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The Role of Filtering in Design Processes: Creating Stabilities in Volatile Contexts by Tentative Prototyping

Abstract

This essay emphasizes the role of friction and filtering in design processes. We will explore filtering dimensions as an integral part and a concise moment in the production of prototypes. At the beginning of this essay, we will focus on the topic of plasticity and instability, taking a closer look at how these two terms are entangled in a nonlinear design process. From there, we aim to discuss the productiveness of nonlinearity in the design process and how the designer acts as embodied filter in exchange with the material that forms the prototype. We will look into how digital material can be manipulated with similar principles, suggesting that the instability in the moment of prototyping is arguably a method of approaching problems (*Probehandeln*). In elaborating these terms, we will introduce excerpts of practice-based research projects to contextualize the topic of prototyping with digital materials, the role of materiality in the design process, and the designer as a filtering dimension. The presented practical work will help us to conclude how creativity arises from instability, demonstrating that tentative prototyping is a productive method in design and collaborative work.

Nonlinearity

Product development and product design are nonlinear processes, meaning there is no straight pathway from an idea to a final product. The idea is not a crystalline nor a diamond that in a second step is poured into a material shape, the prototype.[1] Rather, this process can be described as subtractive, where the idea is metaphorically carved out of a solid block of material. Here, we describe a process that goes from rough to fine, the idea being the blurry shape (or the solid gemstone) that is able to inhabit multitudes of possibilities, shapes; while the prototype, in the process of iteration, matures and concretizes until its final shape is reached. In this process, the material, the designer, and the team of specialists actively filter decisions, degrees of probabilities, and ideas. In this process step, a multitude of changes in perspectives are necessary. The designer is confronted with specific contexts, material behaviors, and socio-economic

1 See Julian Adenauer and Jörg Petruschat, *Prototype! Physical, Virtual, Hybrid, Smart* (Berlin: form +zweck, 2012).

 https://doi.org/10.1515/9783110714883-006

patterns, just to name a few. It can be observed that this confrontation with the real-world causes of instability is of a kind that puts the stable concept in shaking momentum. The process of prototyping can therefore be described as the endeavor to once again balance out demands, with the goal to fit idea and material in a form or interaction. As every product is part of economic and material cycles, it influences more than on a personal level, reflection on parts of society bearing witness to abundance or lack. For the designer, it is indispensable to go to these linked disciplines for research purposes and to seek exchange with experts even at the risk of being called an amateur scientist.

Prototypes

Prototypes and prototyping play an important role in product development. Even when the product is still not more than a vague outline, designers are capable of focusing on certain snippets or features of the upcoming product. These snippets are the basis of the repeated prototyping cycle. On the one hand, the material form of the prototype enables concrete interactive feedback, as Julian Adenauer and Jörg Petruschat described in detail in their book *Prototype!*[2] On the other hand, the prototype in its provision still has sufficient plasticity and fuzziness and, depending on its context, it provokes and enables certain actions. A prototype can help focus on one specific domain of a question, it can communicate certain aspects of a situation or clarify false assumptions. Depending on the design requirements, temporary stabilities are created during prototyping, be it through the material, form, proportions or functionality. If one assigns prototypes to the models, then presumably referring to models that are binding thoughts and bear constructive potentials. Just like a prototype when a model is created, assumptions are fixed in the material.

Exploration Phase

We will leave the overarching description of prototyping to go back to the beginning of the design process, the so-called exploration phase, a moment where instability becomes most obvious. This phase embraces experimental arrangements and material studies, the self-activity of the material is assumed and appreciated, material activity is traced, the designer being the observer. The architect Günter Behnisch describes this approach as listening (*Lauschen*).[3] By listening to the manifold possibilities of the material, it will most likely reveal itself or parts of its potential. Designers are lis-

2 See ibid.

3 See Elisabeth Spieker, "Günter Behnisch—die Entwicklung des architektonischen Werkes: Gebäude, Gedanken und Interpretationen," PhD diss. (University of Stuttgart, 2005).

tening to the material through and with the method of prototyping. What the designer hears, however, is obviously determined by his or her individual skillset, knowledge, and cultural imprint, but also the brief, context, and environment of the experiment. The designer's action oscillates between grasping and conscious tracing to fix and bind explored moments into the material.

Digital Technologies

But how to explore new information technologies? How can we employ the method of material exploration in the domain of digital technologies and complex or abstract systems? Now, the materiality we work with is equally important as working with, e. g., wood, but still, we cannot just take off to the workshop and fiddle around with it. To explore its modalities and possibilities we need a different approach and starting point. Anthony Dunne and Fiona Raby have successfully described and classified the variety and similarities of such approaches in their book *Speculative Everything.*[4] Using specific design projects, they lay out the variety of methods and topics and the unifying principles and rules of designing with prototypes. In this essay, we will take a similar approach of demonstrating some of the presented ideas embedded in a concrete design project as a case study. Because testing objects and prototypes creates a layer of spatial and temporary disruptive critique, a moment of engagement, that is hard to achieve with a text-based publication, but rather experienceable. In teaching and in our own design process we transfer the method of testing prototypes (*Probehandeln*) in the early exploration phase. *Probehandeln* does not mean to focus on usability, but to try to create a moment of engagement determined by a certain materiality, geometry, and interaction properties. The goal is to playfully create prototypes that lure users into a flow and thereby generate insights about specific behavioral patterns and unconscious reactions. These prototypes often employ friction as a productive moment. Especially useful when reflecting on or questioning social standards, everyday routines, or behavioral norms. Furthermore, designers produce *speculative prototypes* to explore technology and interactions in a performative act. The adjective "speculative" includes setting up scenarios to reenact and thereby explore a specific interaction or aspect of a routine, thus creating a better understanding of possible futures.

Case Study

The following part of the essay is an introduction into three excerpts of the ongoing practice-based doctoral thesis *Tessellated Skins and Shells: Designing Biology-Informed*

4 Anthony Dunne and Fiona Raby, *Speculative Everything: Design, Fiction, and Social Dreaming* (Cambridge, MA: MIT Press, 2013).

Wearables for Context-Sensitive Protection and Support by Felix Rasehorn. Three specific moments of this practice-based research are briefly presented to situate and contextualize the discussed filtering layers.

Tessellation Archive—Prototyping with Digital Materials

The first excerpt aims to depict the design approach of prototyping with digital technologies and abstract materials. It is part of an interdisciplinary project situated in the Tessellated Material Systems (TMS) research group. The group consists of researchers from the Cluster of Excellence "Matters of Activity" (MoA). Coming from morphology, engineering, material science, and design, members of the group are commonly interested in the relation between form and function in TMS. The group has collected over 120 specimens of natural TMS, and developed a taxonomy that prioritizes formal similarities over genetic relatedness. The compiled dataset can be appreciated as a research outcome, while from the perspective of a designer, it can also be perceived as a material. That change of perspective transforms the process of defining the taxonomy into a moment of tentative prototyping. It might not be equally productive for all members of the group. Researchers from the natural sciences in particular are most professionally trained in defining taxonomies, tapping into their domain-specific methodologies. The change in perspective, on the other hand, recalls the method of a designer, collaborating with other disciplines and applying design methods to productively contribute to a common effort. Through methodologically treating the dataset as material, the development of categories equals the construction of analogue filters. If the dataset is treated as material and the category understood as the filter, the equation is missing a user. So, who is this material and its shape made for? Answering this question leads to the creation of a persona, this is analogue to the process of writing a paper having a specific peer group in mind. In this project, the persona was a fictional group of architects, designers, and other creatives, interested in finding inspiration in nature's structural systems. Creating this persona implied that the material, the dataset, needed to be made accessible in a way that enabled the persona to draw inspiration and information from it. Through the approach of tentative prototyping, the vision of an interactive web-based archive, accessible for interdisciplinary researchers was manifested. Experienceable prototypes became containers for ideas and arguments in the discussion. Fostered by drawings (fig. 1), interactive prototypes (click dummies), and visualizations (fig. 2), the group could collaboratively decide, agree, and improve the archive. In exploring how a website unpacks to engage people with the presented dataset, an interactive drawing board became the tool to store suggestions, alterations, and ideas (fig. 2). It allowed the visualization and comparison of approaches and helped to evaluate one over the other. After one year of iteration, the tessellation archive has been published (fig. 3). It is a publication that allows practitioners to distinguish form from function, and thus recognizes the unbiased potential of formal tessellation patterns.

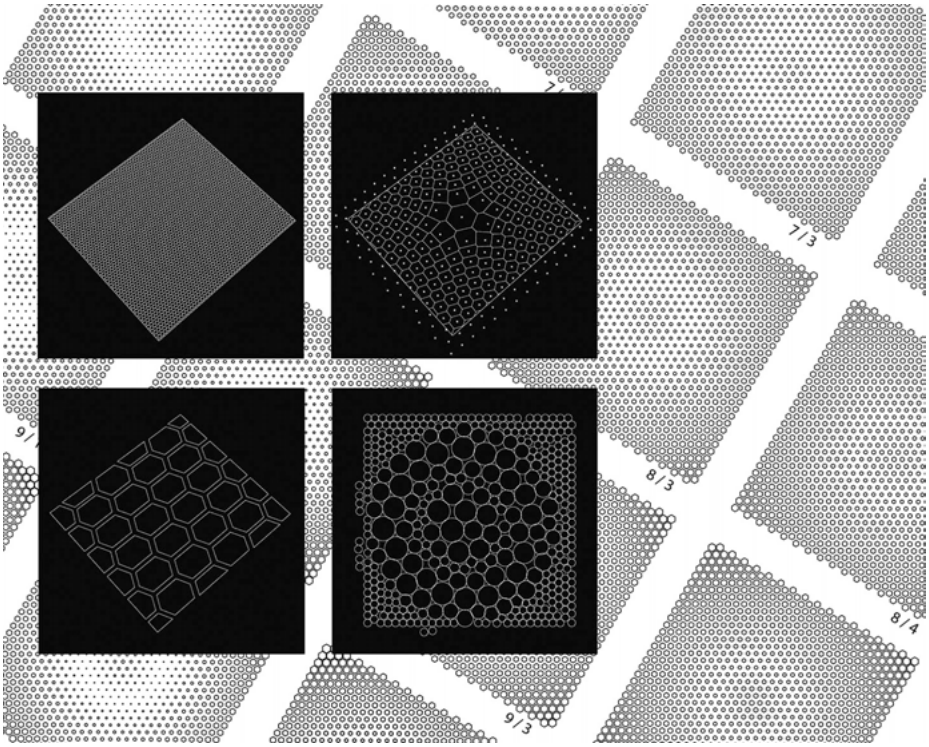

Fig. 1: Drawings of computational models of four categories describing TMS.

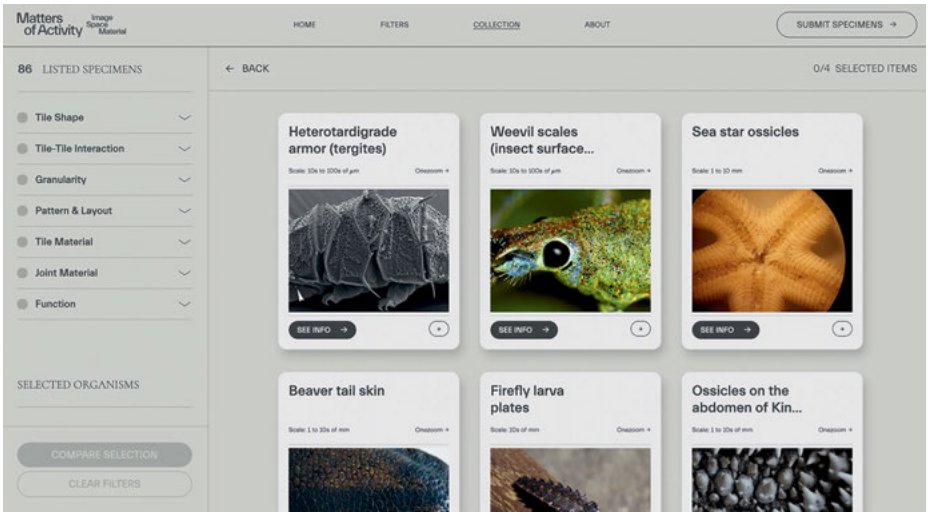

Fig. 2: Digital iterations of prototypes for the interactive archive.

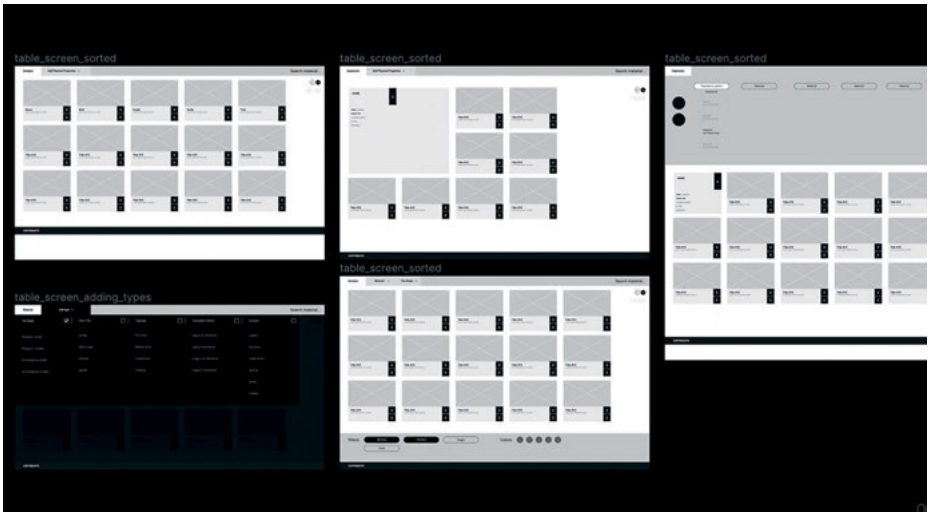

Fig. 3: Screenshot of the "collection" tab of the interactive TMS archive.

Materials as Filters—Listening to the Material

The second excerpt of this doctoral research focuses on the ability of materials to function as filters, not literally, but methodologically. This study aims to replicate the strategy of hierarchical structure that can be observed in natural systems. Natural TMS consist of gaps filled with fibrous interfacing membrane that connect solid tiles. This structural duality presumably leads to multifunctionality. How to transfer the observed natural principles into materialization processes? The role of the designer is to abstract the observed natural phenomena. Instead of digitally simulating the tessellated structures, analogue prototypes were developed. Working with physical materials aids in overcoming limitations in computation and thus in tapping into the field of material-based analogies. In the process of prototyping, mechanically rigid elements are laminated to pre-stretched textiles using 3D printing. The selected textile (jersey 94 percent cotton, 6 percent elastane) therein simulates the soft interfacing membrane between the hard plates as observed in natural systems (fig. 4). The 3D-printed material is laminated to the textile, it structurally represents the hard tiles, trapping surface tension. Once the tension of the fabric is released, those areas laminated with 3D-printed material are structurally reinforced and resist the shrinking force. This duality of properties allows disproportional shrinkage, resulting in 3D surface deformation (fig. 5). Primarily, this study seeks to explore analogies between materialization and natural hierarchical systems. Simultaneously, it demonstrates the relevance of listening to the material properties in the prototyping process. As materials come equipped with specific properties, they can transform into active players in a prototyping process. Therefore, their ability to filter possibilities and formal potentials is recognized.

While materials are usually regarded as passive matter, designers attribute them activity and agency, thus they become aids in order to prove or disprove assumptions.

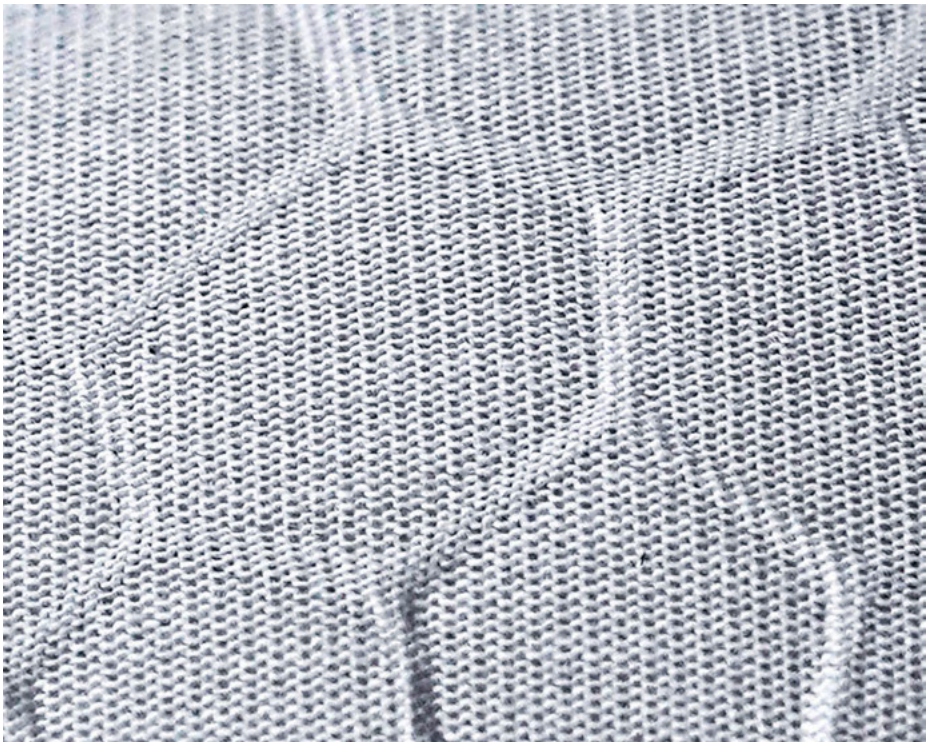

Fig. 4: Close-up of laminated jersey, showing the structural difference between the interface and joints.

Designers as Filters—Perception and Communication

Designers themselves can function as filters; unconsciously in discussions with others or consciously with the aim of changing the direction of a prototype. The third excerpt dives into the design process itself taking a closer look at the collaborative design project *embrace2* developed by Silke Hofmann. Her work is grounded in the extensive and sensitive research in the realm of breast cancer affected women and their specific clothing needs. The project *embrace2* focuses on the product development of alternative underwear individually designed for women affected by breast cancer after mastectomy. In this collaborative design project, designers from the field of fashion, textile, product, and computational design worked together with the wearer as co-designer. The collaborative process peaked in situations that are called fittings (fig. 6), an established methodology in fashion design. A fitting is in itself a technical process in which all participants come together to evaluate the prototype on the wearer's body. Special-

Fig. 5: Iterations of computational geometries 3D printed on pre-stretched textile.

ists from different disciplines with different vocabularies, ideas, and experiences came together to evaluate the respective work. Thus, the fittings were situations in which individual competencies stepped back and common interests were negotiated, discussed, and evaluated. These communication and development processes were intensively negotiated in situ on the physical prototype (fig. 7). In these situations, the designers functioned as filters that looked at the prototype from their specific field of expertise, contributing to a larger body of work. In this joint development step, the ideas of each specialist were exchanged, not primarily verbally but directly on the prototype itself (fig. 8), allowing to filter extremely efficiently and at the same time particularly finely what was technically feasible, aesthetically desirable, and functionally durable. To this day, the developed prototype contains all details and decisions of the discussion. Each collaborator embodies the specific filter to unpack this information which he or she turned into actions that have led to the final prototype.

Fig. 6: Preparation for prototype fitting.

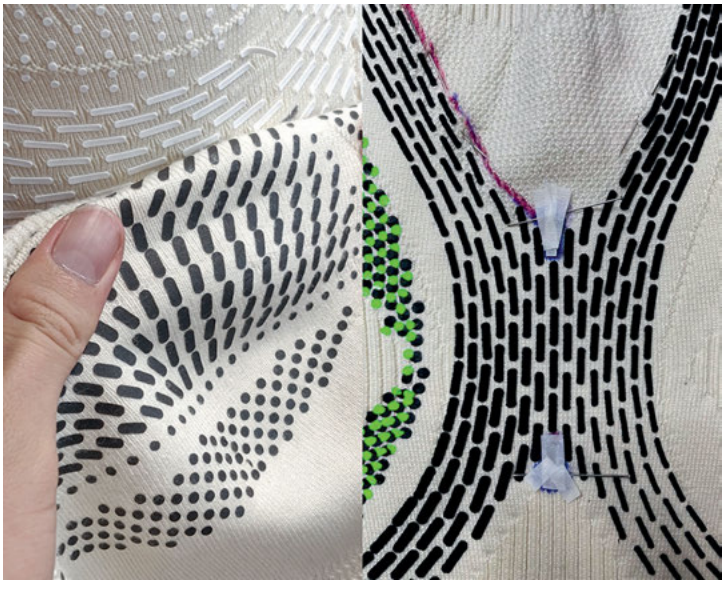

Fig. 7: Details from prototype fittings with traces of communication through the prototype.

Fig. 8: Three 3D scans of prototypes (the upper row showing the back, the lower row the front).

The Magic Moment

Through providing insight into the design practice, we argue that there is no such thing as a "magic moment" or creative thunder that results in ideas and concepts. Rather, creating moments of inspiration is an iterative, communicative, and performative process—a game that is played with the material or together with the collaborators, aimed at constantly improving the object of interest. The process of tentative prototyping is a dense experience that is volatile and therefore challenging. Designers face this challenge by embracing moments of instability with the intrinsic claim that every iteration is a productive development of the one before. But how to know when to stop this process, when is a prototype finished? In this phase, the role of the designer changes once again. He or she is no longer an actor in the play but steps out of it to filter the variety of grains of material. Decisions on functionality, behavior, or spatial anchoring are given clear contours through filtering. It is, finally, a filtering process that leads to conclusions that manifest in material.