating, the variations of thermal mass created capricious variegations and transient textures akin to those of natural weathering.



When warmed up, the specific heat capacity of the fired clay delays and modulates changes in surface temperature and heat dissipation. Slowly, the surfaces change from black to white and become transparent above 27°C.



Finally, the underlying colourful dots appear, creating moments of surprise. While deploying high-precision tools, the process results in surfaces that appear differently each time. The objects have intricate surfaces —fringes between two environments: atmosphere and substance.



The fragment's face is simultaneously landscape and surface. Its dynamically changing colour traces thermodynamic phenomena *(heat)* and expinvisible intensive qualities. The bigger the thermal contrast between the inert substrate and the chromogenic coating, the more distinctively variegated the surface becomes.

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