Phygital Materiality

Sense-driven CMF design and experimental material library by Lucia Suchá

Doctoral research:	Innovative approaches to CMF design in automotive industry
Realization:	2022 — ongoing
Researcher:	Mgr. art. Lucia Suchá
Research supervisor:	Assoc. Prof. Michala Lipková, ArtD.
Text:	Michala Lipková

The doctoral research aims to investigate the possibilities of integrating design and multidisciplinary research in designing materials, surfaces, and color solutions (CMF design). The presented material study aims to test the different perceptions of materials, their surface structures, and color variants when changing the environment and sensory perceptions. In the real world, we experience the materiality of objects through multiple senses, which are additionally influenced by our sensory memory. How does this change in the technically augmented forms of reality?

The contribution to the exhibition is a collection of material samples whose shape was differentiated by (1) parameters used in the 3D modeling software, (2) different 3D printing settings, and (3) the selection of the material. Combining all three aspects affects the final sensory properties of each sample. How do the nuances of the seemingly organic shape, shaped and materialized by digital technology, influence one's perception of the bipolar 'natural to artificial' scale?

In Designing Design, Kenya Hara argues that technology “has no point unless it subtly awakens and activates the senses of the recipient.” Describing the current mainstream design as one ‘deteriorating human senses,’ Hara calls for a ‘sense-driven’ world:

“Some are of the opinion that we gain far more than we lose. It’s true that newly invented technology and media have immense possibilities for cultivating wisdom and our senses. Anything that matures changes shape. Human beings and cultures both mature and metamorphose. But our desire is to metamorphose into better things. Sense-driven describes a situation in which progress pivots on our sensory perceptions. Let’s pit this concept against that of the technology-driven world. Reviewing the world based on our senses would be sound and meaningful for the technology as well.” (Hara, 2007, pp 144-146)

Color, Materials, Finish (CMF) is an area of industrial design that focuses on the chromatic, tactile and decorative identity of products and environments (Becerra, 2016, p.12). Very often, the focus on the form and function of a product results in overlooking the color solution and surface treatment as part of the holistic design solution. In industrial design, sensory features, unfortunately, tend to be neglected as a secondary nuance. At the same time, we can argue that products that work with a stronger perception of materials and active involvement of the senses can help improve products for people with disabilities or even the aging population.

Today, many new or reinvented sustainable materials are gaining attention across industries. Therefore, the sensory aspects of selected materials become crucial in relation to available technologies. Current trends can help break out of the conventional way of designing, add value to a product, and improve its usability and sensory experience overall.

The dissertation research of Lucia Suchá takes place in a period of accelerating increase in consumption on the one hand and in a time of rapid development of new materials on the other. Increased production means more waste and dwindling material resources. Not only within the framework of the circular economy, there is a need and growing demand for materials created through the process of recycling or upcycling as composites or completely new types of material based on waste. Nevertheless, the choice and implementation of emerging materials in industrial design are still insufficient. While virgin materials and natural resources are still available, the use of recycled or alternatively sourced materials is not yet a commonly preferred option.

In her ongoing research, Lucia Suchá has identified the following underlying reasons behind the above-described problems, which her project is aiming to address:

- **Problematic access to material samples:** Reading about many emerging materials and seeing their photos is possible, but deciding on material application by purely visual perception is highly risky. Testing and viewing a physical sample or high-quality material simulation in VR or AR applications is the crucial step to accelerating the use of emerging materials in common product design applications.

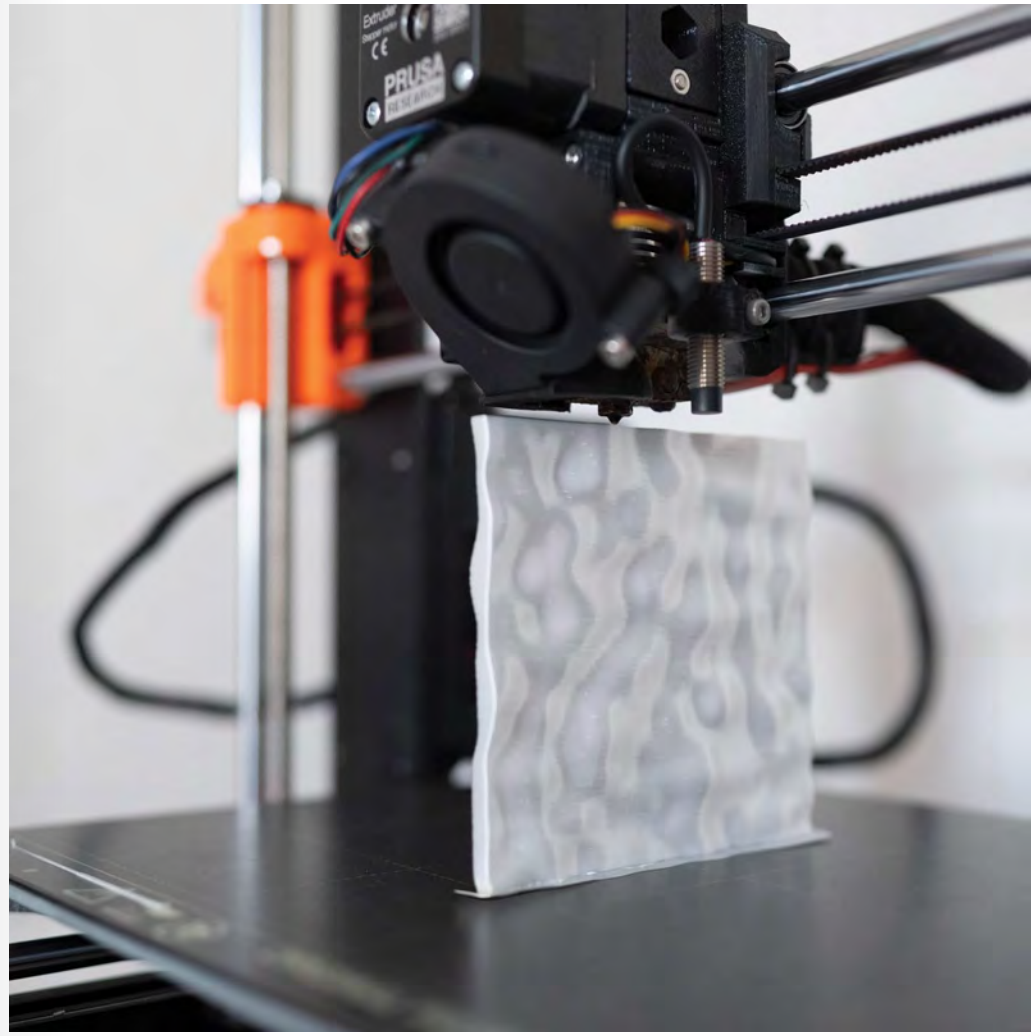
- **The material experience gap:** Since emerging materials are not yet widely used, first-hand experience with them in daily products is rare. The lack of knowledge about the performance, sensoric features, possible applications, and manufacturing limits maintains the experience gap that prevents applying them in one’s design.

Working with emerging materials opens questions about their acceptance by the users. In her work-in-progress research notes, Suchá asks:

“How can we predict user perception of a CMF design solution, the form of which was created in a digital environment and which was subsequently implemented in material with which he or she has no previous experience?”

Based on the two earlier defined problems, Suchá’s doctoral research sets the following qualitative goals:

- **Establish connections between specialized workplaces.** Through the process of creation of innovative material samples, the goal of the research is to connect experts within (or beyond) Slovak University of Technology and establish a working network of researchers who would kickstart long-term cooperation and boost interdisciplinary projects in the field of circular design and material development for industrial applications (material science and R&D, prototyping and production technologies, etc.).



Top: FDM 3D printing of material samples

Next page: Virtual models of material samples in Cinema 4D (top) and physical 3D printed results (bottom)

“How can we predict user perception of a CMF design solution, the form of which was created in a digital environment and which was subsequently implemented in material with which he or she has no previous experience?”

- **Set the foundation for an experimental material library.** The dissertation research is carried out at the recently established scientific and research workplace MX lab, which specializes in cooperation with partners from the automotive industry. The workplace has the ambition (and the need) to build its database of material experiments created within the framework of pre-development projects implemented with the involvement of bachelor and master students. Therefore, one of the goals of Suchá’s research is to suggest a possible classification and form of documentation and display of experimental material samples as a part of the practical part of her thesis.

Besides the mentioned qualitative contribution, the doctoral research plans to deliver tangible outputs, listed below:

- **A phygital collection of innovative material samples.** The collection aims to outline a new approach to designing in CMF design. The collection should contribute to popularizing unconventional or emerging materials within the educational process and beyond the academic environment.

- **Transfer of the collected know-how to a virtual environment.** Another goal of the dissertation research project is to transfer the gained knowledge to the digital realm, making the experimental material designs accessible on a large scale and allowing them to be used in immersive applications (AR/VR industrial design simulations) as high-quality digital material assets.

- **Documentation and retrospective analysis** of the design process will form the focus of the theoretical part of the dissertation, and it will aim to contribute innovative findings to the current state of knowledge in CMF design.

The very first collection of experimental material samples, presented as a contribution to the DESIGN × SCIENCE exhibition at BASE Milano 2024, is a collection of material samples, fully designed and materialized through digital technologies. The shape of each sample was differentiated by (1) numerical parameters used in the 3D modeling software, (2) different 3D printing settings on an additive FDM 3D printer and (3) by the selection of the material.

The objects were printed with PLA 1.75mm filaments by Polish manufacturer Spectrum (distributed under the name “Pearl White”) and recycled Prusament by Czech manufacturer Prusa (distributed under the name “Pearl Mouse”). The two PLA filaments were deliberately chosen for their contrasting vi-

sual characteristics - the "Pearl White" filament claims a silk-like, satin structure effect. On the opposite side, "Pearl Mouse" claims "neutral color," "warm grey with a goldish/ greenish hint," analogous to RAL 210-M or #a5a99b HEX color code.

Each change in settings, material, and color creates a material sample of other properties. The combination of parameters affects the final sensory properties of each sample. The samples explore connections between manufacturing technology and different types of materials to achieve unexpected effects. Through experiments with digital sculpting, material parameters, and simulations in Cinema 4D software, Suchá explores possibilities of digital material sculpting with different intensities and scales. The color perception of each sample is influenced by the intensity of structure and chosen material, while the surface finish is affected by the 3D printing technology settings.

The presented samples open discussion on how the nuances of the seemingly organic shape, shaped and materialized by digital technology, influence one's perception on the bipolar 'natural to artificial' scale.

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Lucia Suchá graduated in Product Design from the FAD STU Bratislava. During her studies, she interned at the crafting plastics! studio and brand Metaformi. She completed an exchange stay in the Integrated Product Design program at Coburg University in Germany. She is a certified instructor of traditional Slovak Bobbin Lace-Making. In 2020, Lucia was selected for the Michelangelo Foundation's Young Ambassadors Programme.

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