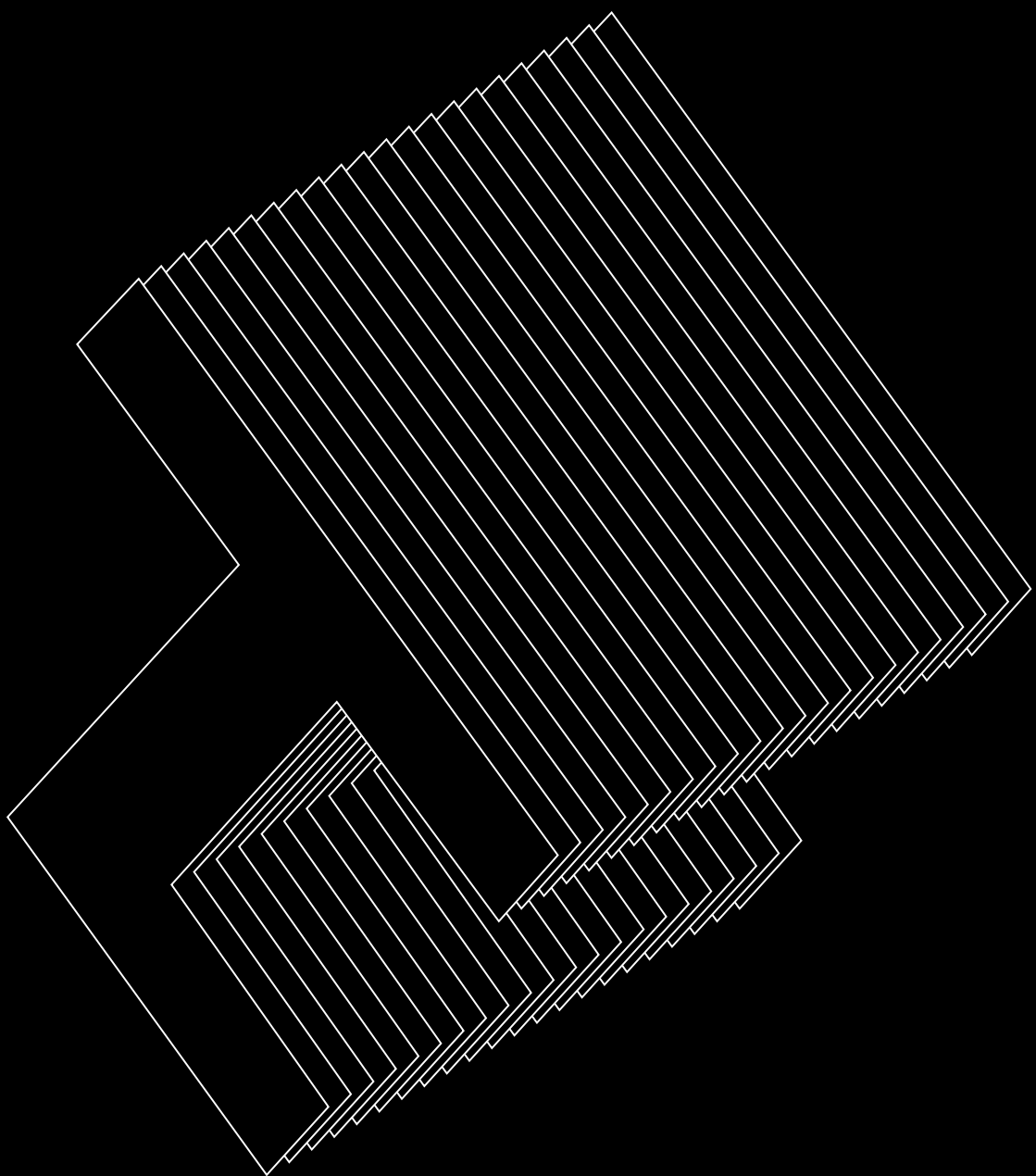
Prototyping Change

Doctoral design research projects at FAD STU in Bratislava



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Michala Lipková

SPEKTRUM
STU

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What are we talking about when we talk about change?

Text: Michala Lipková

The installation DESIGN × SCIENCE at Designblok ‘23 presents a curated selection of six exceptional doctoral design research projects from the Faculty of Architecture and Design at the Slovak University of Technology in Bratislava.

TR1MTAB.com is a communication and networking platform founded by Michala Lipková to actively seek new industry partnerships and accelerate design-driven technology transfer and multidisciplinary collaboration across (and beyond) STU’s faculties.

The concept of functioning as a ‘trimtab’ is inspired by the American inventor Buckminster Fuller; he believed that small actions deliver global impact. Under the tagline Prototyping Change, the platform aims to contribute to systems-level change toward more sustainable and just futures.

DESIGN / CHANGE

Design has an extraordinary power to make ideas tangible. It allows us to experience abstract solutions through our senses and make them understandable through models, prototypes, and other visual clues. Also, for this reason, in today’s world of ‘wicked problems’ (Buchanan, 1992), design as an output, a thinking and work process, or as a strategy finds applications in a wide range of fields, far beyond the boundaries of its original professional classification, understood primarily in the context of the art disciplines.

As a result, the term design is used extensively in often significantly different con-

texts. We use the word design so frequently that it is nearly meaningless. Moreover, while another self-serving comparison of existing design definitions is the last thing we need, we must admit that our language no longer fits its purpose.

The bad news is that our understanding of the concept of design is far from the only thing that very soon needs to change in the face of accelerating 'polycrisis' (Lawrence et al., 2023).

Climate change is very well documented. As the team of researchers from Dark Matter Labs stated in their recent invitation paper on the new European Bauhaus economy, even our most ambitious pledges (IPCC, 2023) lead to climate disaster (Kemp et al., 2022). The authors argue that "apart from design and creativity, our new reality could require new ethics, governance, institutions, accounting regimes, regenerative investments, smart services and systems." The collective sees exploration of "what is emerging at the intersection of the material and immaterial" and "establishing new relationships between tangible and intangible assets" as one of the ways ahead to support the shift towards a regenerative future for our built environment (Johar, 2023).

One thought repeatedly comes to the forefront in the global transition design discourse: only a radical worldview and behavior shift — on the individual, institutional, and organizational level — can lead to the necessary scale of transformation.

How can doctoral design research become a laboratory for the emerging design practice that does not seek minor adjustments to the existing system but is capable of reimagining and transforming it? Which research questions are worth asking, and what kind of design research can contribute to the transition to a future we actually want? How can design enable and accelerate cross-sectoral dialog?

By being both a creative and a pragmatic action-driven profession, design can practically contribute to the change in how manufacturers, entrepreneurs, researchers, scholars (and any other stakeholders) think and work together towards common goals. Using a couple of examples, design research can be useful in providing critical points of view, identifying the one problem to solve by a single project in a given time, and dividing large challenges into smaller, actionable steps. Design naturally brings an iterative mindset, creative curiosity, and collaboration.

We do not pretend to have all the answers, but one thing is clear: The scale of the problems we face requires paradigm-oriented design methods, and we need to speed up learning how to use them together. Such a need has led us to create a platform that allows the accumulation of collective intelligence and facilitates collective action. In the situation when we have a lot to lose by not trying, accelerating collaboration offers an actionable way to go.

DESIGN > PROTOTYPING

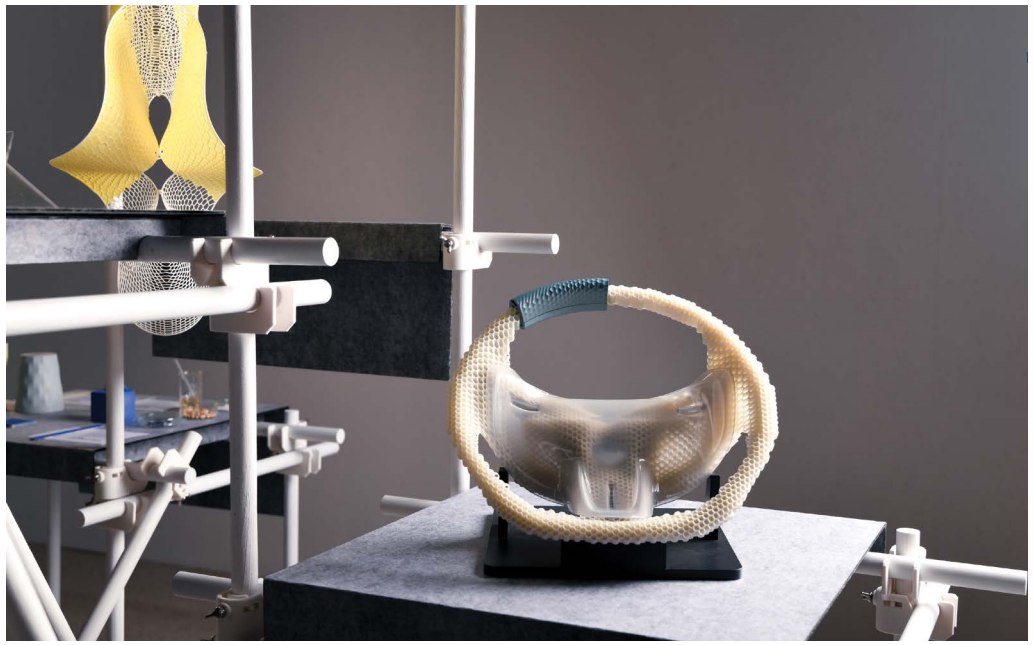
Buckminster Fuller has inspired generations of architects and designers even though he did not receive formal architectural or design training. Scholarly sources refer to Fuller using countless adjectives: architect, system theorist, writer, designer, inventor, futurist, or philosopher – reminiscent of the contemporary concept of 'antidisciplinarity' (Ito, 2014).

Contemporary media is rediscovering Fuller's concept of being a 'trim tab' — the legendary metaphor of a ship's miniature rudder. A small part that can influence a large system (Fuller, 1962) inspires young people to reshape their immediate surroundings actively. In today's reality, which can easily induce helplessness, the idea of being a 'trim tab' resonates even more.

Fuller's concept of acting as a 'trim tab' inspired the name of the recently founded platform for design research and technology transfer at the STU in Bratislava. Built on the belief that small actions deliver global impact, the platform promotes the idea of design-driven innovation under the motto of Prototyping Change. This communication and networking platform aims to actively seek new industry partnerships and accelerate collaboration across STU's faculties.

Another of the many famous (overquoted but still inspiring) thoughts by Buckminster Fuller tells us never to try changing things by fighting the existing reality, advis-

Manual heat bending of SymaLITE® boards



Installation DESIGN × SCIENCE
at the The Trade Fair Palace
during Designblok 2023 in Prague

“Contemporary media is rediscovering Fuller’s concept of being a ‘trim tab’ — the legendary metaphor of a ship’s miniature rudder. A small part that can influence a large system (Fuller, 1962) inspires young people to reshape their immediate surroundings actively. ”

ing us to “build a new model that makes the existing model obsolete” (Sieden, 2011, 358). Fuller himself was a tireless maker, using experiments and business activities to test and develop his ideas in the real world — be it a radical view of low-cost housing or his unconventional vision of energy-efficient car.

British designer Pascal Wicht compares the act of prototyping during the design process to “creating hypotheses that can continually be shaped and refined” (Wicht, 2023). The emphasis on ‘prototyping’ within the platform’s communication strategy is intentional. By intentionally avoiding using the term ‘design’ at the forefront of the narrative, we switch attention to design as a process — a research activity to test ideas, a process to learn from, rather than supporting the idea of producing polished artifacts.

Under the tagline Prototyping Change, the platform aims to contribute to systems-level change step by step. We have replaced the subject “I” in the name of the ‘tr1mtab.com’ URL with the number “1” to emphasize the importance of a single step if taken in the right direction.

Prototyping Change refers to design’s ability to bridge disciplines and help innovative ideas ascend across the ladder of technology readiness levels by producing tangible outputs of research processes that are otherwise hard to comprehend from the outside and challenging to communicate to potential partners. When we use the term ‘technology transfer’, we refer to the big picture and the general notion of transferring results from scientific research or technological inventions from academic environments to business applications — beyond the formal processes of IP registration of patents or utility models.

DESIGN × SCIENCE

The curatorial selection of six doctoral research projects in the study program Design at the Faculty of Architecture and Design, Slovak University of Technology in Bratislava (FAD STU) represents a retrospective of successfully defended dissertation projects, which were in the making after 2014 or are still ongoing. However, much more than that: The selection reflects an undeniable generational shift on the one hand, and the other, it illustrates trajectories of ongoing transition. All projects bring their own view of the new position of the designer - be it a role in a multidisciplinary scientific team, entrepreneurial endeavor, creative community, territory of philosophy, or computationally enhanced product development.

“Under the tagline Prototyping Change, the platform aims to contribute to systems-level change step by step. We have replaced the subject “I” in the name of the ‘tr1mtab.com’ URL with the number “1” to emphasize the importance of a single step if taken in the right direction.”

The current study program Design at the FAD STU stems from an industrial design agenda originally developed at the Faculty of Mechanical Engineering three decades ago. Early understanding of industrial design at STU saw the discipline as a strictly form-oriented, convergent view of design practice, comparable to the Danish Design Ladder model’s first step of “design as styling” (Kretzschmar, 2003). While the executive profession of industrial design styling is no doubt still needed and should not be underrated, the current strategy of STU’s Institute of Design and FAD supports a diversity of approaches to design creation in its full spectrum of formal outputs, understanding design as a “first and foremost a thinking process” (Rams, 1995, 152).

The biggest opportunity we currently recognize is the focus on strategic and systemic positions of design. Therefore, at FAD STU, we aim to elevate local doctoral design research as an opportunity for an ‘upgrade’ towards interdisciplinary and cross-sectoral collaboration, focused on supporting technology transfer by design-driven innovation. At the forum of Prague’s Designblok, we illustrate our vision with six tangible examples.

The installation DESIGN × SCIENCE is a result of a collective effort. The production team of doctoral students and graduates worked hard to find the best way to frame messages of complex research projects attractively and comprehensively. The installation’s title was first mentioned in a group discussion by Petra Hurai, coming up from a collective brainstorming about choosing the right message for the show - one suitable for arguably a short attention span of mass design fair visitors. We use the mathematical sign of multiplication between the words ‘design’ and ‘science’ to represent the metaphorical amplification that design can offer for different fields of science and research.

Each of the presented projects bridges disciplines differently. Tibor Antony dives into insights from chemistry and psychology, developing an exemplary integration of natural and engineering sciences for an ambitious biotech startup. Petra Hurai provides actionable critical reflection stemming from cross-sectional problems of time, exploring philosophy, physics, biology, cognitive psychology, neuroscience, and other disciplines. Matej Dubiš brings a detailed insight into possible integrations of computational tools into human-centered product development. Vlasta Kubušová challenges cross-disciplinary material research in bio-based materials with their future applications and environmental effects in mind. Martin Mjartan has become a ‘trimtab’ of the creative community, aiming to develop a resilient platform for collaboration between academia, creative industries, and disappearing crafts. Soňa Otiepková spotlights surface coloring as an ignored problem of material science from the perspective of commercial scalability of industrial applications of bioplastics.

Installation DESIGN × SCIENCE
at the The Trade Fair Palace
during Designblok 2023 in Prague

The installation concept DESIGN × SCIENCE started to be formed even before the final technical details of the six selected doctoral research projects on display were specified. The authors of the installation design, František Dorko and Martin Sombathy, agreed to participate in developing a modular exhibition display, potentially usable in the future for other occasions.

Experimental prototyping of the exhibition display became part of their ongoing research in circular design. The design research project initiated by Martin Sombathy maps sources of locally available residual material from industrial production in Slovakia that are not being reused or recycled for various reasons. The goal of Sombathy's mapping is to discover the opportunities to close open loops of local industrial production by product design.

The installation uses SymaLITE® boards provided by Mitsubishi Chemical Group. SymaLITE® is recycled low-weight reinforced thermoplastic used for producing three-dimensional components utilizing low-pressure molding, finding multiple applications in the automotive industry such as car undershields, engine and gearbox covers, etc. (Mitsubishi, 2023). While the material life cycle is designed to reuse the scrap edge trims, the production cycles exceptionally leave local subcontractors with extra boards in stock with minor imperfections that fall outside of the acceptable production tolerance limits. Trying to avoid unnecessary recycling of unused industrial intermediate products, Dorko and Sombathy were looking for possible applications in small series production. The DESIGN × SCIENCE installation display became one of these design opportunities.

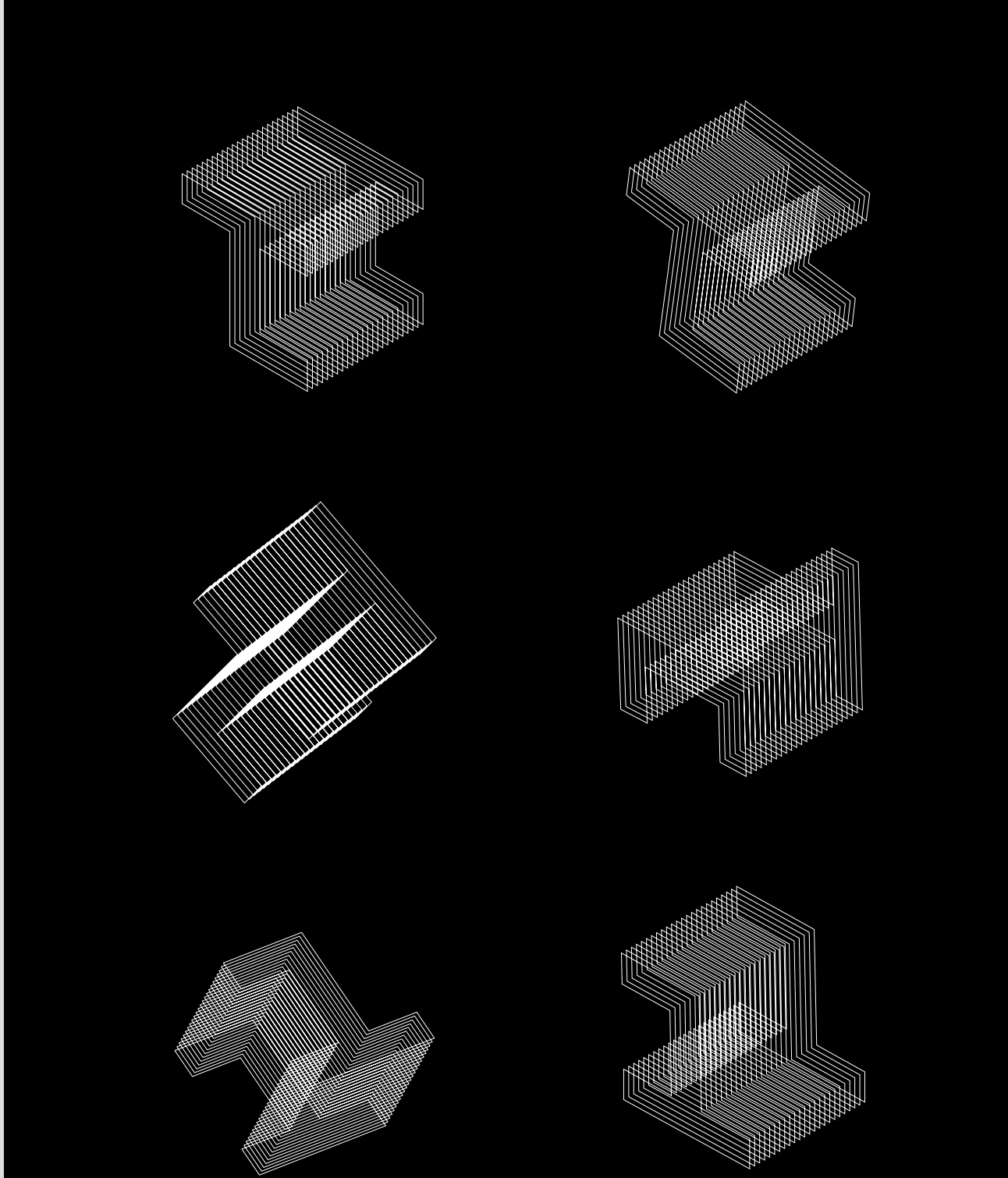
The modular display system, used for the first time in the DESIGN × SCIENCE installation, works exclusively with locally available resources. The system uses heat-bent spare SymaLITE® as the main display surface. The construction is made of beech wood rods, connected by custom 3D printed PLA components and standard bolts and nuts inspired by joints used in construction scaffolding. Each part of the exhibition system is replaceable and fully demountable, allowing for future adaptation, reuse, or recycling.

The installation DESIGN × SCIENCE, presented at the 25th edition of Prague International Design Festival Designblok, is the first group presentation of doctoral design research projects from FAD STU abroad.

In other words, it is itself a prototype. Let us give the format a chance to open an ongoing conversation and become an invitation to collaborate!

Trimtab | Prototyping Change
www.tr1mtab.com

Trimtab is a platform for design-driven technology transfer and multidisciplinary collaboration at the Slovak University of Technology in Bratislava. Founded by Michala Lipková, the platform seeks opportunities to prototype innovative solutions with positive impact and bring added value to the production loop.



Spatial transformation of the double meaning symbol T/1, present in the logotype of the Trimtab platform

Biophilia

Design for poly-sensorial biophilic experience by Tibor Antony

Doctoral research:	Application of Microalgae in the Context of Industrial Design
Realization:	2014 — 2019
Researcher:	Mgr. art. Tibor Antony, ArtD.
Research supervisor:	Prof. Peter Paliatka
Text:	Michala Lipková

Second generation of Spirulina
Lamp working prototype

As a part of ongoing experimental design research initiated within Tibor Antony's dissertation project, Spirulina Lamp #2, focuses on implementing microalgae into urban interior objects. Spirulina is an organism with multifunctional properties, holistically contributing to people's well-being indoors — especially when considering the oxygen cycle, introducing natural greenery, food, and light.

The project aims to increase the interior artifact efficiency by utilizing the multiple functions that microalgae provide, ranging from the greatest nutritional impact with a low environmental blueprint to creating a poly-sensorial biophilic experience through an integrated indoor object design. The product's essential part is its internal polyfunctional component; it underwent three distinct stages and gave birth to two patents.

Through this case study of designing for nourishing polyfunctionality, Tibor Antony offers a new look at the role of industrial design in the reality of accelerating climate crisis: the creation of new sustainable lifestyle scenarios.

Today's increasing trend of home-office lifestyles and people's rapid migration to cities causes urban inhabitants to spend around 90 percent of their time indoors, with 66.6 percent of this time spent in their homes (Dimosthenis, 2013). Antony (2022) points out the entanglement of worldwide high-impact food production problem in the following way:

"According to OECD, in 2050, 70 percent of the world's population will live in urban areas (Kitamori, 2012). An expected increase in the total global population to ten billion by the same year will create extra demand for food by 69 percent compared to the current state (Raganathan, 2013). Agriculture is responsible for 70 percent of water use among other sectors (industry, households), and it takes up 37 percent of agricultural land. Based on a study by the European Commission, meat and dietary production has an increasingly higher energy consumption (Monforti et al., 2015). Reducing the footprint requires a rapid dietary shift toward vegetarian and vegan foods. Some possible alternatives are synthetic meat, insect-based diets, and microalgae proteins. When we look at the energy embedded in food, around 74 percent is consumed during its processing, distribution, packaging, and cooking" (Antony, 2022, 81).

How might we achieve the required drastic reduction of goods and services consumed per person? In his text, Antony suggests addressing the need to consume and produce less with a new approach to industrial design, represented by the Spirulina Lamp case study. Antony introduces the notions of 'nourishing polyfunctionality' and 'elemental richness' as necessary characteristics of all future appliances, quoting Lance Hosey:

"If we could dramatically improve the effect that every physical thing has on our quality of life, we'd surely end up with fewer things. Environments large and small, public and private, would be shaped by neither excess nor scarcity but, instead, by a kind of elemental richness where everything is more fruitful and fulfilling" (Hosey, 2012, 98).

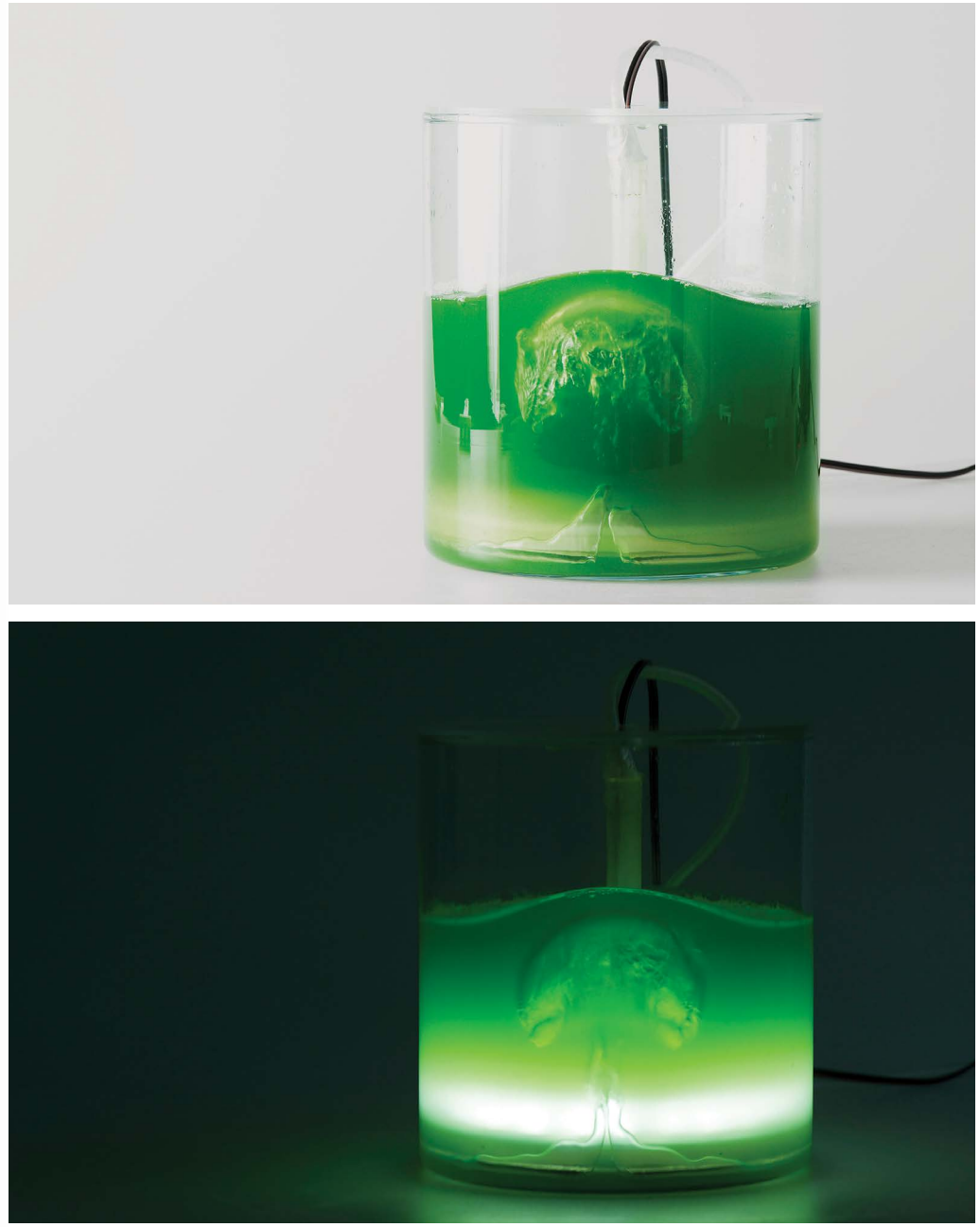
Designing to achieve 'polyfunctional qualities' of the product forms the conceptual basis for Antony's case study. He formulates his research hypothesis as follows:

"Design for Environmental Sustainability should not only be concerned with problems such as emissions reductions, energy efficiency, and material recyclability. The so-called 'Eco-Design' should purposely seek solutions with healthy and positive benefits for human beings and the ecosystems surrounding them. Such a strategy's implied richness and abundance can be achieved by integrating living systems into an industrially made artifact, taking advantage of polyfunctional quality" (Antony, 2022, 84).

Indoor microalgae cultivation was chosen as the research subject due to its holistic contributions to a healthier indoor environment. The choice was mainly influenced by Spirulina's synergistic potential to 1) provide healthy food, 2) provide natural greenery, 3) facilitate oxygen generation, and 4) CO_2 absorption, and at the same time, provide the opportunities to interact with 5) light and 6) living acoustics. Having the highest nutrient density of plants, allowing them to achieve the greatest nutritional impact with the least volume, Spirulina meets the requirements for future environmentally friendly food production. According to Antony (2022), the project focuses on local, indoor Spirulina cultivation for personal consumption with no need for logistics or packaging.

So far, produced for human nutrition almost exclusively on an industrial scale in a cultivator, container, or a reservoir (so-called 'photobioreactor'), Spirulina's cultivation process requires access to light (for the photosynthetic process to occur), mechanical agitation of water mass, maintenance of a specific temperature spectrum, and addition of dosages of a nutrient medium, influencing its nutritional quality and speed of growth.

Except for the few ongoing attempts (LillyBot 2.0, Spirugrow, Spirawline) to create a domestic appliance for Spirulina cultivation, mapped by Antony, there has been no successful example of introducing a home appliance with this purpose on the market so far. Commercial cultivators active on a factory scale are focused on the productivity and quantity of food without taking advantage of other enriching aspects of microalgae and their capacities for the individual or the community.



One of the working prototypes of Spirulina Lamp's integrated core mechanism, demonstrating the creation of air bubbles at the bottom of the reactor

First two from the top: 3D prints of different air agitators for the first generation of Spirulina Lamp prototype

Bottom: A dimmer and a 3D printed cover working as a light diffuser

“The product is conceived as a sophisticated interior lighting device enabling Spirulina cultivation in a domestic or commercial environment. The product’s basic value remains identical — direct consumption of fresh Spirulina at home without intermediaries. The light is not only used for photosynthesis; its part is released into a room.”

After exploring different design concepts (Oxygenic wall, Microalgae curtain, Spirulina Lamp, Dining table, Meditation cultivator), Antony decided to proceed with the design concept of an indoor multifunctional lamp, which seemed to have the simplest construction and allowed for a straightforward manufacturing process with a limited budget. The product development began with the first step of developing the device’s inner structure.

Before initiating the lamp’s design, Antony conducted experiments, allowing him to gain real-world experience with Spirulina cultivation. Antony states that experiments carried out during the design and prototyping phases are presented as a synthesis of three disciplines: Chemistry, Phycology, and Design. The realization of four prototypes of the inner photobioreactors aiming to verify the working mechanism has led to the creation of specific knowledge, successfully filed for a patent registration procedure (Patent Nr. SK288927B6, titled “Multifunctional Component Designed for Agitation of Microalgae Cultures in Photobioreactors,” registered at the Industrial Property Office of the Slovak Republic). In his research paper, Antony provides the following simplified description of the solution:

“The component transfers heat from a LED chip to the water mass in close surroundings. Therefore, it acts primarily as a heater for the microalgae culture and presents a light source for the photosynthetic process. Besides these two functions, the component helps with the bio-culture’s agitation through the air bubble release cycle. It also prevents biomass sedimentation at the vessel’s bottom” (Antony, 2022, 85).

The development of the internal mechanism concluded with the execution of the final prototype — the first generation of the Spirulina Lamp. The lamp’s integrated core component is the essential part of the product and enables its complex functionality: internal illumination of the Spirulina culture; secondly, it works as a heater for the culture by dissipating heat from the installed LED chip; and thirdly, it provides the culture with mechanical agitation by producing bubbles at the vessel’s bottom. The author describes the prototype as follows:

“The product is conceived as a sophisticated interior lighting device enabling Spirulina cultivation in a domestic or commercial environment. The product’s basic value remains identical — direct consumption of fresh Spirulina at home without intermediaries. The light is not only used for photosynthesis; its part is released into a room. Such function of complementary room illumination transforms the object into an integrated addition to the living space” (Antony, 2022, 87).

Antony quotes Victor Papanek (1995) on the biophilia thesis, which, in his words, “states that our biological systems feel a sense of satisfaction when exposed to actual natural greenery, seasonal cycles, fresh air, or daily light.” The Spirulina Lamp aims to support our innate tendency to seek connections with nature by exposing the natural elements (the Spirulina biomass) through translucent glass and light. The dynamic and visually stimulating green ‘scenery’ inside the reactor vessel and the rhythmic stream of air circulation can resemble actual greenery.

The first generation of the functional Spirulina Lamp prototype informed the following second generation, constructed already as a part of the follow-up start-up project after the successful defense of the doctoral thesis. The redesign included a new approach to the solution of the internal patented part: the second generation of the core experimented with a spiral motion of the water mass and integrated air-lift pipe for biomass harvesting. The third stage was focused on simplicity and combined the best from the first two prototypes: i) spiral motion, ii) LED heating, and iii) gravitational harvesting. From the form factor perspective, the second generation’s main vessel prototype has a more vertical form, and it is placed on a vertical stand (or a “leg”) working as a support for the reactor, enabling easy access (height) to the harvesting dish and makes the whole product completely independent of the room furnishings.

The author concludes the paper published in The International Journal of Designed Objects with thoughts on the project’s overall impact:

“Integrating a living organism into a human-made object presented a promising path toward creating richness and abundance in a product. The objective was to achieve at least some of the efficiency and polyfunctionality of natural structures. Such a method seemed applicable to any product type in the context of an urban interior. However, a detailed examination of Spirulina and other microalgae proved that every living system has its own properties and makes a specific, individual contribution to human beings and the environment. It meant that integrating microalgae into any interior or product is not universal unless there is a strong connection between the product’s function and the living system’s biomechanics. (...) Experimental design with the ambition to create a new type of lamp presents one of the ways of bringing this biotechnology closer to humans” (Antony, 2022).

Tibor Antony
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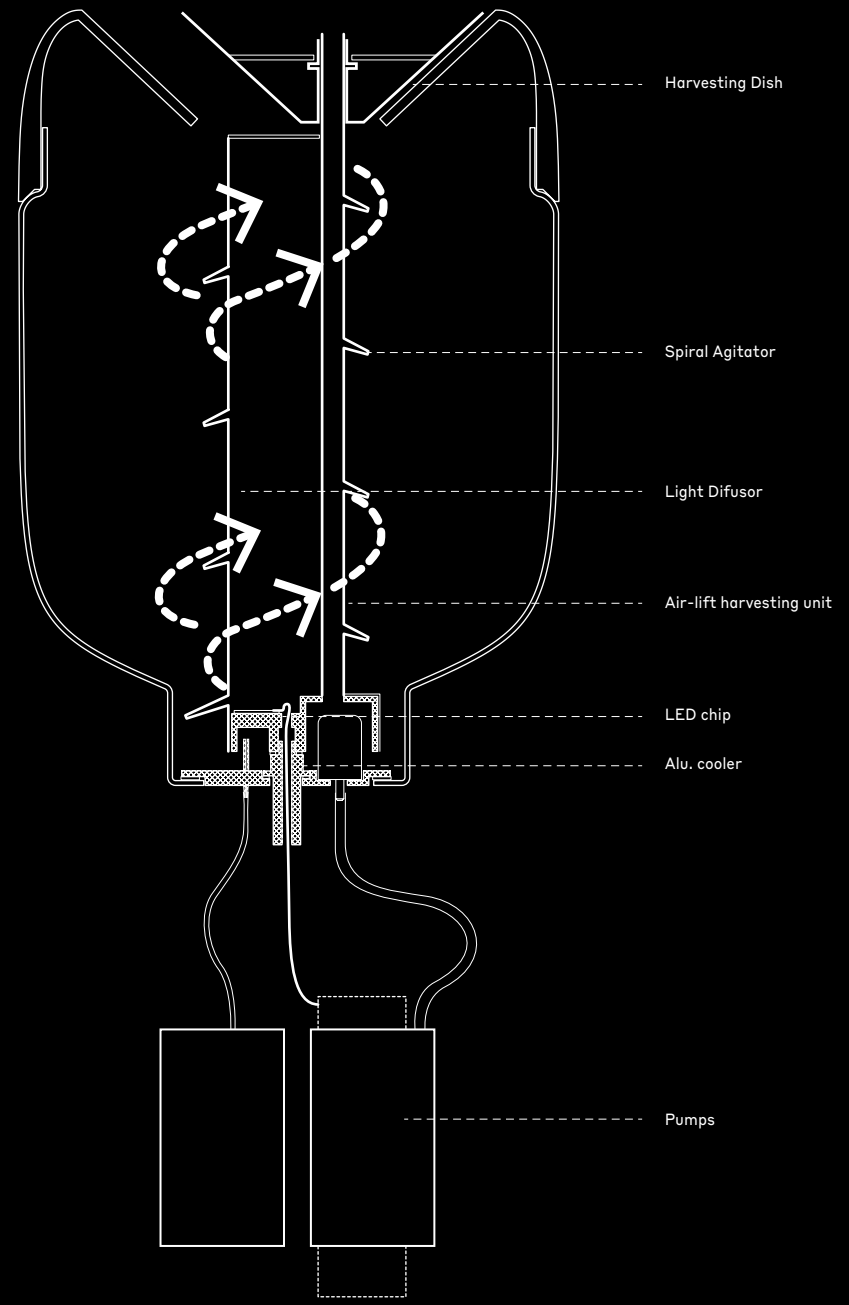
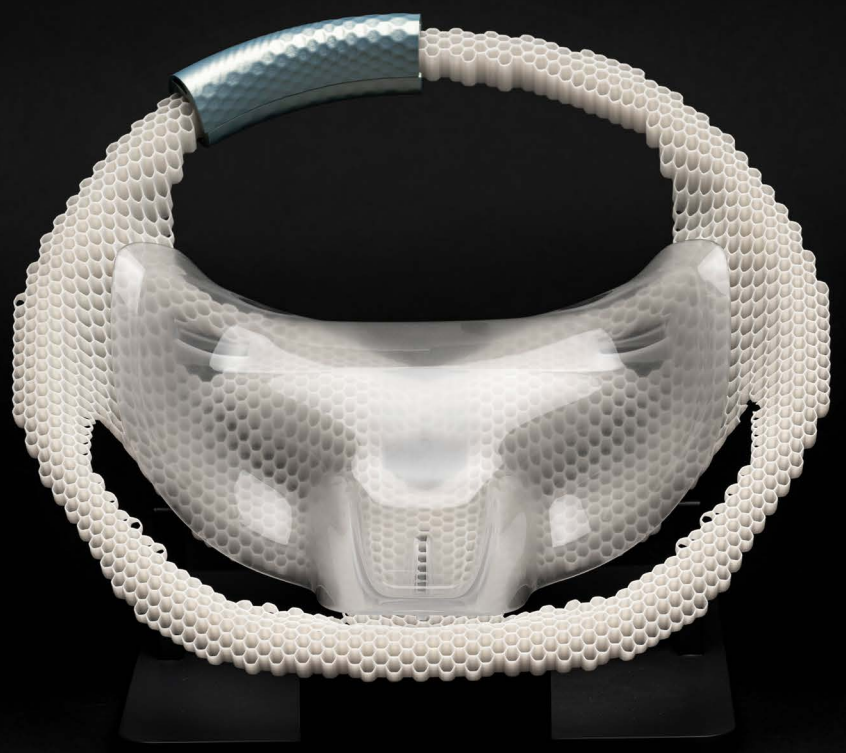
www.spirulinalamp.com

After working for several years in industrial design, Tibor Antony currently works as an Assistant Professor at the Institute of Design at the Slovak University of Technology in Bratislava. He has co-founded the start-up Living Elements, dedicated to applying microalgae biotechnology to the consumer market. He is the author of 2 patents.

Technical drawing of the second Spilurila Lamp prototype, illustrating the spiral motion of the integrated core element



Generative Design
Rethinking linear workflows
by Matej Dubiš



Doctoral research:	The Potential of Generative Design in Automotive Design
Realization:	2014 — 2018
Researcher:	Mgr. art. Matej Dubiš, ArtD.
Research supervisor:	Prof. Peter Paliatka
Text:	Michala Lipková

Generative design enables us to design increasingly complex, optimized, or mass-personalized products. Matej Dubiš's research pursues generative design methods and their potential for a specific discipline: automotive design.

The research mainly focuses on the methodology of generative design, specifically, the designer's role and the generative design process divided into four blocks: concept, algorithm, parameters, and results. Based on them, the thesis described in detail the possibilities of applying generative methods in the automotive design process, focusing on their impact on how designers work, think, and use tools.

The tangible outcome of the doctoral research is three physical demonstrations of different generative methods in designing a steering wheel, hypothetically mass-produced by 3D printing technology.

The dissertation project of Matej Dubiš, successfully defended in 2018, extensively explores a fast-accelerating field of methodologies and applications of generative design. In the preface of the thesis, Dubiš suggests that there is nothing less we can expect from the field of generative design in the future than "a complete transformation of the design profession as such" (Dubiš, 2018, 9). Additionally, the author stresses that designers "need to understand and utilize the emerging opportunities to keep creating relevant designs" (Shapes of Logic, 2018, 55).

Dubiš restricts his research interest to the intersection of design (as a professional field), automobile (as a subject of design), and generative creation methods. The research questions were defined as follows:

- Is it possible to meaningfully connect automotive design and generative design methods?
- Which uses of generative design methods in automotive design are the most promising?
- What are the benefits and pitfalls of such a connection?

The research compares the 'classical car design process' and the incorporation of generative systems into design development. Dubiš illustrates the difference by describing the car exterior design process as one aiming to achieve a perfect shape ('car sculpture') following technology and industry-specific design requirements, using traditional techniques such as sketching and clay modeling. On the other hand, while using generative design methods, instead of shaping the final form directly, an algorithm is created to generate it:

"Incorporating generative systems into a design process instantly increases the effectiveness of modeling complex or variable structures. Together with digital fabrication, they also allow for previously impossible design approaches. Various kinds of data can be used for creating thoroughly personalized products. Optimization algorithms can be directly integrated into a design process. Designers can truly mimic nature by applying its principles in form finding. Possible convergence points between the two design approaches arise mainly from the specifics of car design and the cars themselves. The data-rich nature of modern cars provides innumerable options for data-driven design development, optimization, or customizability. Properly implementing generative methods will open new ways of connecting design and engineering" (Shapes of Logic, 2018).

In the literature review part of the thesis, the author introduces several different examples of good practice to illustrate the implementation of generative methods into automotive design workflows at multiple different stages (Mercedes-Benz Bionic Car study 2005, Renault Twin'Z concept 2013, sound-absorbing structures in Peugeot Fractal 2015, BMW VISION NEXT 100: Alive Geometry 2016 or EDAG Genesis 2014). The theoretical part of the thesis further describes different fields of application of generative design. Dubiš identifies and analyses six areas of applications, related mainly by positive relationship to computing technologies as a tool for creation: generative art, computer-aided design, digital architecture, digital manufacturing, data-driven design, and artificial intelligence (Dubiš, 2018, 23 - 30).

While admitting that none of the definitions of the term 'generative design' can currently be considered as established and generally accepted, in chapter 2.1, Dubiš sums up that different existing definitions and explanations intersect on the fundamental role of the algorithm, rules, or code in the design process. In his research, Dubiš refers to this entity as the 'generative system'. Based on documented analysis of scholarly sources, the research suggests working definitions of 'generative method' and 'generative system' (Dubiš, 2018, 20):

"Generative methods in design are those design methods that involve working with a generative system."

"A generative system in design is a functionally autonomous system, generating decisions, elements or properties of elements at the level of design creation."

Along with the summary of generative methods' understanding and following up on the theoretical work of Philip Galanter (Galanter, 2016, 2008), who suggests that the key element of generative art is the use of an external system to which the artist cedes partial or total control, Dubiš suggests the following definition of generative design, suitable for the scope of his research:

"Generative design is any design practice in which the designer hands over control to a functionally autonomous system that contributes to or is on the verge of providing the finished design work" (Dubiš, 2018, 22).

As the author aptly states, digital and computations techniques are not the only example of a "functionally autonomous system" — a generative approach to creation can use biological generative systems (Neri Oxman, Tomáš Libertiny) or material-driven systems (Antoni Gaudí) to name a few, the research, however, focuses solely on the context of digital design tools. As the definition mentioned above suggests, the generated output does not have to be the final design and usually comes to its further processing in the design process:

Three 3D printed results of steering wheel design process case study, named after the generative system used: Heterogenous HoneyComb (page 29), Delaunay Construction (page 30) and Custom Stress Lines (page 33).

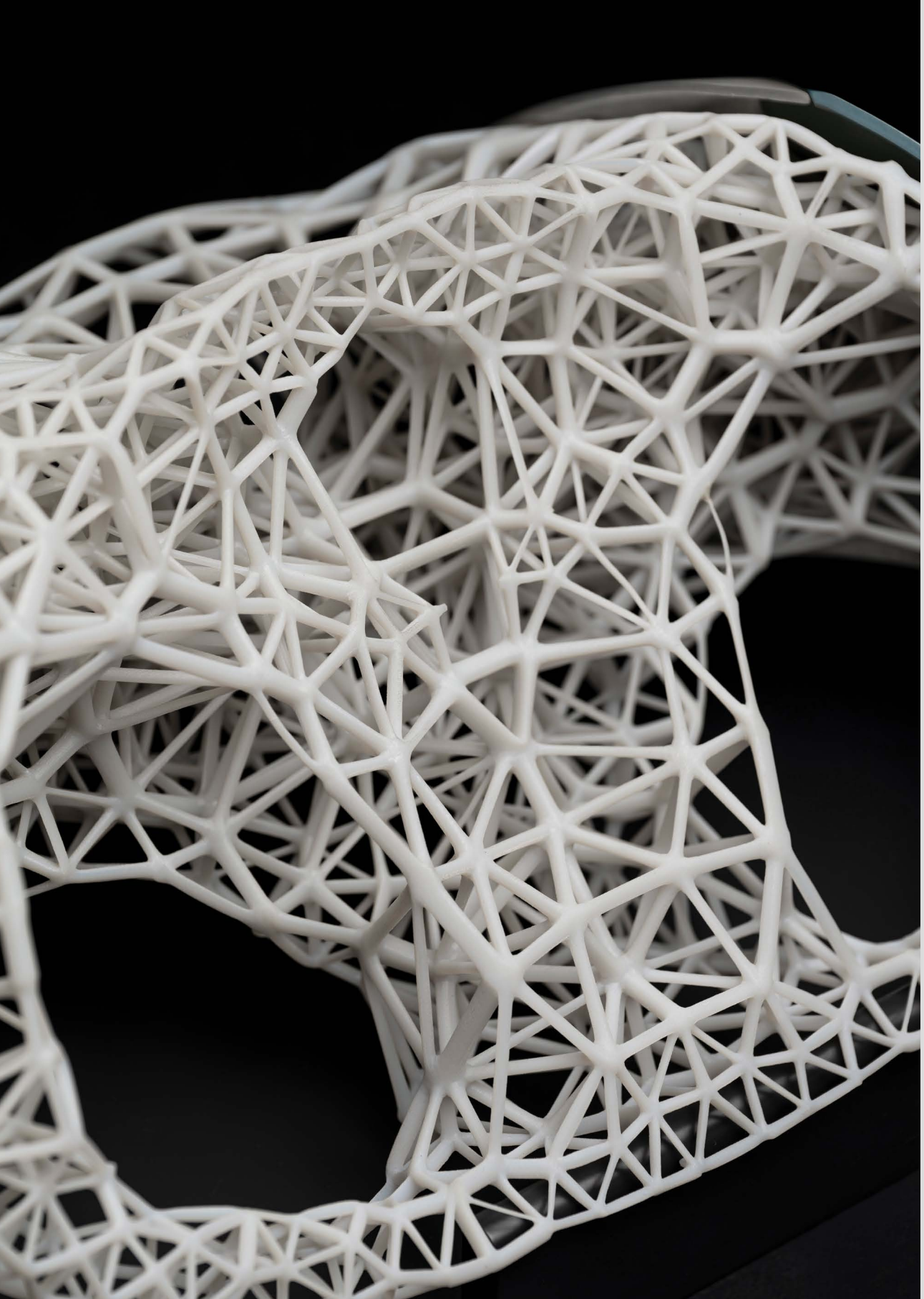
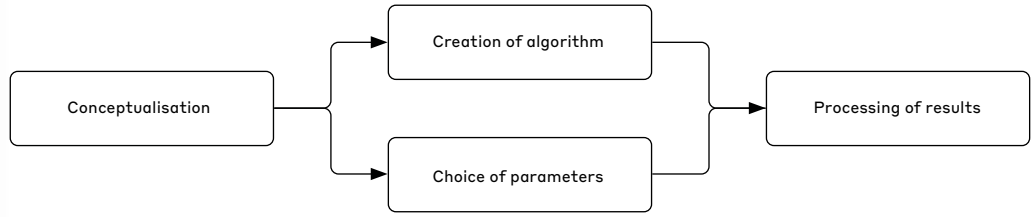


Diagram of human activities in
the process of generative design



“Algorithmization of part of the creative process does not necessarily mean weakening the author-creator position. Although the author often retreats from classical design positions using generative methods, his or her skills and experience find other applications. A different type of author-product relationship emerges, determined by working with the source data and logic that generates the form. Figuratively: The designer puts down the sculpting spatula and takes the DNA of his creation directly into his hands” (Dubiš, 2018, 34).

Dubiš further suggests a diagram of human activities in the process of generative design: Conceptualization — Creation of algorithm / Choice of parameters — Processing of results

As the author further explains, conceptualization is understood as a crucial phase of planning the overall design process, which precedes the ideation phase:

“Conceptualization is an intellectual activity, present at the beginning of each step in the design process — thinking about the design in the process of its creation. (...) ... [During conceptualization], we form the absolute foundations of the design to be created: the problem to be solved, the general approach, the design intention, the desired results, and the procedure by which we plan to reach them. Following steps of the creative process, gradually realize and materialize this concept” (Dubiš, 2018, 39).

The research brings a unique take on the methodology of the generative design process from the perspective of industrial design: The author analyses algorithm types (top-down and bottom-up), reflects the ‘algorithmizability’ of the task in the design process; he compares the concept of linear/sequential development with iterative prototyping from the perspective of design. Parameters are categorized by their origin, according to the method of entry, and according to the function of the parameter in the generative system. Finally, the author describes different types of outputs of the generative systems, along with the possibilities of their post-production.

The second part is devoted to the practical application of acquired knowledge, aiming to demonstrate and evaluate the possibilities of using generative methods in car design. After a series of smaller experiments, the three explorative case studies of the steering wheel design became the tangible output of the practice-based phase of the doctoral research. The use of generative methods was explored at various phases of steering design. The result of the practical part consists of several generative systems and design parts combining the use of generative and conventional design methods. In all presented case studies, Dubiš uses the scheme ‘concept - an algorithm - parameters - result’ to describe the design process; each subprocess is described in detail and analyzed.

The diagram Continuity of Demonstrated Design Methods visualizes the design process that preceded the three presented objects. The design process started with initial topological optimization, the goal of which, in this case, was not to verifiably optimize the design of the steering wheel but to adopt the method itself and explore the possibilities of its use in the design process. Dubiš has used a Millipede add-on for Grasshopper by Kaijima Sawako and Michalatos Panagiotis as the main software tool for topological optimization.

The results of the initial topological optimization (TO) were used in three further experiments with three different goals: Custom Stress Lines (to better render stress flow in the TO model), Heterogenous HoneyComb (to create well-controllable, regular structure, modified by TO data), Delaunay Construction (to create flexible, compact spatial structure). The three experiments bring results generated by the algorithmic system, iteratively created by the designer. Since the generated outputs were far from the functional steering wheel, further steps focused on bringing data closer to the designer's function of the object by digital sketching, NURBS modeling, and even with further use of the generative system in the design of the steering wheel details: design of the intermediate structure and surface support, variable grid of reinforcement and attachment of outer shell or the parametric haptics (chapter 4.3.10.1) and thumb tracing (chapter 4.3.10.2) experiments:

"During the creation of a generative system, the designer responds to the given problem not with a specific shape but with an idea encoded in the algorithm. Do I want to show the flow of forces in the model? I will program a drawing system that will track these forces. (...) In the next step, it was necessary to focus on the 'humanization' of the results so far, both artistically and functionally. I tried to achieve artistic humanization through a human author's interpretation of the generated form. I focused on the aesthetic specifics of the individual structures and their creative potential for inspiration in the styling of the steering wheel. By functional humanization, I mean getting closer to an ergonomically suitable and otherwise practically usable steering wheel. Again, the goal was not the complete design of the steering wheel, but rather a methodological grasp of some important milestones on the way towards it" (Dubiš, 2018, 146).

The publicly available thesis describes the technical details of all case studies, methodology, and design process steps. In conclusion, the author claims that the great support for the relevance of the thesis was the nine-month internship spent in the environment of VW Group Future Center Europe (July - September 2016 and July - December 2017) in Potsdam, Germany. The design studio supported the physical realization of the final tangible outputs of the dissertation project — 3D printed demonstrations in the steering wheel design process.

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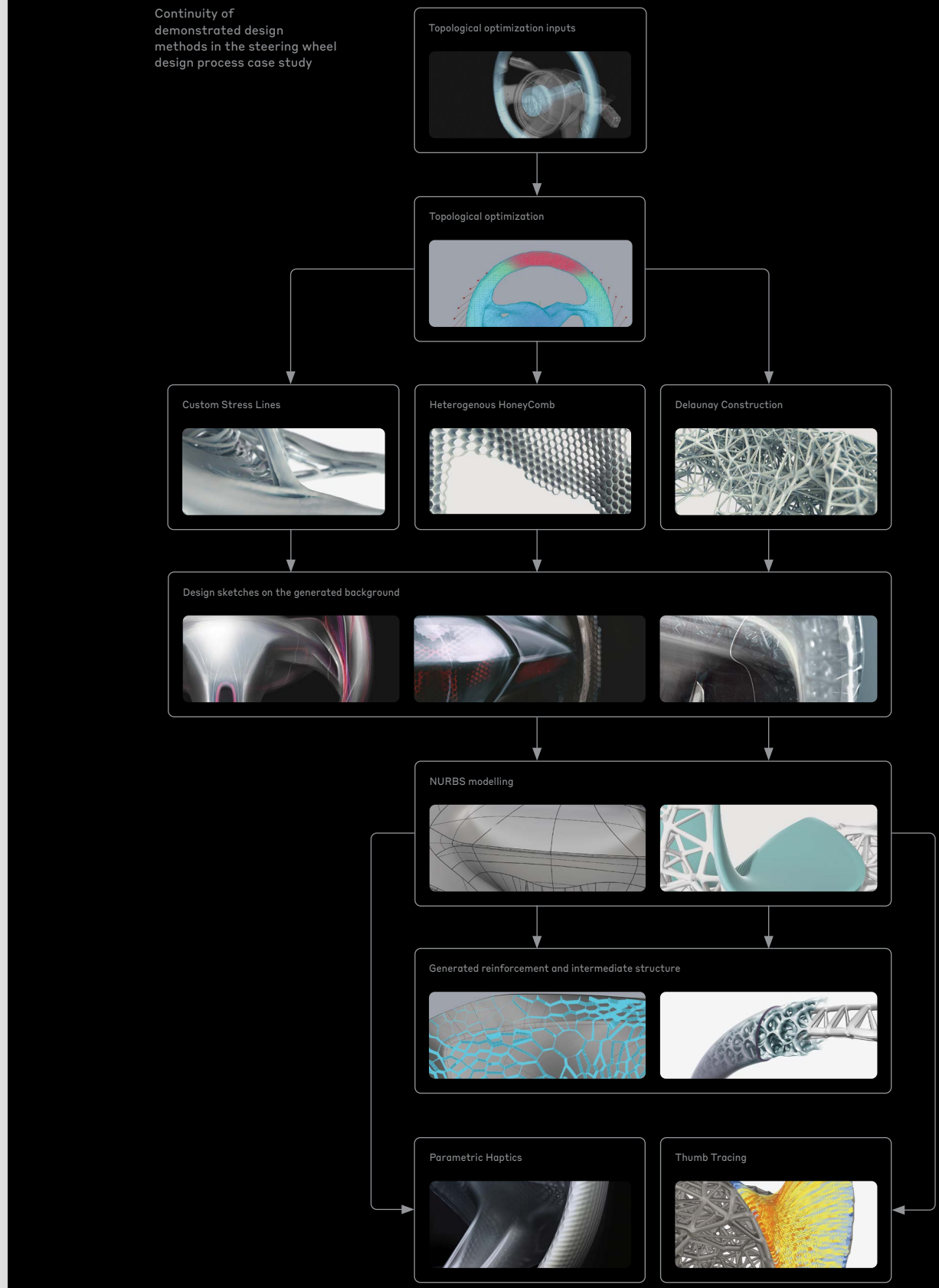
During his doctoral studies, Matej Dubiš helped implement Grasshopper modeling and parametric design at VW Group Future Center Europe in Potsdam, Germany. He currently works as a human-machine interface designer in ŠKODA AUTO a.s.



Collaborative craft

Enabling serendipity by community building and craft by Martin Mjartan

Doctoral research:	Design as an Integrating Element of the STU Creative Center in Bratislava
Realization:	2018 — 2021
Researcher:	Mgr. art. Martin Mjartan, ArtD.
Research supervisor:	Prof. Peter Paliatka
Text:	Michala Lipková

Experimental drinking glass design by Martin Mjartan for Herbert Syrups

In his dissertation thesis, Design as an Integrating Element of The STU Creative Center in Bratislava, Martin Mjartan focuses on intersections of community building and craft-based design practice in the tertiary design education context. Learning from the theory of creativity and the history of creative industries, the core of Mjartan's research activities involves creating opportunities for unexpected interdisciplinary connections to arise in the academic environment through the discussion platform Pechtle Mechtle.

In the suggested pedagogical approach, Mjartan emphasizes the importance of being active in the local and international creative community by directly collaborating with artisans and producers. Using features of informal education, workshops organized by Martin have allowed students to explore different materials, e.g., leather making, concrete 3D printing, and working with hemp. The most recent collaboration with Herbert Syrups presents experiments with hand-blown glass.

Martin Majartan's research keywords are communication, creativity, collaboration, community, and execution. The emphasis on prototyping and 'making things happen' was apparent in all his activities during the studies. The doctoral research focuses on direct contribution to the local context of design education at the FAD STU and the development of the

Creative Center of STU (CC STU), located in the faculty's building. The goal of the emerging CC STU fulfills the role of a multidisciplinary platform, aiming to support cooperation between various disciplines at the technical university and fields of creative practice beyond the academic environment.

While the concept of the 'creative class' (Florida, 2002) needs no introduction anymore, Mjartan's reflection revolves around the notion of 'creativity,' quoting Csikszentmihalyi (2013): "Creative individuals are exceptional because of their ability to adapt to almost any situation and work with whatever is available to achieve goals. (...) Creativity does not happen in people's heads but in the interaction of a person's thought processes with his socio-cultural context. It is a systemic rather than an individual phenomenon."

In the context of product design education, Mjartan criticizes the concept of the 'sole genius', and he suggests understanding creativity as the "result of relationships and people's interaction with the surrounding facts or context in which creativity is manifested" (Mjartan, 2021, 18), referring to the Sawyer's claim that "creativity is almost 80% learned and acquired" (Sawyer, 2013).

In his thesis, Mjartan proposes a definition of "design as a profession combining various disciplines' discoveries into complex works of aesthetic and ethical qualities" (Mjartan, 2021, 20). The thesis sums up seven in-depth interviews with recognized experts and, at the same time, active connectors from different research centers and knowledge hubs across STU, ranging from scientific fields concerned with basic research, such as photonics or machine vision, to applied research fields such as robotics or civil engineering. All interviews agree that collaboration between different departments and practices is highly desirable and plays a key role in the university's future development in an international sense.

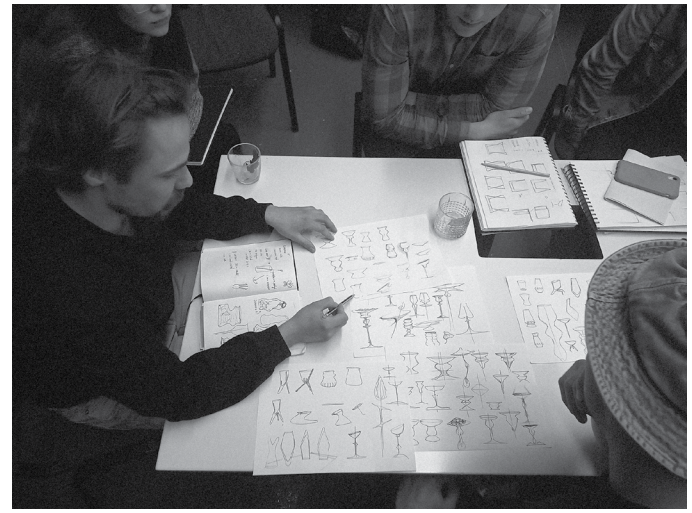
How can we effectively prepare a design student for successful work in contemporary creative practice with the need for multidisciplinarity and with the definition, as mentioned earlier, of creativity in mind? Mjartan tries to answer the question by experimenting with two forms of informal education:

- **Informal discussion in the form of a public event**
  The discussion platform Pechtle Mechtle was founded in 2016 as a grassroots activity of a group of students of FAD STU's master design course (Petra Debnárová, Adriana Bártfayová, Zuzana Wasczuková, Matej Čička, and Martin Mjartan). By the time of thesis publication, 35 public discussions had been organized, hosting 52 speakers. What started as an informal networking activity from pure curiosity later evolved into a popular go-to event with wide recognition. Mjartan's survey confirmed that the participating students consider targeted interactive discussions with creative industry members a relevant part of their design education.

- **One-off voluntary workshops**
  In a four-year timeframe, from 2018 to 2021, Martin Mjartan conducted 7 practical workshops dedicated to different materials and topics of the creative industry. All workshops were promoted through an open call, and participation in them was — as it was in the case of the discussion platform — voluntary, outside the existing curriculum. Workshops have always filled their capacity even though they were not mandatory and came with a cost (in some cases). Partners from the creative industry were extremely helpful in providing all the necessary know-how and tools for the workshop. Three out of seven workshops were organized on request from the local companies: the project Clean or Dirty? (in Slovak 'Čistý či špinavý?'), initiated by Slovak firm Redox s.r.o., a creative marketplace for the City of Žilina, and a Hempcrete workshop in cooperation with Austrian startup Hempstatic. All workshops focused on craft-based design, and small series production brought satisfactory results (the workshops Experience Leather / Zaži kožu, Taste the Clay / Ochutnaj Hlinu, and Blow Glass / Fúkni sklo). The follow-up surveys confirmed that workshop participants considered a practical workshop a "time-efficient form of design education."

Right: Atmosphere of craft-based design workshops organized by Martin Mjartan

Next doublepage: Experimental drinking glass designs and a steel mold for shaping hand-blown glass by Martin Mjartan



Based on the realized and evaluated activities, Mjartan's research contributes to the ongoing discussion on the future of design education, confirming the need for new roles of the lecturer in the contemporary context of higher education, such as content curation and management (Černý, 2019), creation of opportunities for "the act of knowing and as a creative act" to emerge (Freire, 1970, 75—79) or development of an "achievement habit" (Roth, 2015) through iterative and multidisciplinary project-based learning.

The project Blow Glass #2, on display as a part of the installation at the Designblok '23, is a continuation of one of the previously mentioned craft-based design workshops focused on familiarising students with the specific requirements of designing for small-series production. Organized for the first time during the pandemic, the Blow Glass workshop focused on experimentation with the traditional hand-blown glass technique, using wooden or metallic molds. Both glass collections were designed by FAD STU students with Martin's support and supervision and prototyped through partly remote, partly direct cooperation with glass artist and craftsman Ondřej Novotný from renowned Czech glassworks in Nový Bor.

The second workshop was organized by Martin, already in his new role of assistant professor, after successfully defending his thesis in 2021. The collection resulting from the Blow Glass #2 workshop series presents 12 pieces of drinking glass designed for Slovak producers of local handcrafted syrups - the brand Herbert Syrups from Trnava. The brief identified three types of drinking glasses the brand is currently interested in producing:

- "long drink glass" for the brand's new fermented, prosecco-like drink (200 ml);
- "mixed drink glass" with the approx. volume 300 - 400 ml for both alcoholic and non-alcoholic drinks;
- "lemonade glass" (500 ml).

The result of the workshop is 12 unique pieces of glass intended for serial production. The creative part of the Blow Glass project took place in April and May 2023 at the FAD STU in Bratislava as a series of design workshops. An important part of the whole process was the participation of brand representatives at the feedback sessions, commenting on the student designs, sharing insight into the business side of syrup making, and providing an actual tasting of the products. The authors of the 12 designs: Ondrej Ferianec, Anna Gergelyová, Barbora Hagarová, Rebeca Ihringová, Juraj Kotoč, Martin Miština, Tomáš Páriš, Barbora Pavlikovská, Vanessa Píverová, Paulína Varechová, Martin Sombathy and Martin Mjartan.

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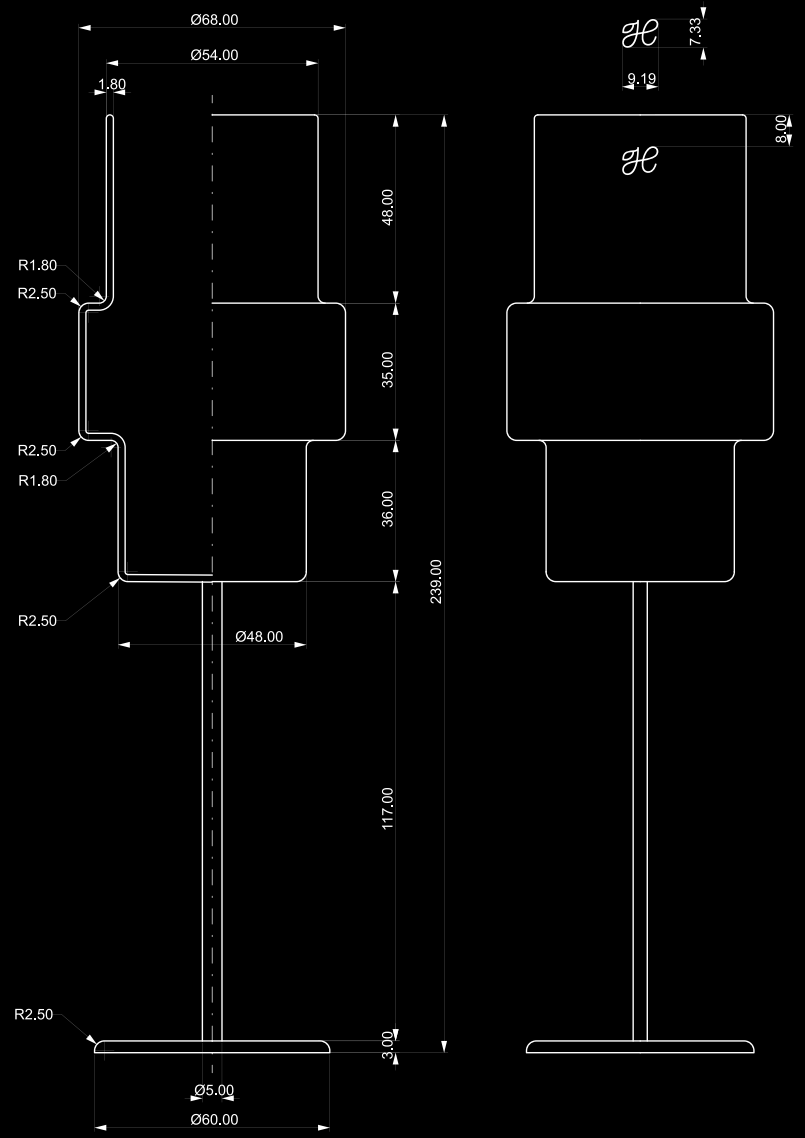
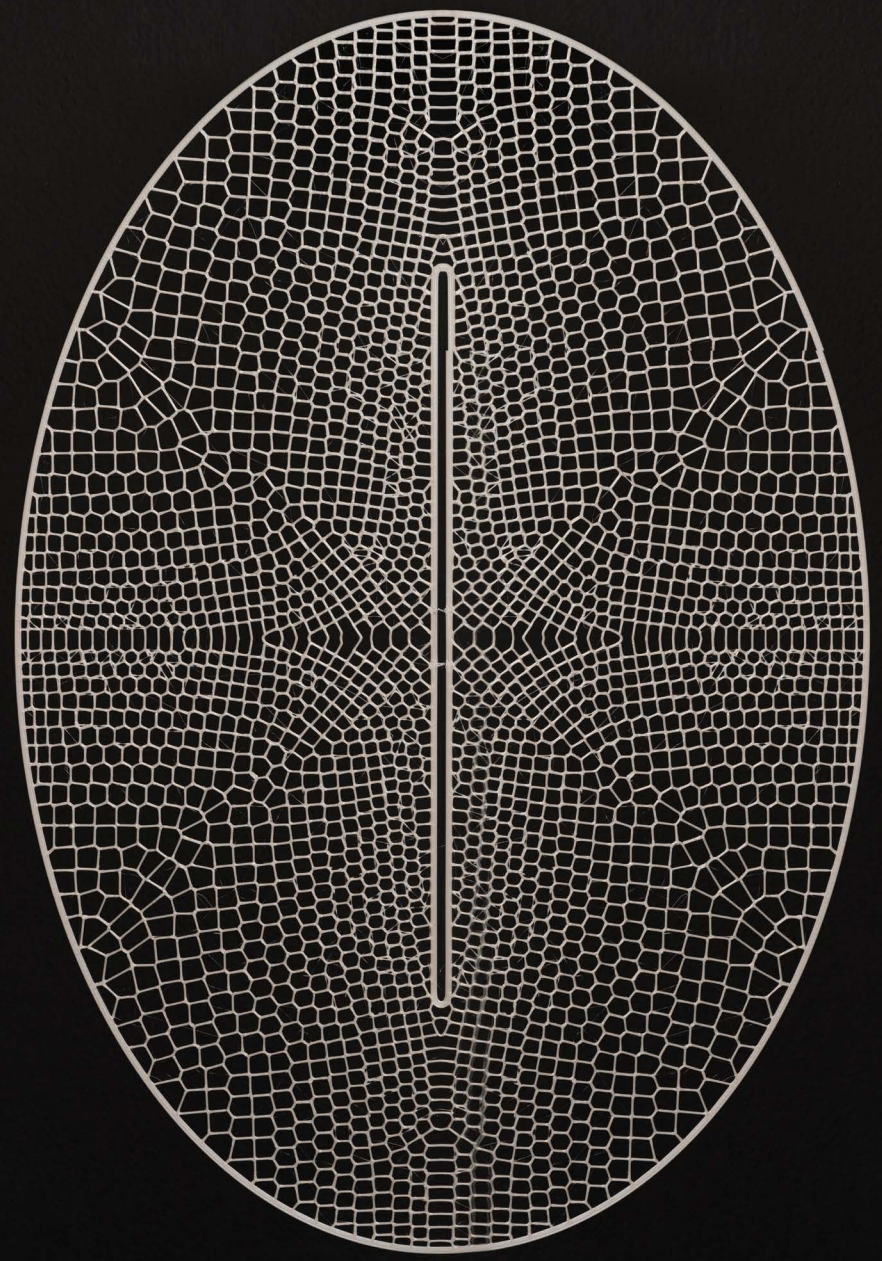
Martin Mjartan's creative work is centered around hands-on experimentation and sculptural work with metal. In 2018, Martin participated in the very first Young Ambassador program at Michelangelo Foundation's Homo Faber exhibition in Venice. Several of his works are permanently placed in public space, including the IMMORTAL TRUTH monument in memory of the murdered journalists Daphne Caruana Galizia and Ján Kuciak and his fiancee Martina Kušnírová.

Technical drawing of a drinking glass design for the Herbert Syrups brand by Martin Sombathy



Senseable Biomaterials

Design-driven innovations in biomaterials by Vlasta Kubušová



Doctoral research:	Design-driven Biomaterials Innovation for Positive Impact
Realization:	2019 — ongoing
Researcher:	Mgr. art. Vlasta Kubušová, MA
Research supervisor:	Assoc. Prof. Michala Lipková
Text:	Michala Lipková

Detail of folded 3D-printed lattices

The project Sensbiom #1 is one of Vlasta Kubušová's Fulbright fellowship results at DumoLab Research for Biodegradable Architecture at Penn's Weitzman School of Design and in collaboration with crafting plastics! studio and Label-Free Research Group at Center For Bits and Atoms, MIT.

The project brings together biomaterial-driven and computer-controlled manufacturing of aroma-active lattices. The research team sets forth the question of materials in the built environment being able to passively identify harmful particles and respond with aroma-active molecule release to help detoxify indoor air.

The 3D printed lattice-like forms are prototypes of self-supporting, scented modules made from two types of bio-based materials: biopolymer blends aiming to replace fossil fuel plastics and water-based biocomposites made from the most abundant biopolymers on Earth such as chitin, cellulose, and silk.

Vlasta Kubušová has approached her doctoral studies from a strong position and is in an already advanced stage of previously carried out independent creative research. Together with Miroslav Král, the founding duo of crafting plastics! studio has explored the vastly unknown field of bioplastics derived from plants for more than a decade:

"Realizing dynamic research and innovation in materials and design, we provide a base for interdisciplinary progress towards enjoyable sustainability and more transparent production. We explore new product development methods, from a basic craft approach to high-tech machinery. Our pursuit is to fully control the product's lifespan, from its origin — in the form of unrefined material — through the final product until its inevitable decay." (Kubušová et al., 2023).

“Our pursuit is to fully control the product’s lifespan, from its origin — in the form of unrefined material — through the final product until its inevitable decay.”

As a visiting doctoral degree candidate and Fullbright scholar at UPenn’s DumoLab Research for Biodegradable Architecture at Penn’s Weitzman School of Design, Vlasta Kubušová has focused on investigating the scaling potential of innovative biologic materials for the use in product design and architecture systems. The project Sensbiom #1 focused on exploring biomaterials’ sensory (especially olfactory) properties.

Kubušová’s research intention has grown from a previously explored idea of distinguishing natural and synthetic materials by the sense of smell. Together with Moritz Maria Karl, crafting plastics! studio investigated the possibilities of olfactory properties of bioplastics during their common research project Breathe In/Breathe Out, presented for the first time at Milan Design Week in 2019 and later at MAK’s Vienna Biennale For Change in 2021:

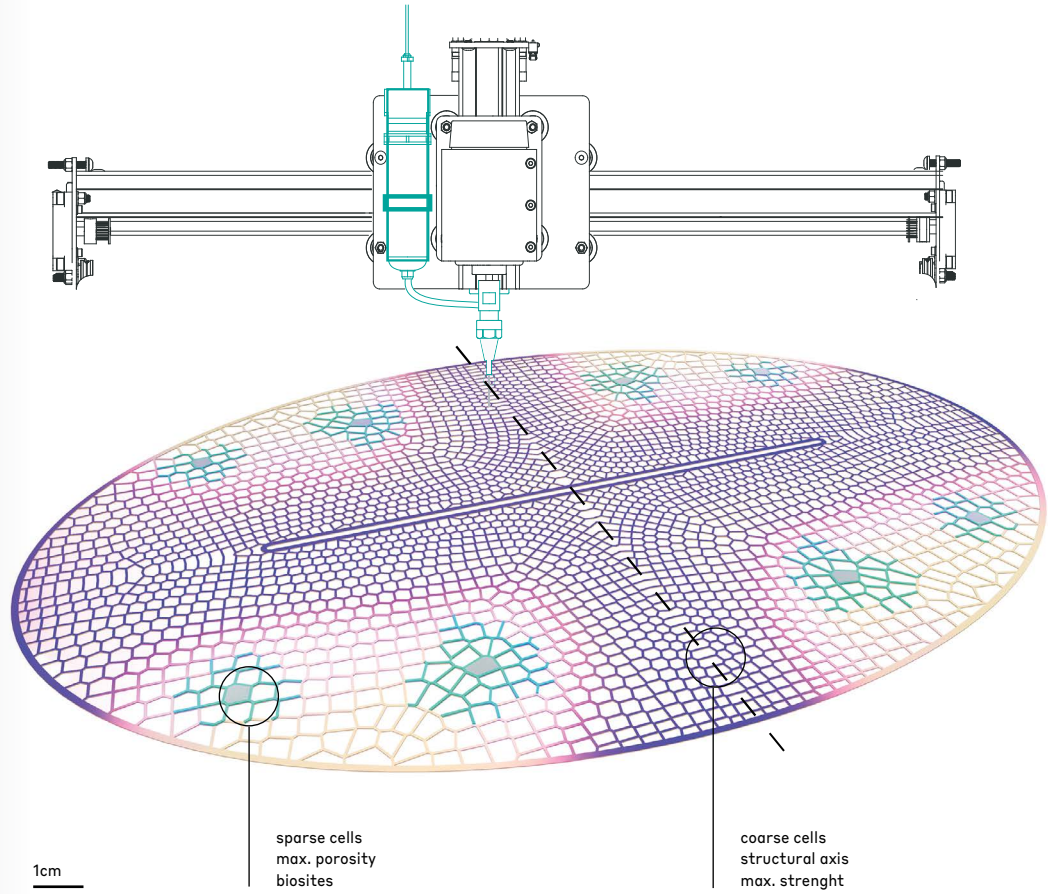
“By discussing the complexity of challenges when integrating bioplastics for longer-lasting products, we discovered that these new materials are missing their own identity. (...) We need to create new acceptance for the natural alternatives and enhance their own features and properties, respecting where they came from and their entire lifecycle. (...) One of the challenges in implementing bioplastics on a larger scale is that it is very difficult for the user to identify whether the product is made from petroleum-based plastics or a biocomposite. The sense of smell can add an additional material property and help to distinguish natural and synthetic materials. (...) Within the design research project Breathe In/Breathe Out, we aimed to develop a unique scents library for the bioplastic material NUATAN. On the one hand, this would help customers distinguish between synthetic and natural plastics and create a new relationship with these new materials that suddenly gets their own identity or story” (Wirth, 2021).

In her initial research proposal for the Fulbright fellowship, Kubušová draws attention to the “interactive and responsive potential of biomaterials towards their environment and consumers” as being a much-underexplored feature:

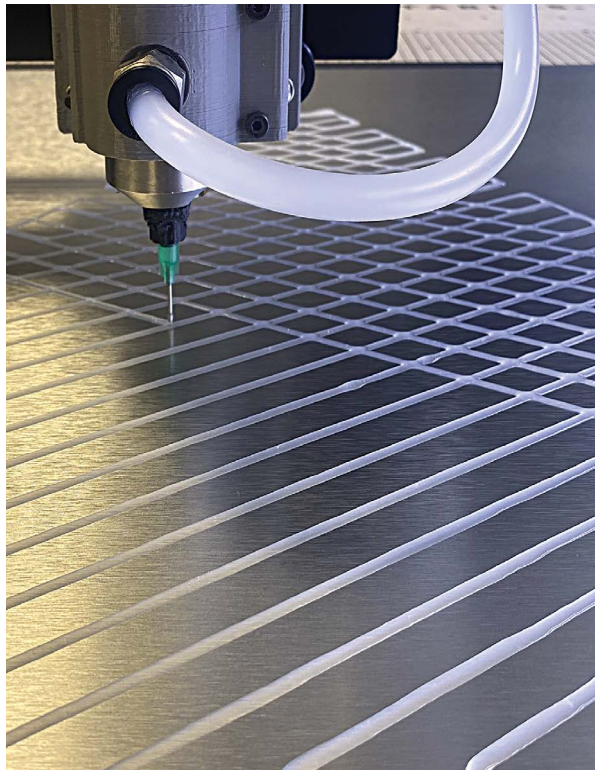
“Biomaterials are also very good candidates to host and enhance interactivity thanks to their programmable properties, i.e., encapsulations of active molecules of responsive substances. In general, visual and haptic properties primarily perceive materials currently used in architecture, interior, and product design, and olfactory properties are much less prominent. However, features such as a scent play a central role in the emotional acceptance of material and decisively determine its distinctive character.”

One of the multiscale questions asked by material scientists, designers, architects, and synthetic biologists (UPENN, 2023) was, “Could future materials help detect and correct the presence of toxic volatile compounds?” Sensbiom #1 became an interdisciplinary cross-country collaboration, proposing new design-driven solutions for integrating interactive biomaterials based on waste resources into functional everyday applications. The technical development and final material fabrication solution of the Sensbiom #1 project is in detail documented in a research paper published by the team in Frontiers magazine:

“Cell-free protein expression systems are combined here with 3D-printed structures to study the challenges and opportunities as bio-fabrication enters the spaces of architecture and design. Harnessing large-scale additive manufacturing of biological materials, we examined the addition of cell-free protein expression systems (‘TXTL,’ i.e., biological transcription-translation machinery without using living cells) to printed structures. It allowed us to consider programmable, living-like,



Mesoscale design methodology. Additive manufacturing is used to functionally distribute fibrous biopolymer blends in 50 cm long lattices with varied cell size and material composition (Figure 3 from Frontiers, 2023, 7).



Cells cloning (top) and additive manufacturing of biological materials (bottom) in DumoLab Research

Next doublepage: Laia Mogas-Soldevila, director DumoLab Research, in the Sensbiom #1 installation at ICA, Philadelphia

responsive systems for product design and indoor architectural applications. (...) We propose a roadmap towards creating healthier, functional, and more durable systems by deploying a multiscale platform containing biologically active components encapsulated within biopolymer lattices operating at three design scales: (i) supporting cell-free protein expression in a biopolymer matrix (microscale), (ii) varying material properties of porosity and strength within two-dimensional lattices to support biological and structural functions (mesoscale), and (iii) obtaining folded indoor surfaces that are structurally sound at the meter scale and biologically active (we label that regime macroscale)" (Frontiers, 2023).

Following a build to understand its philosophy, the installation of Sensbiom #1 became an attractive and tangible outcome of an otherwise difficult-to-explain science research project. Sensbiom #1 was publicly presented during the ACADIA 2022 conference reception at the Institute for Contemporary Art (ICA) in October 2022 in Philadelphia. The temporary installation combined biomaterial-driven and computer-controlled manufacturing of aroma-active, 3D-printed lattices as self-supporting, scented modules.

The modules were made from two types of bio-based materials: biopolymer blends aiming to replace fossil fuel plastics and water-based biocomposites made from the most abundant biopolymers on Earth, such as chitin, cellulose, and silk. The team set forth the question of materials in the built environment being able to passively identify harmful particles and respond with aroma-active molecule release to help detoxify indoor air.

"Zingernone (4-(4-hydroxy-3-methoxyphenyl) butan-2-one) is the aroma infused into the water-based biocomposite modules during fabrication and demonstrates the potential of air-purifying scents released by active materials. In particular, zingerone can help purify the air as it is thought to have known pharmacological and biological activities, including anti-inflammatory, anticancer, antimicrobial, and hepatoprotective activity" (Kubušová et al., 2023).

The installation was a joint effort stemming from ongoing work on the SENSBIOM Project (Senseable biomaterials for healthier habitats) by DumoLab Research for Biodegradable Architecture at Penn's Weitzman School of Design and crafting plastics! studio and the project soon continued further with a second iteration. Sensbiom II — Solar Active Materials was presented by crafting plastics! & DumoLab Research at the Milan Design Week 2023. The follow-up project proposes a future where objects help humans reconnect with the planet using environmentally interactive materials derived from renewable resources — this time by visualizing ultraviolet radiation (UPENN, 2023).

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Vlasta Kubušová is a material designer, researcher, and co-founder of award-winning crafting plastics! studio, an interdisciplinary design studio focusing on circular design and research in innovative, responsible materials. During her doctoral studies at FAD STU, Kubušová received a Fulbright Scholarship for 2021/2022, working on interactive biomaterials at the University of Pennsylvania (DumoLab Research). Recently, Kubušová received MIT-SLOVAKIA MISTI Global Seed Funding for project Senseable Matter — research in interactive biomaterials for design and architecture with Dr. Andreas Mershin at Massachusetts Institute of Technology.

Redefining Color Coating

Color palette for sustainable future by Soňa Otiepková

Doctoral research:	Color in the Design of Bioplastic Products
Realization:	2020 — ongoing
Researcher:	Mgr. art. Soňa Otiepková
Research supervisor:	Assoc. Prof. Andrea Urlandová, PhD.
Text:	Michala Lipková

Paints and color coatings significantly contribute to pollution by microplastics in our environment. In cooperation with the Faculty of Chemical and Food Technology STU in Bratislava, the doctoral research by Soňa Otiepková addresses the specific problem of bioplastics surface coloring. While bioplastics' main advantage is degradability, most paints and coatings are designed to last much longer than the product.

To develop a biodegradable color palette, Otiepková experimented with samples of Nuatan, a bioplastic developed by the crafting plastics! studio. The resulting formula contains binder resin based on soybean oil and mineral pigments. The final color palette is suitable for bioplastic surface coloring, and it was carefully designed to meet the requirements of commercial design projects utilizing bioplastics.

Soňa Otiepková's doctoral research project aims to map, document, and classify emerging approaches to color in product and material design from the perspective of circular design. Otiepková spotlights the long-overlooked problem: the contribution of paint to global plastic leakage. Research organization EA - Earth Action, in their 2021 report Plastic Paints the Environment, claimed that particles of paint account for more than half (58%) of all the microplastics that end up in the world's oceans and waterways every year (Paruta et al. 2021, 14). The main research question was therefore framed as follows:

"The majority of current progressive approaches to design creation and research is set in an ecological framework, considering their impact on the environment. The question is not whether color is present in this process, but rather where it stands, whether it can help it, and how much it affects it" (Otiepková, 2021).

The prevailing use of synthetic and chemically enhanced colors makes products hard to recycle, and as Otiepková aptly points out, "the color today is designed to last much longer than the product itself."

In one of her published research papers (2021), Otiepková identifies three problem areas in the relationship between color and design:

- **“research gap”** - arguing that the potential of color in the context of sustainability is not being researched sufficiently and the topic is being overlooked,
- **“color manufacturers”** - Otiepková points to the distortion of the perception of colors by manufacturers in order to maximize profits, be it, e.g., the gender color coding (blue vs. pink) or the pressure to achieve unnatural long-lasting colors that will not fade,
- and so-called **“color relativity,”** with which Otiepková refers to “the flatness of the color industry,” described at the example of the concept of branded corporate colors, strictly avoiding any changes in the shade when used for promotional products.

In her mapping of the sustainable approaches to color in design, the author classifies four contemporary trends:

1. sustainable (progressive) coloring approach,
2. coloring of recycled materials,
3. coloring of bio-based materials,
4. reusing products through new color coating solutions. (Otiepková, 2021)

In the practical part of her research, Otiepková focuses on coloring bio-based materials by collaborating with a Slovak design studio crafting plastics! (www.craftingplastics.com), known for their long-term experimentation with bioplastic materials and their own certified biodegradable material blend Nuatan (www.nuatan.com). The main objective of the cooperation with the studio within Otiepková’s doctoral research project is to expand the possibilities of using bioplastic materials in durable products through color. In cooperation with the Faculty of Chemical and Food Technology STU, the specific problem of the surface coloring of bioplastics is solved through experimental research: examining various creative methods of surface coloring with the use of natural pigments, dyes, and binders.

Through experiments and durability tests, Otiepková developed a formula containing binder resin based on soybean oil, which she has successfully used on bioplastic surfaces. The formula was used in a creative workshop with design students at the FAD STU in Bratislava as a part of the research. The workshop resulted in a palette of colors with a given formula and mineral pigments specified in the NCS color system. The palette’s individual colors are chosen carefully to be easily combined. According to the author’s words, the goal of the research is to “contribute to the development of creative methods of coloring of bioplastics, which complement and support the ecological properties and the lifespan of the material and also expand the possibilities of using bioplastics in creative industry and product design.”

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Soňa Otiepková’s work is mainly characterized by working with colors and textures. She co-founded Villo Design, an awarded children’s furniture company. She works as a researcher in the field of colors and materials and collaborates with the studio crafting plastics! She is a doctoral degree candidate at FAD STU in Bratislava. Besides her work in product design, Otiepková is also dedicated to contemporary weaving on 100-year-old looms, exploring the possibilities of color within the craft technique.

S1010-Y

S0570-Y10R

S0585-Y40R

S8005-Y80R

S0510-Y90R

S1020-R60B

S2565-R80B

S7020-R80B

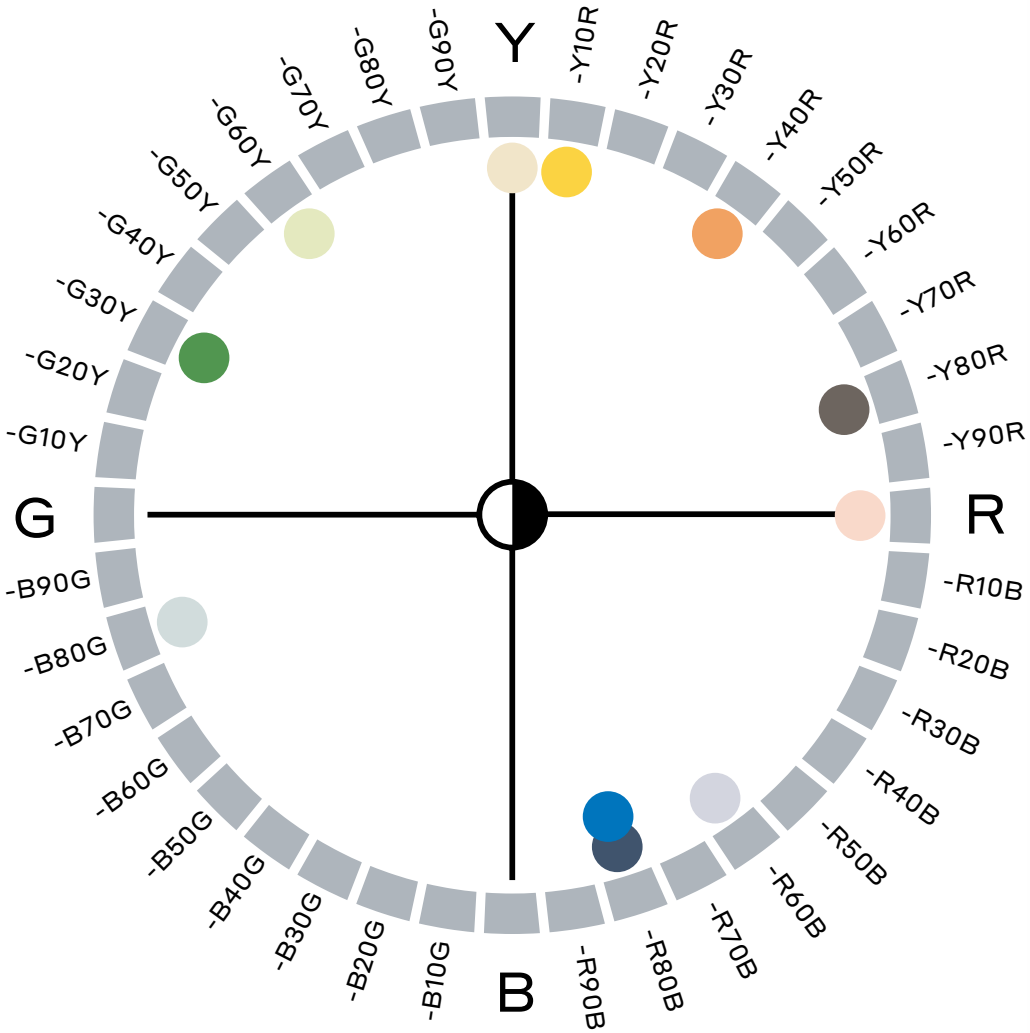
S2005-B80G

S3050-G30Y

S0520-G60Y

Left: Creative workshop with students of design at the FAD STU in Bratislava, September 2022

Top: The final palette of colours, suitable for surface colouring of bioplastics



Right: Creative workshop with students of design at the FAD STU in Bratislava, September 2022

Top: The final palette of colors specified in the NCS color system

Experience of Time

Toolkit for experience design and speculation by Petra Hurai

Doctoral research:	Principles of Time Measurement and their Development Using Intelligent Technologies
Realization:	2016 — 2023
Researcher:	Mgr. art. Petra Hurai, ArtD.
Research supervisor:	Prof. Peter Paliatka
Text:	Michala Lipková

Ephemeris wristwatch design concept by Petra Hurai

Petra Hurai's dissertation research thesis, Experience of Time, describes the complex concept of time from the perspective of the design process and social development. The perception of time is a phenomenon subjectively felt by a person and can be accurately described thanks to research advancements in physics, biology, cognitive psychology, neuroscience, and the like.

Hurai's research mainly focused on exploring the notion of 'subjective time' described through sensory perceptions. The project considers the subjectivity of time as a characteristic feature that should be included during the design process — 'designing with time'. The thesis proposes an inspiring tool for designers and the general public; it explores the relational context of subjective time and sensory perceptions through visual clues.

'Thanks' to technology, our days are longer, our loved ones are always within reach, and our work never ends. We hear about the imbalance between the biology of our bodies and the pace of modern times in the media every day. In his book In the Bubble, John Thackara begins the chapter on speed by quoting the English writer Bruce Chatwin, retelling a story of a group of white explorers in Africa who forced native porters to rush to their expedition's destination. At the point when the porters stopped and refused to continue the journey, they argued: "We have to wait until our souls catch up with our bodies" (Thackara, 2006). In an era in which Stewart Brand calls long-term thinking 'challenging and rare' (Brand 1999, 2) and Douglas Rushkoff (2013) warns against 'the twenty-first-century presentism', designers have the opportunity to provide a counterpoint to the current acceleration culture and contribute to the expansion of the limited understanding of time.

“Objective time is the concept used worldwide on a daily basis using numbers and dials. It can accurately be described by mathematical and physical principles. On the contrary, subjective time is described as a perception of time tied to an individual experience. Subjective time can be perceived as duration of time, distortion of time or temporal illusion, such as perceived speed of time or length of time interval, Vierordt’s Law, oddball effect or chronostasis.”

The topic of subjective time already appeared in Hurai's diploma thesis, in which she describes a subconscious perception of time that consists of visual signals placed on a watch dial as a reminder of upcoming events. The diploma thesis resulted in two wristwatch designs, Ephemeris I and II, with mechanical and hybrid movements. The Ephemeris concept operates with anticipation — a psychological phenomenon that influences the subjective passage of time — if we know what awaits us = time passes faster.

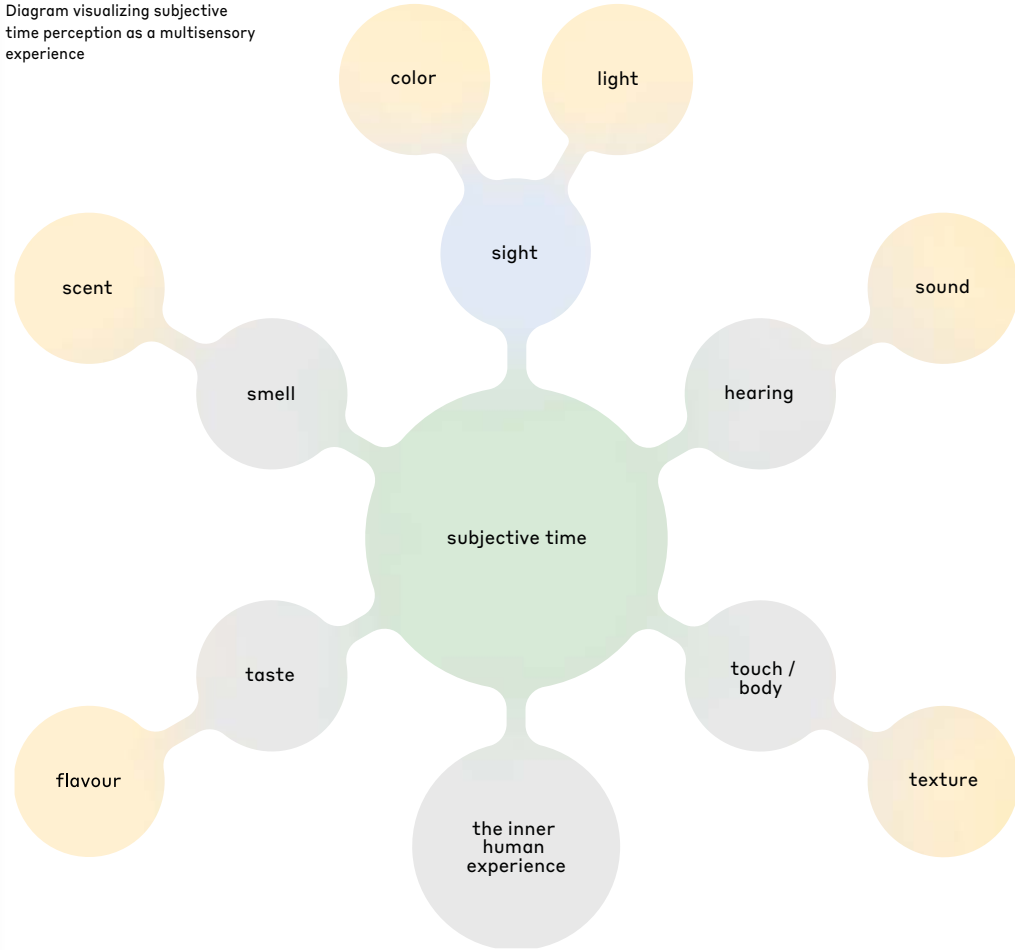
The dissertation project Experience of Time initiates a much-needed conversation about the phenomenon of individual time perception. The core of the research carried out by Petra Hurai is based on changes in society after the period of the COVID-19 pandemic. In her thesis, Hurai draws attention to the still overlooked notion of subjectively experienced perception of time, which can be accurately described thanks to improving scientific research today:

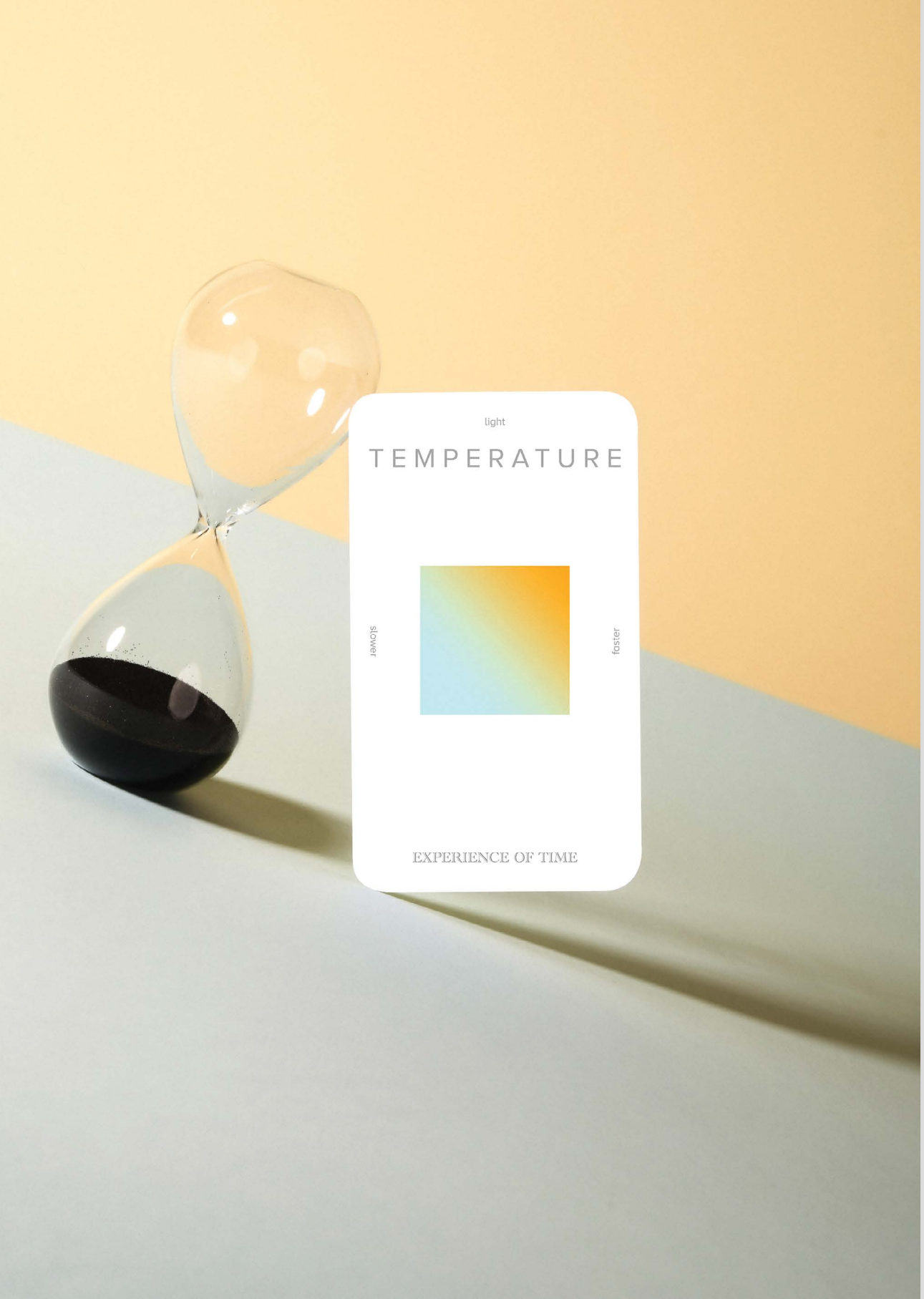
“Objective time is the concept used worldwide daily using numbers and dials. Mathematical and physical principles can accurately describe it. On the contrary, subjective time is a perception of time tied to an individual experience. Subjective time can be perceived as the duration of time, distortion of time, or temporal illusion, such as perceived speed of time or length of time interval, Vierordt’s Law, oddball effect, or chronostasis (Foster, 2022). The basis of the concept of subjective time was created by the French philosopher Henri-Louis Bergson. The concept of time describes the duration of time — ‘durée’ — one of the temporal illusions perceived by a person” (Hurai, 2023).

The immediacy of communication technologies largely marks our perception of time, and it radically differs from how our ancestors in pre-industrial times perceived the current passage of time. The research considers the subjectivity of time as one of the important external characteristics of product design that should be included in the design process — rather than as the final touch or as an additional function.

One of the strong aspects of Hurai’s dissertation is visual representations of complex concepts in the form of representative charts and diagrams, similar to ‘images of philosophy’ used to express philosophical thoughts through a rich system of metaphors and other means of imagination (Zapletal, 2022, 246).

Diagram visualizing subjective time perception as a multisensory experience





The dissertation thesis's main ambition is to contribute to describing different aspects of subjective time experience. One of the key charts of the thesis visualizes the concept of subjective time perception as a multisensory experience, assigning specific properties to each of the senses (e.g., 'light' and 'color' in the case of sight).

"The notion of subjective time can be described and further explored through sensory perceptions. Perception of time is defined as the multisensory experience based on an individual interpretation of internal and external stimuli. A set of stimuli then creates a space for the subconscious perception of the passage of time (duration of time). The research consequently deals with one of the temporal illusions — the duration of time that is possible to describe via scientific methods, such as measurement of the duration (and speed) of the perceived time interval. We explore different ways to define and measure this 'unit' of subjective time through a visual form of a conceptual chart containing basic senses, sensory dimensions, and their properties ('zeitgebers'). One example of subjective time perception is the situation when the time interval is perceived as shorter if the color of the perceived object or space is in warm hues (red or yellow hues) (Thönes et al., 2018)." (Hurai, 2023).

The tangible outcome of Hurai's research project — the Experience of Time toolkit — becomes an inspiring, ready-to-be-explored provocation targeted not only at design experts. As a designer, Hurai successfully applies her creative training and art craft to distill her theories into tangible, open-ended visual clues. The universality of the cards allows interdisciplinary discussion, offering a new perspective on the concept of subjective time measurement through evocative visual guides, focusing specifically on the perceived speed of time interval.

"The toolkit consists of a deck of cards, in which each card displays one property ('zeitgeber') of a sensory dimension and the length (speed) of a perceived unit of subjective time. The project brings a new viewpoint on the concept of time, initiates a conversation on the subjective time phenomenon, and highlights its importance as an essential dimension in the design process" (Hurai, 2023).

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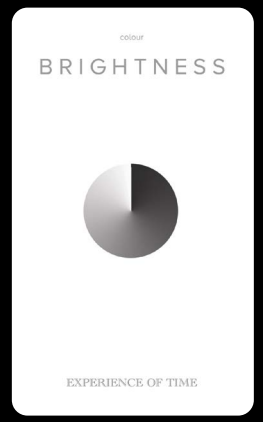
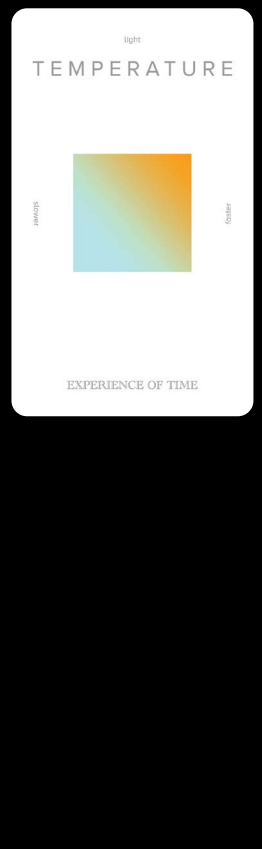
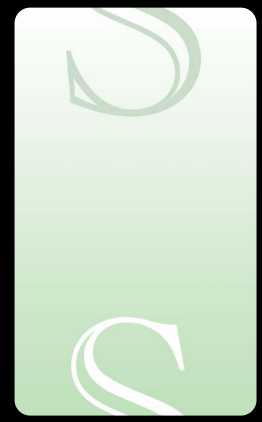
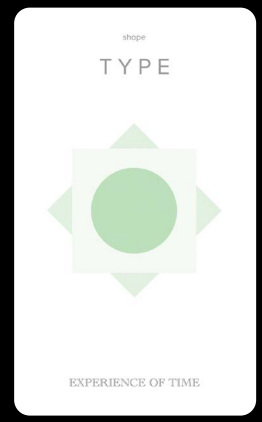
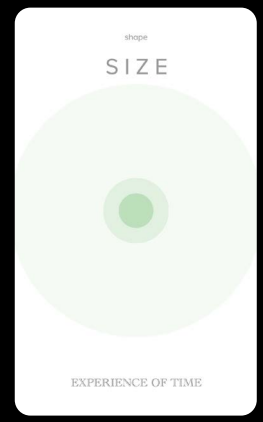
Petra Hurai is a visual storyteller, creative director, and founder of The Shamrock Green Studio, focusing on bespoke photography and visual communication. She is an experienced product designer passionate about practice-based and theoretical research and the art of watchmaking.

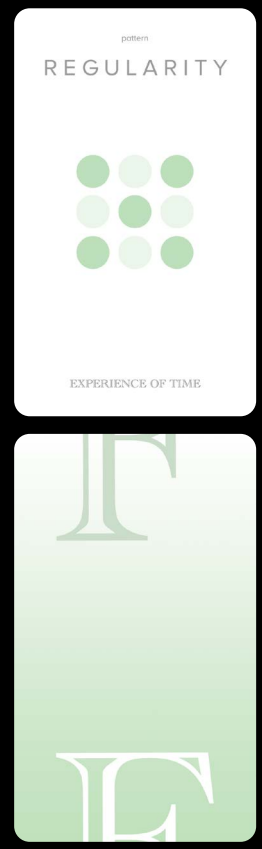


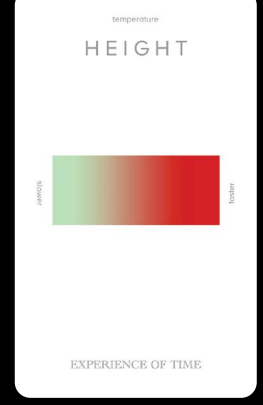


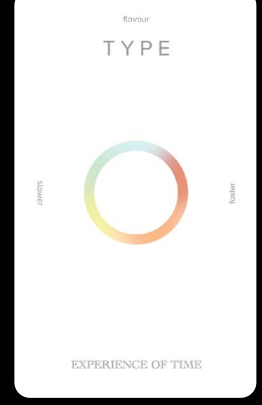












Experience of Time toolkit:
a set of cards for the illustration
of subjective time perception,
focusing specifically on the
perceived speed of time interval

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