The single-subject issue no. 66 of Diid offers an articulated reflection on the processes of "*subtraction and addition*" of values, meanings, signs, information, languages, functions, materials, technologies, skills, and visions. The various contributions offer design scenarios touching on the proposed theme, associating it with aspects of the contemporary in which tangible and intangible are reflected in the development of digital technologies on the one hand and the centrality of the disciplines of user experience and service on the other. Subtraction is valued as substitution with intangible practices, in which the digital element prevails. Addition is proposed as taking responsibility and expanding design's fields of interest. Many of the contributions investigate fertile scenarios and are addressed to those who study, are interested in, and work in the world of design, and represent an opening to and stimulus for new design possibilities.

Luca Bradini

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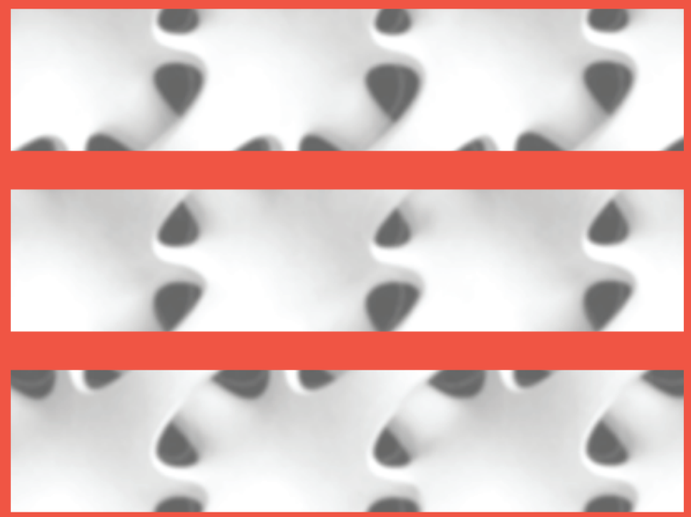

Focus

Focus gallery > p.154/p.165

Adding Motivations, Subtracting Choices

Designers have long been concerned with finding ways to foster positive (i.e. sustainable, healthy, safe, socially acceptable, etc.) users' behavior. The approach typically used in product design consists in limiting users' choices through product optimization and automation. An example is electronic devices (e.g. computers and smartphones) that automatically go to sleep to save energy. However, studies have shown that this technical approach cannot alone sustain significant behavioral change. There has thus been a recent push towards influencing users to make the right choice instead of simply limiting choice: this is the emerging field of "*design for behavior change*". Several approaches have been developed under this umbrella term: all of them acknowledge that artifacts play an important role in influencing human behavior. However, such approaches also feature specific traits and different behavioral strategies ranging from fully conscious (where users are actively involved in attitude change) to unconscious (where users are not fully aware of the product's effect) or combinatory.
In this article, we present the most relevant strategies to influence user behavior: *decisive, coercive*, *persuasive*, and *seductive*. We describe how these strategies can be used in a top-down or bottom-up way by means of four examples. As a conclusion, we can affirm that in design for behavior change designers can either *add* motivations (in a gentle manner – persuading – or in a strong one – coercing) or *subtract* choices (deciding for the user or seducing them), in order to foster positive behaviors.

[design for behavior change, behavioral strategies, sustainable behavior, digital platforms]

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Design for Behavior Change

Design for behavior change is a sub-field of design concerned with exploring ways for design to influence human behavior. In everyday life, there are indeed numerous situations in which the way we behave is intentionally designed by someone else. This often happens, for instance, in commercial enticements. It is widely recognized that retail environments are designed to tempt us to buy things.
According to Redström (2006), this influence is valid in a more general sense: in the Western world, we are used to living in an artificial environment, made up of objects in which modes of use are inherent. As an example, Redström, referring to the well-known Stokke case, explains how chairs can be designed to influence the way people sit. However, even though all design activities are inherently linked to behavior change, Redström (2006) argues that a more in-depth understanding of how to effectively and deliberately affect user behavior is still work in progress. Moreover, research should investigate the ethical dimensions of behavior-change strategies. For a manufacturing company, finding an appropriate level of product behavioral influence and ensuring the moral acceptability of such influence is crucial (Lilley, 2009).
Even if design's persuasive power can be applied to almost any area of human life, when we speak of '*design for behavior change*', a social benefit is usually implicit, ranging from encouraging users to exercise to energy saving. Indeed, the areas in which design for behavior change is most frequently applied include health and wellbeing, sustainability, safety and social issues as well as crime prevention.
In general, when designers are called on to design products intended to change user behaviors, there must be some reason why the desired behavior is not the norm. In this regard, Tromp, Hekkert and Verbeek (2011) use sustainable behavior as an example. Socially speaking, connecting collective concerns with a set of resulting desirable behaviors such as commuting to work by train rather than taking the car is straightforward. Still, sustainable behavior like this can be overruled by an individual's desire for flexibility and/or convenience. The designer's task is thus to deliberately address individual interests in order to stimulate socially desired behaviors. However, influencing users' behavior can be challenging. In spite of several years of campaigns encouraging people to act sustainably, users are indeed slow to adopt more sustainable behavior (Lilley, 2009).

Four Behavioral Strategies

This section proposes a classification of possible strategies to influence user behavior. The influence of a designed object on the way users behave ranges from weak to strong and from implicit (i.e. unconscious) to explicit (i.e. conscious). On this basis, Tromp, Hekkert and Verbeek (2011) have distinguished four types of influence: coercive (explicit and strong), persuasive (explicit and weak), seductive (implicit and weak) and decisive (implicit and strong). In other words, products can *coerce*, *persuade*, *seduce* users, or decide for them. It is important to stress that different

people assign the same artefact to different categories and the effect on users can thus differ from the one originally imagined by designers.
Hereafter, we will briefly analyze the main features of each kind of strategy.
A strategy is referred to as decisive when design makes the desired behavior the only possible one (Tromp, Hekkert & Verbeek, 2011). Infrastructure and building design is typically decisive: if we want to oblige people to take exercise we can remove elevators from buildings (or make these impossible for standard users to access) so that people will be forced to use stairs.
Although coercion can be effective, it is often associated with negative consequences such as poor user experience or subversion of intended behavior. Therefore, this kind of influence in product design is limited. For Lilley (2009), enabling products designed to limit users' choices (e.g. mobile phones that block phone calls while driving) would in most cases be seen as unacceptable to users accustomed to controlling their devices.
Manufacturing companies are very cautious in this respect because giving products an autonomous decision-making ability, however sporadic, can annoy users and prompt a decline in sales. In general, research indicates that it may be easier for manufacturers to justify the use of more forceful action where target behaviors threaten personal or public safety or are illegal, as in the previous example of the use of mobile phones whilst driving (Lilley, 2009).
In some specific instances, however, users may respond positively to automation of certain actions, citing convenience and time savings as benefits. An example is the heating system that turns off and on automatically.
A final issue to consider with decisive strategies is that, being them implicit, users learn nothing new, since they are not consciously thinking about their own behavior.
Similarly to decisive strategy, a coercive-influence action is also often experienced as conflicting with individual freedom and is thus applicable only to contexts in which the desired behavior is almost unanimously agreed upon. As a result, the public and institutional domains are fields to which coercive design can be well suited because government and managers have the authority required to implement such action (Tromp, Hekkert & Verbeek, 2011). Coercive products usually limit or make certain actions more difficult. They can also provide some sort of 'punishment' for not-intended behaviors. Typical examples are speed camera and speed bumps. Other common examples are websites available to registered users only, which 'coerce' them into giving a company their personal data. Of course, in this latter case, users can choose to leave the website.
Persuasive strategy consists in making certain behaviors desirable, because associated to specific rewards, or to positive experiences. Users recognize the benefit of some actions and they usually take on an active and conscious role in pursuing them. Therefore, persuasive design is both weak and explicit.
In 2002, Fogg introduced the term '*persuasive technology*' in relation to human-computer interactions designed to alter users' attitudes through persuasion. One of the first examples is Nintendo's *Pocket Pikachu*, a digital pet that requires care and feeding. The device contained a pedometer that registered its owner's movements. For the digital pet to remain healthy, its owner had to be physically active, walking, running or even jumping to activate the pedometer (Fogg, 2002).
Nowadays, persuasive strategies are broadly adopted in a growing field of research focused on the persuasive power of technology, which is seen as having an important role as experience medium and creator (Cash, Hartlev & Durazo, 2017). Torning and Oinas-Kukkonen (2009) stress the importance of designers taking responsibility for the ethical aspects of their designs, when they are intended to encourage specific behaviors.
Seductive strategies use subtle kinds of influence that can be very useful in eliciting desired behaviors in social fields which do not deal with matters of 'life and death', because these phenomena often do not allow for strong strategies based on enforcement. A typical domain is domestic energy saving. An example of this strategy is the garbage bins designed to resemble a basketball basket whose goal is to invite people to try a shot rather than leaving their garbage lying around. In the case of seductive products, the influence is therefore weak and implicit.
These four strategies have been traditionally applied through a top-down approach, in which designers define what behaviors should be encouraged and design specific products and experiences to foster them. However, the raise of digital technologies and ubiquitous computing allows the creation of dynamic and customizable digitally-enriched products, which can be adjusted by users. Instead of designing specific experiences, designers can provide users with flexible platforms that let them define their own goals in terms of behavioral change, as well as the best strategies to achieve them.
Below we discuss two examples of top-down strategies in the field of sustainable design and two example of bottom-up approaches in the field of digital behavior.

Designing for Sustainable Behavior

Within the broader field of design for behavior change, design for sustainable behavior is a research area centered on defining strategies designed to influence the use of products in the direction of decreased resource consumption. The aim is also to offer companies a systematized behavioral perspective that can be integrated into their existing product development processes. Indeed, promoting technical innovation to increase products' energy efficiency has been shown to be a questionable energy saving strategy. In this respect, Herring and Roy (2007) have argued that, in the long term, increasing product energy efficiency will not lead to energy savings but to overall increases in energy use.
Studies have shown that, on average, energy consumption issues inspire limited individual interest. In addition, it has been recognized that users' energy consumption mindsets stem from real interaction with products and their understanding of the associated benefits. Therefore, understanding energy consumption requires an

understanding of the complex behavioral processes which drive user interactions with energy-consuming products.
Hereafter, two examples of speculative design concepts developed in the authors' research activity are presented. Their objective is specifically to foster energy saving user behaviors.
Peace Time[1] is an ambient interface, connected to a mobile application, which aims to help users to adopt flexible behavior in future smart grid scenarios. The ambient interface consists of a 'nest' hanging from the ceiling and a set of wooden birds to be placed in the house (Katzeff, Wessman & Colombo, 2017). This design activity can be categorized as a case of persuasive strategy, with users being encouraged to change their habits by engaging sensory experiences which prompt them to consciously shift electricity-consuming activities to different times of the day.
When peace time starts, a fragrance is released into the house from the nest. Fragrances are selected by users from a set of natural aromas (e.g. wood, flowers), which create a connection with nature. A pleasant sound of tweeting birds (emitted by the wooden birds) signals peace time thirty and fifteen minutes before it begins. The birds can be placed in the nest or other places in the house to alert users that peace time is near.
To notify users how long the current peace time will last, the nest drops from the ceiling when *Peace Time* starts. Distance from the ceiling is an indication of how much peace time is left with the distance from the ceiling nearing as peace time unfolds. A connected mobile/web application informs users about forecast peace times allowing them to plan electricity-free activities around future peace times.
In the second design activity[2], a seductive influence was adopted. The concept development applied the principles of embodied interaction. These principles are based on the notion of a circle of influences among products' physical properties, users' interaction with the product and the creation of meanings in users' minds (Dreyfus, 1991; Ingold, 2000). The sense making process is not just based on decoding information conveyed by product features but is also made possible by the creation of a personal dialogue between users and the product itself. Such dialogue encourages reflection-on-action and the creation of new meanings. To test this approach, a meaningful tactile experiences with an interactive shower tray was designed. The aim was to promote water saving behaviors in situ.
FEEL (Feelings and Experiences for an Embodied Learning) is a squared shower tray capable of changing shape to generate a novel shower experience. The tray was made up of an external case and a number of soft pins which popped up randomly at different rhythms, creating a tactile experience resembling a foot massage. The data collected in a preliminary study showed that users' reasons for showering are usually one of two alternatives: taking a short refreshing break; relaxing and pampering themselves.
In accordance with these two scenarios, *FEEL* is designed to change shape in a fast and more marked way in the initial minutes of the shower, for the average amount of time that users usually spend on a short shower. The speed of the soft pin movements then slows before stopping altogether when the maximum average shower times are reached, i.e. the 'natural' moment at which people feel they have finished and it is time to get out.
Over time, *FEEL* creates a dynamic coupling between users' actions and the temporal choreography played out on the responsive shower floor. Once this coupling is in place, the temporal pattern decreases over time to lead users to decrease the time spent under the shower. The size of the decrease is small and barely noticeable. Indeed, it is important that users feel their showers to be the same. After several weeks, users will get a 'natural finished feeling' in a shorter time, thereby saving water without being forced or persuaded to make a conscious decision to 'do the right thing'.

Providing Platforms for Self-influence

As the two previous examples show, products are becoming more and more interconnected and augmented with digital technologies. Due to their enrichment with constantly-updating information, learning systems, and customizable digital features, such products have an even greater power to dynamically influence users' behavior over time. Therefore, if we look at the strategies for behavior change, we should consider not only traditional products, but also platforms made of connected physical products and digital services.
In this context, many solutions are being developed to stimuli users to take on more positive, healthy and sustainable behavior. Digital platforms give users freedom to customize their goals and rules in using these services, offering them the choice to engage in positive behavior. In doing so, they suggest a way to improve, without necessary limiting the choice, instead making the user actively engaged in the change. Under this perspective, behavior change starts from the users' will to change their attitudes. Designers should therefore provide users with digital solutions that they can consciously decide to tune to their needs, in order to achieve some changes in their behavior. In this case, the user's involvement is more active and conscious in the initial phase, when they set their goals (e.g. using the phone less, making more exercise), and then, according to how the platform is designed, the influence strategies are put in place.
In these solutions, the decision power is not anymore in the hands of the designer, but is given back to users by making them more responsible of their choices. As Eyal (2014) states, indeed, we should design things that make people do what they want to do.
This change in paradigm, from a top-down to a bottom-up approach, can be exemplified by the examples described below.
As previously discussed, designing products that limit users' choices can be seen as unacceptable to users accustomed to controlling their devices. What can be done, instead, is to give the user the power to decide the exact moment in which her choice should be limited.

The *Moment app* (https://inthemoment.io) is indeed an interesting example at this regard. Spending time together in the family, being in the moment, is always more difficult because of the bond we created with our phones. The *Moment app* allows parents to set specific screen-free times during the day, for instance during meals, when all the family's devices will result disconnected.
The *Freedom app* (https://freedom.to) is a similar example: like many others on the market, it allows users to schedule some time of computer disconnection from the internet, in order to improve productivity. Indeed, the constant urge to check social media, emails, and messaging platforms makes a greater number of workers much less efficient and more distracted.
Both these platforms allow a form of consensual decisive influence, where it is not the designer, but the user who decide the modalities to impede certain behaviors.
With a similar goal to the *Freedom app*, *FocusMate* (www.focusmate.com) creates a 50-minute working session over video with an unknown partner, with whom there is no chat or collaboration, just peer pressure on getting a specified task done. In this case, the user actively creates obstacles and limitations to distraction, putting in place a self-planned coercive influence.

Conclusions

Behavioral design strategies aim to encourage, change and sometimes force users' actions, behavior and habits. Four different strategies have been presented consisting of decisive, coercive, persuasive and seductive influences.
The first two examples reported focus on the 'weak' kind of strategies to behavioral design, the persuasive and the seductive ones. They focus significantly on sensory experiences, showing that design can affect people's behavior either by asking users to take on conscious changes (i.e. adding motivations, as in the case of the *Peace Time* ambient interface) or by subtly leading them to react to changing conditions in the environment (i.e. subtracting choices, as in the case of the *FEEL* shower tray).
Stronger approaches may be needed in certain situations, e.g. when users need to be discouraged to perform unsafe, dangerous or illegal actions. This is also the case when we want to stop our urge to interact with internet devices, to constantly check our mail and social accounts. Indeed, thanks to digital technologies, users can return to be the decision-maker in influencing their behavior by fine-tuning digital tools that the designer put at their disposal.
It is therefore crucial that designers understand the conditions in which these solutions are operating, by analyzing context constraints, the degree of persuasion required, the nature of users' roles (more or less active and conscious) and the reasons behind the need to modify users' behavior in specific contexts. These ultimately also asks for the need of ethical considerations.
Adding sensorial stimuli and motivations that leverage users' emotions and experiences or giving users themselves the possibility to subtract choices prompts very powerful reflections on relevant problems and issues, which is a first step towards actual behavioral change.

[1] This design activity was developed by Sara Colombo in collaboration with the RISE Interactive (formerly called Interactive Institute) of Eskilstuna (S), within the FlexibEl research project.

[2] This design activity was developed by S. Bergamaschi during the period as a visiting PhD at Twente University (NL), under the guidance of J. van Dijk.

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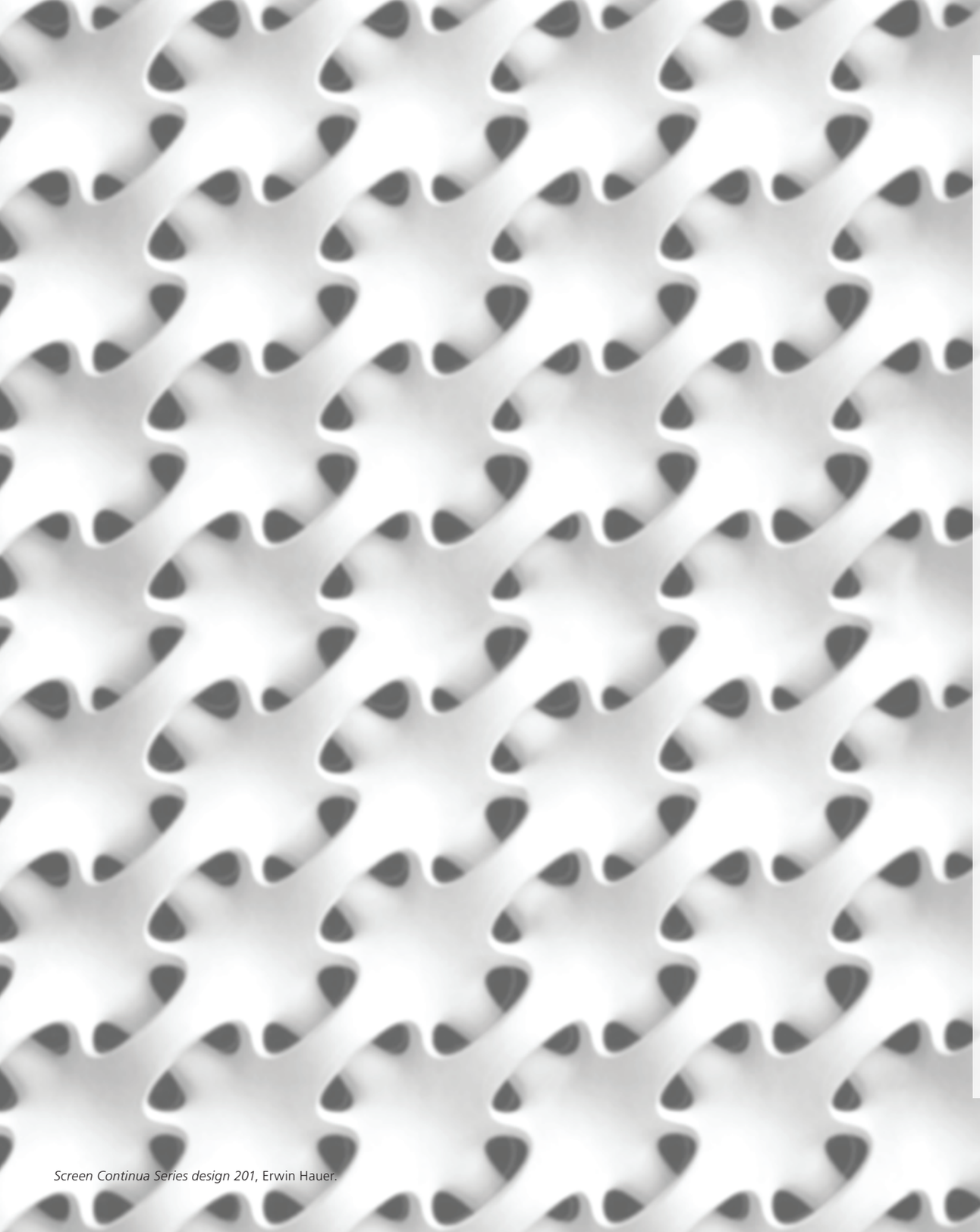
Focus gallery



Screen Continua Series design 201, Erwin Hauer.

Focus gallery

To articulate and simplify

The spread of evolved enabling technologies marked the beginning of the digital era that has its roots in the combination between computation and advanced manufacturing. The two-way connection between the design process and the productive process does not imply a formal evolution without logical relationships, but technology is characterized as a process through which to materialize optimized products through an articulated and complex path that includes morphogenetic computation, the search for innovative fabrication methods and material. The complexity of the technological evolution becomes the means capable of transforming the articulated processes into material systems through direct connection, between digital model and productive process, converting articulated matter into an element generating synthesis. Control over the procedure becomes a digital model capable of metabolizing parameters relating to the materials, geometric constraints, and instruments used, establishing a new relationship between designer and product. In this design potential, the layering of design-to-production concepts (Scheurer *at al.*, *From Design to Production: Three Complex Structures Materialised in Wood*, 2005) and file-to-factory concepts (*Burry Mark, Models, Prototypes and Archetypes*, 2012) plays the essential role that leads to seeking design solutions, to the possibility of concentrating in a single workflow an operating methodology that involves defining a design through which to integrate geometric parameters, materials, and fabrication processes. To better comprehend this aspect, the following image gallery compares how articulated design approaches may lead to a rational simplification of the product. Complex fabrication processes are a driver of development for materializing the complexity of digital space.

Davide Paciotti

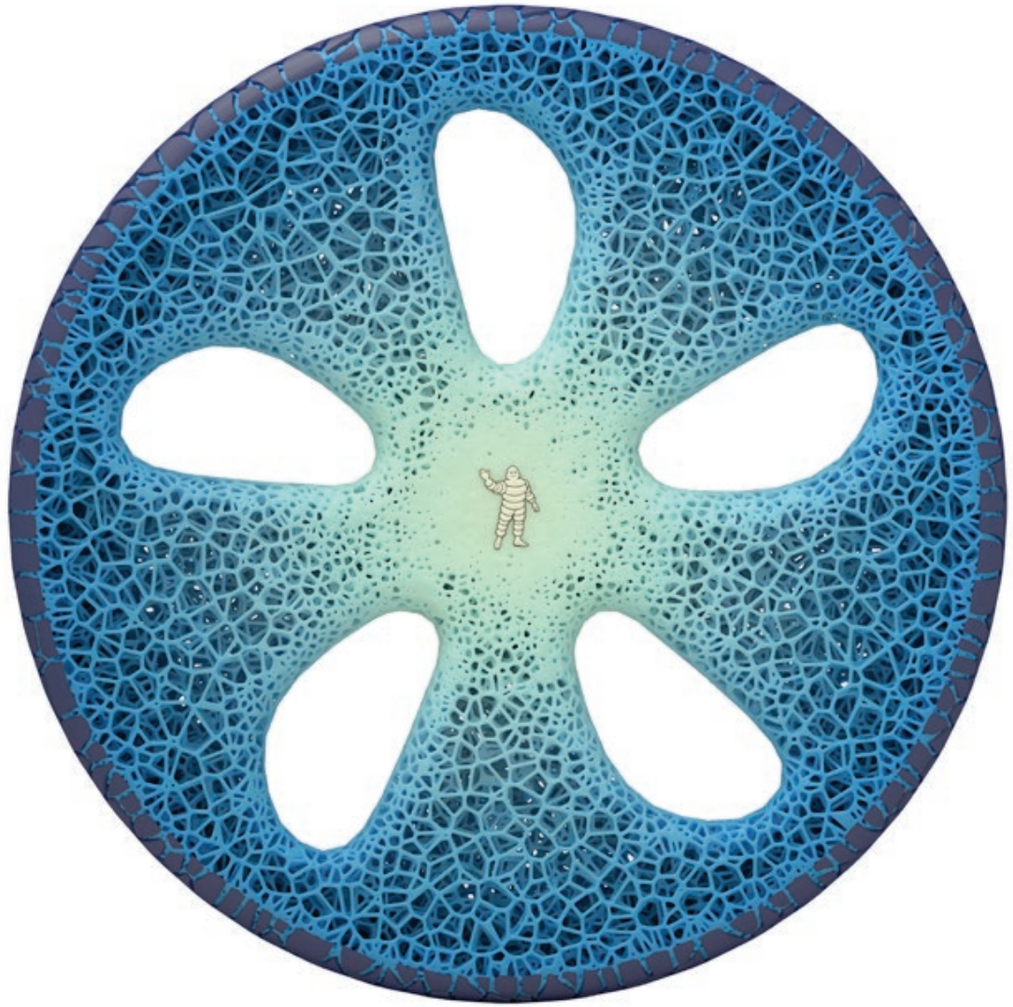
[advanced manufacturing, optimization, making matter complex]

01

02

Designing complexity
>
Programmed or designed performance, or a product's increased performance, is an additional step forward that enlarges the already broad possibilities offered by additive fabrication, with the objective of simplifying and streamlining an individual product's components that are commonly employed using programmable or self-assembling elements. Programmed morphology effectively transforms the final product into a specialized object.

03



04

01 *Adidas 3D Runner,* Adidas, 2016.
02 *4D printing*, Self-Assembly Lab, 2013.
03 *Shapes of Sweden project,* Lilian van Daal, 2015.
04 *Vision Tyre,* Michelin, 2017.

01

Technological experimentation
>
In so prosperous a technological advance, the product is increasingly often faced with complex systems, or brings to light now-forgotten typological expressions in which its role no longer entails merely a rereading, but the outlining of a new language based on experience. The product of experimental research as a synthesis of structure, matter, and technology, in search of new interaction experiences.

02

03

01 *Edible growth*, Chloé Rutzerveld, 2014.
02 *Stone hand-axe number 5*, Ami Drach + Dov Ganchrow, 2014.
03 *Pneumatic Products,* Patrick Parrish, 2018.

01

02

Articulating the intangible
>
The implementation of technology also leads to exploring areas in which morphology, production technology, and typologies of materials lead to defining an absolute product quality. In certain musical instruments, this is possible in the transition from analog to digital; the product incrementally loses material quality and ends up a complex morphology or absence of material. At the same time, there are other objects that hold up practically unchanged over time, but their nature is strictly analogical, without that valance of communication and form that is the prelude for an integral vision of design.

03

04

01 *Piezoelectric violin,* Monad Studio, 2016.
02 *Travel bass guitar,* Monad Studio, 2016.
03 *Detail of a shooting trombone*, Anonymous.
04 *Scaccia Pensieri*, Anonymous.
05 *SLG200 series,* Yamaha, 2015.

05

01

02

03

Material experimentations
>
The use of technology or the overlapping of a basic module or of a single material seen as support for the making of designs useful for people, characterizing the object in the contrast between light and heavy, which it satisfies in its complexity and in its reflective vision of reality.

04

01 *Research Pavilion* 2013-14 *at the University of Stuttgart*, ICD/ITKE
02 *Pom Pom*, Fernando and Humberto Campana, 2002.
03 *Favela*, Fernando and Humberto Campana, Edra, 2002.
04 *Magnetic Motion,* Iris van Herpen, 2014.
05 *Litracon,* Áron Losonczi, 2011.

05

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