Material Designers

Boosting talent towards circular economies
MaDe (Material Designers) is a project, co-funded by Creative Europe Programme of The European Union, which aims at boosting talents towards circular economies across Europe. MaDe is a platform, a training program, an award and an event series showcasing and demonstrating the positive impact Material Designers can have across all industry and on the generation of an alternative creative industry aiming at circular economies.

Material Designers are agents of change. They can design, redesign, reform, reuse and redefine materials giving them an entirely new purpose. Increasing the potential of materials, they can go on to research, advise, educate and communicate what materials are and can be in the immediate, near and far future, implementing positive social, economic, political and environmental change across all sectors towards a responsibly designed future.
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How Materials can Shape our Future

Circular Design and Circular Material Design

Expert Interview

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Pere Llorach, PhD
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In our quest for a paradigm shift, from linear to circular, we are considering materials in their entirety. That implies, among other things, that we are changing the premises upon which we build our relationship with materials and their sources. As designers, as users, as consumers, as producers, as citizens, as policy makers, our approach is evolving.

Materials play a key role in the configuration of our environment and our life. Indoors, outdoors none interstellar they allow us to thrive, providing us with comfort, function, beauty, and the many other qualities that nurture and enrich our lives. Materials can be visible or invisibly interwoven within our realities. They can be close to our skin or become part of what we breathe. They can be healthy or make us sick.

To the observer, scientific or intuitive, materials carry the seed of form and function that can fulfill our human needs. Materials form our natural and cultural landscape, being a powerful source of expression and information. A living archive of genuine human interaction with the planet. Our finite source yet is industrially scalable. It becomes a cultural resource yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste and by-products is captured and ends up visible and valuable. They carry on their value at every stage. Cities should learn to use the collective waste value (material and monetary) for restorative urban design. Democratic material design thrives in open source yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste and by-products is captured and ends up visible and valuable. They carry on their value at every stage. Cities should learn to use the collective waste value (material and monetary) for restorative urban design. Democratic material design thrives in open source yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste and by-products is captured and ends up visible and valuable. They carry on their value at every stage. Cities should learn to use the collective waste value (material and monetary) for restorative urban design. Democratic material design thrives in open source yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste value (material and monetary) for restorative urban design. Democratic material design thrives in open source yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste value (material and monetary) for restorative urban design. Democratic material design thrives in open source yet is industrially scalable. It becomes a cultural value (material and monetary) for restorative urban design. Cities should learn to use the collective waste value (material and monetary) for restorative urban design.

Moving forward from the Anthropocene into the Planthroposcene. Luckily for us our biosphere offers a huge pool of such material possibilities. By weight, biomass on Earth is estimated at 550Gt. Out of which 450Gt are plants (Yinon M.Bar-On et al. PNAS 2018), by far the most prominent category and one that is rich in material opportunities. Algae, fungi, and other populations are also heavy weights in the total picture of the biomass. They can store the equivalent of the fast carbon cycle management. Unlike humans, which classify among the smallest groups by weight (0.06Gt) but nonetheless generating plenty of emissions.

At the end of life, bio-based materials can be pyrolyzed turning them into bio-chars. Thereby prolonging the time span of carbon sequestration for belated release at convenience. In this regard, hemp is an outstanding carbon negative material example. It grows in short cycles (90 to 120 days) in densely populated fields. It works well as a rotating crop, which prevents land use changes and improves soil condition for subsequent crops. Moreover, it can be fully utilized for multiple materials and end use applications. Increasingly in use, hemp development is reaching almost every field of human activity and is advancing thanks to destigmatization. The key point being its ability to capture a lot of carbon (estimations range from 8 to 22 t/h) in a short time span, especially when compared to forests or to any other crops.

Democratic materials are honest and transparent materials. Some are rescued from waste streams and sent back to circulation after reprocessing. And some might grow near us or perhaps in remote places.
During last decades designers have mainly designed products which are thrown away after their use. Provably it is not only their fault. Companies pressure to create rentable products made to be best-sellers have had a hard influence on product design. Consequently, annual municipal solid waste generation per capita in developed countries is between 1 and 2 kg/day and between 0.5 and 1 kg/day in undeveloped. (Kaza et al., 2018).

The current linear economy based on the take-make-dispose model is considered to be the main contributor to this large amount of waste generation (Ghisellini et al., 2016). Inspired by natural cycles, the circular economy aims to close the loop of industrial material flows by using waste as source to produce new products and services. When that happens, usually people tackle the most essential issues for living, such as increasing energy, water or food self-sufficiency. Solutions obtained from these kinds of design processes will not be the most high-tech solutions ever but “a high contribution to solve real and tangible problems from individuals and communities.” (Thackara, 2015). Production sovereignty can be achieved if tools are provided to individuals to produce whatever they could imagine or design. New technologies such as digital fabrication which create a closer relationship between people and machines could help to stimulate and promote self-assembly (Díez and Posada, 2013). Also, the thinking on the future use of our product materials once are converted into waste. Systemic thinking (Espejo, 1994) is mandatory for designers to understand that products are not something completely isolated but are complex systems that must be connected with other systems (Conway et al., 2018; Purdonnad et al., 2018). These connections will enable that waste flows from a system can be used as raw sources by other systems, is on designers’ hands to apply circular design on products and services.

1. CIRCULAR DESIGN TO DESIGN AND PRODUCTION SOVEREIGNTY

Current global social movements do not focus exclusively on resources and environmental issues as circular economy does. Working together, creating sovereign communities and increasing their self-sufficiency are some of the goals that more risky people are focusing on to make a real change and create alternative ways of living partially or totally out of the system. Sovereignty can be defined as the right of individuals and communities to make their own decisions regarding something. If we think about design or production sovereignty, we can define these concepts as the right to take our own decisions concerning the way everything is designed and produced. To achieve these sovereignties different actions could be considered.

From a resources point of view, local materials should be used. If flows are not managed locally, the possible environmental impacts derived from resources transportation could keep at the same level as today’s production systems. Furthermore, using local resources have positive social impacts such as reducing community’s dependency on importations, benefitting local economies and increasing their self-sufficiency. Communities may have the capacity to decide which local resources do they want to use, the way they want to extract them and resources price without being subject to global politics and economy.

At design phase level, we should boost the creativity that can be generated when people work together to create something for the social and natural environment they live (Manzini, 2015; Thackara, 2015). Production sovereignty can be achieved if tools are provided to individuals to produce whatever they could imagine or design. New technologies such as digital fabrication which create a closer relationship between people and machines could help to stimulate and promote self-assembly (Díez and Posada, 2013). Also, the thinking on the future use of our product materials once are converted into waste. Systemic thinking (Espejo, 1994) is mandatory for designers to understand that products are not something completely isolated but are complex systems that must be connected with other systems (Conway et al., 2018; Purdonnad et al., 2018). These connections will enable that waste flows from a system can be used as raw sources by other systems, is on designers’ hands to apply circular design on products and services.
A circular material designer (in contrast to circular designers or conventional DIY materials designers) can be defined as a Designer trained to detect unused materials from technical or natural flows and transform them into circular materials by using their design aptitudes. This profile has the potential, not only to increase community’s sovereignty but to create circular materials which can be used to generate circular self-made and local solutions. Circular material designers will produce new circular materials and develop their transformation processes, available for communities, which could be used to create solutions that tackle citizens’ concerns. Circular materials designers could be the seed of small local changes all around the world.

Joe Iles

As Circular Design Programme Lead, Joe’s role is to inspire and empower millions of designers to create products, services, and systems for the circular economy. Part of the team since 2011, Joe has helped shape the circular economy narrative, crafting stories and messages to reach new audiences and improve understanding.
Circular Material Design

1.2 CIRCULAR MATERIAL DESIGN

Material Tinkering and Creativity

DIY Recipes: Ingredients, processes & materials qualities

Expert Interview

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Acquiring knowledge about materials and processes through materials exploration is a fundamental step in the roadmap of Material Designers’ practice and education. The most successful way to get tacit knowledge about materials and to foster creativity for further development and innovative solutions is to engage in an experimental and goal-free exploratory practice (Pedgley, 2010; Parisi et al., 2017). We refer to this approach as hands-on early stage exploration as Material Tinkering.

Material Tinkering is the art of manipulating the material creatively for discovery and learning purposes. In this process, a hybrid mindset is required: one targeted to pure blue-sky exploration is combined with a scientific approach based on a trial-and-error approach. In fact, on the one hand, only through documentation of processes and results it would be possible to proceed to the further steps of materials development. On the other hand, material designers need to accept uncertainty, approximation and the unexpected discoveries they may encounter and to embrace failures and mistakes (Pye, 1968). With this approach, material designers can tinker with and for materials. By establishing direct contact with matter, they learn by doing and educate their sensitivity to the sensory and aesthetic qualities of the materials.

The adoption of this approach to matter allows material design practitioners and students to discover the opportunities that unconventional – often hidden – resources, tools and processes – often inspired by other fields – may offer. As a result, they produce novel materials of their invention, which often have innovative features and communicate the designer’s unique vision. Finally, it allows moving from conceptual materials (principle of materials Karan et al., 2015) to invention of existing materials, encouraging a paradigm shift in the invention of new materials, which takes on an increasingly material-driven design nature (Karana et al., 2016).

In this chapter, we introduce the theoretical background related to the concept of Material Tinkering, including providing its definition, origins, and varieties of this design formation of discovery and creative process. In this description, we make a distinction between tinkering with materials and tinkering for materials. Then, we provide a description of tools, approaches, strategies and recommendations to tinker with and for materials, inspired by desk research and by case studies. We believe that these would help material designers to approach both material stages of Barat and fostering creativity and sparks of ideas for breakthrough and cutting-edge solutions in terms of materials and processes innovation.

In the education of material design students and the practice of material design professionals, one fundamental way to get knowledge about materials is to acquire tacit knowledge through a learning by doing approach, considering both hands-on early stage exploration as Material Tinkering.

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In the Material-Driven Design (MDD) method (Karana et al., 2015) Material Tinkering is encouraged; indeed, a specific phase of the design process is dedicated to it. The MDD method is a new methodology for the exploration and design of materials. It is based upon the notion of material experience (Karana et al., 2015; Giaccardi & Karana, 2015) and combines practical experimentation, user studies and observation. The phase is called “Tinkering with Materials” and it is designed to allow the material through its direct manipulation, which is crucial in the MDD method to further develop the materials.

We can use the lens of experiential learning (Smith, 2002) and understand that experiential learning is the type of education undertaken by students who are able to acquire and apply knowledge, skills and feelings by being involved in a “direct encounter with the phenomena being studied rather than merely thinking about the encounter” (Borzak, 1981). The main contribution on the topic is the work of David Kolb (1984) and Keith Kolb & Fry (1975) who developed the model of “Experiential learning cycle” out of four elements: 1) Applying (active experimentation), i.e. testing a particular action in a specific situation through active experiences; 2) Experiencing (concrete experience), i.e. having a concrete experience of it and its effects within a particular situation; 3) Reflecting (reflective observation), i.e. understanding the effects in the specifics through reflective observation to anticipate it if it happens again with the same conditions; 4) Generalizing (abstract conceptualization), i.e. the formation of abstract concepts to gain experience of the action, which may be the particular instance and suggest the general principle. Kolb and Fry (1975) state that the experiential learning cycle should be approached as an iterative process in the form of a continuous spiral that will help the designer develop the process restarts with a new Applying step in which the action is tested in new situations within the range of generalization. In the same way, tinkering is an iterative process covering every step of the experiential learning cycle. The Material Tinkering process encourages continuous development and perpetual prototyping.

03 TYPES OF TINKERING – DIFFERENT AIMS AND APPROACHES

By observing the tinkering practices and aims, we can distinguish between tinkering with materials and tinkering for materials. These two areas have two entirely different aims, and therefore two different methods. The first area, so-called tinkering with materials, is connected and intertwined: to approach tinkering for materials, designers need to pass through tinkering with materials. Iterations between the two phases are possible, but the first research area that we are going to illustrate now can be found in the experiments carried out by the participants in the 6 international workshops of Made project.

04 TINKERING WITH MATERIALS

We argue that this approach may be helpful to foster material designers’ creativity and to educate them about the iterative nature of the development of the material. Tinkering in this phase is designed to allow the material designers to experience the experimental, expressive, and sensory characteristics of materials. Tinkering with materials favours the acquisition of knowledge on the material and the development of procedural understanding. There are also material demonstrations of processes, i.e. shaping and showing variations around the creation of forms. After the inspiration phase, demonstrations emerging from tinkering for materials can be a valuable resource for the design activity. In fact, by doing tinkering for materials without a design application in mind, the designer uses exploratory research to create and nurture a vision that may be the input for the development of the material and its meaningful application.

These direct, engaging and creative experiments are often used by material designers to develop low-tech self-produced materials. We are talking about DIY-Materials (Rognoli et al., 2015; Ayala-Garcia & Rognoli, 2019). In fact, the dissemination of workshops, fab labs, maker spaces, access to libraries and sharing through online platforms facilitate this type of experimentation. Thanks to this democratization of knowledge and technologies, even inexperienced people can tinker.

06 HOW TO TINKER WITH AND FOR MATERIALS? METHODS AND RECOMMENDATIONS

In this section, we present recommendations, approaches, and tools inspired by desk research (literature review) and case studies (Parisi & Rognoli, 2017; Parisi et al., 2017). The tinkering process is extensive. Information can emerge by three types of actions. Those that lead to obvious connection and those that come from the interventions after the process. It is possible to define a structure – model, blueprint, plan, or template – for materials tinkering, in three levels characterized by different operations:

- Tinkering applied to the formula: this practice aims to discover how variations in the recipes can impact on the final results.
- Tinkering applied to the process: this practice seeks to identify possible manufacturing processes and to understand the material behaviours through the relationship between the variables of the process and the results.
- Tinkering applied to the sample: this practice aims to identify the possible surface treatments, the possible variations in the composition of the materials and other behaviours of the samples through direct manipulations.

For example, the Technical and Sensory Characterization of the Material is defined first by the modifications in the preparation of the materials such as the addition of ingredients or filling of other compounds or elements. These, in turn, may be performed through the use of moulds of different shapes, texturing, colouring, temperature and other conditions’ variations, process. Finally, embodied exploration can be used to explore the effects such as, for instance, strength, toughness, and elasticity, or home-made experiments to test their technical characteristics, such as tensile strength, flame resistance, impermeability, water-resistance, etc. Also, it is possible to add and try different treatments on finished samples.

Here, we list emerged pattern and suggestions from case studies, i.e. more than three years of tinkering with and for materials in design courses, thesis projects, and workshops:

- Be inspired by techniques and “recipes” from other fields, for example culinary, science and biology, agriculture and farming, arts, and others, activating a trans-disciplinary cross-pollination.
- Be inspired by techniques and recipes from your or other cultures and traditions.
- Enhance authenticity: show the raw ingredients in the final samples or some characteristics of it, e.g. fibres, colours.
- Reconnect with material provenance: some ingredients are characterized by the unique conditions of the environment or location they have been collected in, and the time they were collected. This can interest minerals or organic resources such as plants. Emphasize this unique characteristic to show the geographical and temporal coordinates of the material.
- Be creative: Stress unconventional connections with other ingredients and processes (unlikely connectable) to develop unexpected and original results.
- Ceding control to materials vitality and spontaneity: support the material instead of concealing and restraining it.
- Establish a dialogue with the materials: be inspired by what it does and its performances, i.e. what it says.
- Appreciate materials dynamism: respect the time required by the material – to grow or to stabilize – and observe changes over time.
Value imperfection of materials; tinkering and DIY practice may generate inhomogeneous results.

Be open: be open to the unexpected, serendipity and uncertainty.

Be disruptive: break the rules and disrespect conventions; accept failures and mistakes, and learn from them.

Use embodied and tactual experience to test material properties and qualities; develop your own vocabulary and lexicon to describe and name material qualities.

Iterate: learn from intermediate steps and further/improve the material. This will foster creativity and continuous development and perpetual prototyping.

The results of the Tinkering of materials are collections of material samples (material drafts and material demonstrations) with different qualities and characteristics, supported by specification about the process, the tools to use, the resulting qualities and characteristics, in a kind of “book of recipes”, using the culinary metaphor. Often, one result of the tinkering activity is an Abacus, i.e. a visual and textual instrument with the shape of a matrix reporting the variations within the same material samples production. Videos, diaries, posters, and other communication tools and multimedia are often used to enhance the storytelling about the final result and the whole experience around material tinkering, i.e. the material designer journey.

Additionally, the tinkerers use pictures, videos, drawings, notes and intimate diaries to document the development. Documentation records the process and makes it visible, communicating it and allowing tinkerers to return to any part of the process. Creating a narrative is also useful for building the identity of the material and then telling it to an audience.

A topic still to be investigated concerns the aesthetics of the materials resulting from a tinkering activity. Tinkering emphasizes imperfect, organic and rough surfaces, activating a process of humanization of the materials, making them honest, expressive and vulnerable (Parisì and Rognoli, 2016). This is mainly due to the use of a low technology approach, very close to craftsmanship, and the use of local waste and resources, characterized by high disposal and low prices (Ayala-Garcia & Rognoli, 2017). However, it is a current practice given the confirmed growing trend and the presence of emerging profiles of material designers. In addition to practice tinkering to gain knowledge about materials, foster creativity and increase innovation, the emerging profile of the material designer has another crucial role. It is the one to divulge this experimental practice to reach an audience and to increase its aesthetic and cultural value in order to make it acceptable, as a result.

Material Tinkering is a practice that can drive innovation and design uniqueness. As David Pye (2007) put it “the range of qualities that mass production is capable of right now is so woefully limited”. Indeed, we can observe a relation between tinkering and the emergent practice of crafting, with the meaning of “making with own hands”.

Someone can define this approach as a nostalgic return to traditional practices. Actually, it can be considered precisely the opposite. Indeed, this practice characterized by artisanal inspiration, hands-on experimentation and creativity can be exploited as a creative engine to look forward – to the future and innovation – improving and qualifying the culture of materials for design.
Today there is widespread awareness that the continuous growth of modern societies is driving our planet to collapse. Humans are consuming as if the Earth could have unlimited resources. Since the 1970s, we have set in motion a mechanism by which every year, we consume much more than the planet can regenerate; the overshoot day, that is the day when we run out of the available resources, always comes earlier. In 2050, continuing like this, it is expected that we will be able to consume the equivalent of the resources of three planets Earth (UN, n.d.). The situation is even more difficult if we think that we have not yet developed efficient recycling and recovery systems.

The current economic model is still mostly linear, following a simple pattern: production -> consumption -> disposal. The idea of managing materials cyclically to increase production efficiency has been known since the early stages of industrialization (Simeone at al., 2019; Fuss-Luke, 2004). More recently, various schools of thought have emerged with the aim of more efficient management of resources, from cradle-to-cradle design (Braungart & McDonough, 2002), up to biomimicry (Benyus, 2002), which can now be found in the Circular Economy as a holistic framework of good practices. According to Ellen MacArthur Foundation (2012), more recent theories such as performance economy, cradle to cradle, biomimicry and blue economy have contributed to refine further and develop the concept of CE.

One of the first definitions of circular economy says that it “... an economy designed to enable the regeneration of resources and to minimize the consumption of natural resources” (Braungart & McDonough, 2002, p.4). This definition is based on the understanding that the current economic model is still mostly linear, following a simple pattern: production -> consumption -> disposal. The idea of managing materials cyclically to increase production efficiency has been known since the early stages of industrialization (Simeone at al., 2019; Fuss-Luke, 2004). More recently, various schools of thought have emerged with the aim of more efficient management of resources, from cradle-to-cradle design (Braungart & McDonough, 2002), up to biomimicry (Benyus, 2002), which can now be found in the Circular Economy as a holistic framework of good practices. According to Ellen MacArthur Foundation (2012), more recent theories such as performance economy, cradle to cradle, biomimicry and blue economy have contributed to refine further and develop the concept of CE.

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daily and what happens when they are not needed anymore. Several scholars have recently defined CE as a holistic, restorative and resilient economic model based on innovative projects for the reuse of products and materials, and the recovery strategies through closed-loop supply chains and reverse logistics (Sillanpää & Ncibi, 2019; Ghisellini et al., 2016).

Beating “circular” is not just a question of reintroducing materials and waste into the production cycle, but also to remedy the inefficient use of natural resources, products and materials. It is a question of clearing away the very concept of “waste” and recognizing that everything has a value (Lacy and Rutqvist, 2016).

To this extent, designers need the right training to tackle complex challenges and apply knowledge within multidisciplinary teams in response to the urgent challenge they have to face. One of the significant concerns in implementing the CE principles relates to the flow of materials and the possibilities of reshaping the current state of our society in terms of artefacts and infrastructure. Since the traditional industrial drivers that pushed materials research are no longer valid on all fronts, designers don’t have to rely solely on pure science when it comes to material development. In fact, the expansion of the designer’s knowledge of materials and the exploration of technologies, activism and do-it-yourself practices (Andersen, 2014; Bettiol & Micelli, 2014; Tennenbaum et al., 2013).

In recent years, many initiatives based on DIY practices (Fox, 2014) have flourished around the world. These also concerned professional design and not just the world of amateurs. In fact, the designer today has to acquire control of the entire design process by developing material artefacts autonomously. Kotler (1986) defines do-it-yourself as an activity in which individuals employ raw and semi-raw materials and parts to produce, transform, or reconstruct material goods, including those obtained from the natural environment. When designers faced this growing trend related to self-production and focused on the material dimension, a new class of materials for design. We also investigated their aesthetic potential (Ayala & Rognoli, 2017) and their propensity to become bearers of social innovation (Rognoli et al., 2017). The main phases for the development of a DIY-Material. Material drafts are samples that come out directly from the material experimentation phase, focused on understanding the adequacy of the chosen sources and the correct use and dosage of the components. In this case, the focus is on the sensory qualities of the future materials and those colours and elements to create textures, transparencies and chromatic effects. Material demonstrators are therefore slightly more advanced prototypes, in which the experimentation phase focuses more on the formal potential and feasibility of future processes, experimenting with potential forms and techniques (Rognoli and Ayala-Garcia, 2020).
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Observing the emerging phenomena and the different case studies available (Rognoli et al., 2017), it is evident that the choice of material source is usually motivated by the desire to find the answers to the many looming and increasingly evident problems in our planet. For this reason, experiments are

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The experimentation process will produce various new material draft samples; during their aesthetic and technical evaluations they probably start making speculations on its applicability. The material drafts, as well as speculative artefacts, create the possibility of thinking about them and can be defined as draft samples of possible worlds. The designer today is increasingly inclined to look at material samples as a set of properties and qualities to be explored. Material samples can be defined as speculative since they are like drafts, still open and available for experimentation; they allow the materials designer to conceive and imagine alternatives, starting from a material that is not entirely imaginary but has roots in reality and that can evolve into meaningful and preferable material experiences. Material drafts can be speculative also trying to anticipate and create scenarios and visions of future and new material applications. In this phase, the timeline in which to place one's project depends on the feasibility glimpsed in the samples and by the designer's choices, in some cases going closer to the speculative (e.g., Digital Lichen by Davide Piscitelli).

Furthermore, it is also possible to speculate on the past. Materials can also look to the past to shape new possibilities for the future. Here storytelling can play an important part in the project's description; being at the very heart of human cognition, interactions and cultures (Beckman & Barry, 2009), the field of design uses storytelling as a tool to describe the creative process. When it comes to materials development, some designers adopt this technique to tell how they achieve a particular material. Unlike traditional scientific recipes, this process is often explained based on performance, Material Designers transform components to obtain a more precious material and in fact, we talk about DIY recipes precisely to recall the fact that, as happens with ingredients in cooking recipes, even materials can be modified, customized and improved. Each has its essential cookbook and anecdotes.

In this chapter we have tried to outline the main phases that all DIY recipes have in common, emphasizing the role of the materials designer as a catalyst with the potential to manage the complexity of the circular approach.

To conclude, we want to underline that also during the development of the material project, it was essential to consider the creativity of the designer in choosing of primary sources, their imagination in designing and the procedure therefore the recipe, and the efficiency in communicating, supported by the storytelling of the entire DIY-Material project.


The impetus of the circular economy strongly influences the design of materials for the products of the future. Bringing new material objects into the world will increasingly require a considerable evaluation of the ethical responsibility. The materials with which new things will be made must be cyclical like those of nature: produced with waste materials and reusable at the end of their life.

It will be even more necessary to treat post-production and post-consumer waste in an upcycling perspective that is geared towards increasing the value of the materials resulting from recycling. In the past, recycled materials were perceived as chip materials, since it was customary that recycling negatively affected their technical performance, degrading them and reducing their potential subsequent applications. Today the value of a new material is no longer tied only to its technical performance, but also to its perceptive, evocative and experiential characteristics. This offers new and unprecedented possibilities for regenerating waste. The design of materials with the contribution of design must therefore be oriented towards identifying the most “uncomfortable”, most difficult and expensive waste to dispose of, to reinterpret and regenerate it, while also increasing its value, so as to make the recycling process sustainable and convenient.

In the objectives of sustainable development, the material component of new products constitutes a burden that aggravates the environmental weight of the products due to it requiring a consumption of material and energy resources. Regardless of the specific impact of the material, the greater the quantity of material used to produce new objects, the more the environmental, economic and social impact of the objects increase. The reduction of material is therefore one of the most important strategies to follow. Nevertheless, objects are made of materials and it is therefore necessary to deal with the theme of designing new materials in light of the indications that emerge from the SDGs. The most involved objective is Objective 12: to guarantee sustainable consumption and production models, which aim to generate sustainable consumption and production models, through an ecological management of chemicals and all waste, along with a substantial reduction in waste generation through measures such as recycling or reuse. Objective 12 also aims to halve food waste as well as encourage businesses to adopt sustainable practices.

Can creativity help determine what would be the ‘next oil’ in the 21st century?

In the process of creating new materials, creativity can therefore constitute an intermediate meeting point in the collaboration between designers and scientists that can help them dialogue and collaborate through common prefigurations to reach shared objectives, along with cohesion and relational empathies capable of generating joint and consistent paths. The mutual collaboration between designers and materials scientists, carried out creatively will allow to define the materials of the future, which must come from highly renewable resources, be versatile, not require high-impact transformation processes as well as be easily recyclable or biodegradable. It is not said that they will be chemical synthesis materials: the oil of the future could come from biodesign processes, as well as, for example, from vegetable fibers such as hemp or the cultivation of biological systems such as fungi or bacteria.

Carla Langella

Creativity is a tool of primary importance in the design of new materials, with it being a quality that belongs not only to the world of designers but also to that of materials scientists, who need creativity to set up new lines of research as well as elaborate the predictive principles that guide them in the defining of investigation processes and innovative application protocols. In the process of creating new materials, creativity can therefore constitute an intermediate meeting point in the collaboration between designers and scientists that can help them dialogue and collaborate through common prefigurations to reach shared objectives, along with cohesion and relational empathies capable of generating joint and consistent paths. The mutual collaboration between designers and materials scientists, carried out creatively will allow to define the materials of the future, which must come from highly renewable resources, be versatile, not require high-impact transformation processes as well as be easily recyclable or biodegradable. It is not said that they will be chemical synthesis materials: the oil of the future could come from biodesign processes, as well as, for example, from vegetable fibers such as hemp or the cultivation of biological systems such as fungi or bacteria.
## Circular Material Designers

### Material Education:
**New Training, New Skills**

Valentina Rognoli, PhD  
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### Materials Designers:
**A New Design Discipline**

Laura Clèries, PhD  
Elisava Barcelona School of Design and Engineering  
Valentina Rognoli, PhD  
Design Department  
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### Expert Interview

Richard Lombard  
Matterofimportance
With the evolution of technology today and designers’ continuous exploration and interpretation, the material world is undergoing tremendous changes. The investigation and exploration on new materials and their unique characteristics have caught attention of not only designers but also design educators. This chapter shows how current material education evolves to enable design students to create a conscious dialogue with materials, especially considering the material as desiguable to achieve circular design by focusing on their “personologies”; their experiential attributes. The chapter contains three parts: a brief review of relevant literatures on design and material education, a desk research on the changing material world as new context of material education, as well as a summary of material education in design based on existing educational phenomena and its future prospects.

Materials have always been considered as one of the essential elements in design practice and design education. The first Bauhaus Design School, had a dynamic and growing educational approach, constant improvement to the professors’ teaching curriculum (Cross, 1983) and the consideration of one’s own sensations and expressions as its principal foundation (Itten, 1963), with the characteristics of one’s own sensations and expressions as the foundation (Itten, 1963). There, materials and processes were highlighted as vital components of the education approach with one of the principal aims: to encourage students to understand basic and specific material characteristics (Wick, 2000) and explore primary material perceptions based on hands-on exploration (Itten, 1963). Influenced by Deeds, and the epistemology of epistemology, the following New Bauhaus in Chicago constructed the practice-based knowledge generation within the courses (Moholy-Nagy, 1947; Fiedler & Feierabend, 1999). It had a deep pedagogical goal “to help” shorten the road of self-experience, ...[to help] shorten theroad of self-experience, ...[and give] the students ample opportunities to make a careful choice of his field of specialization later” (Educational Program, 1937-38). Students were asked to define and explore two general types of practice with materials and tools: one to “build” and explore materials’ existential attributes, such as the Material Perception Tools (van Kesteren, 2009), Expressive-Sensorial Atlas (Rognoli, 2010) and the Material Aesthetic Database (Zuo, 2010). These sources are introduced to design students as well, to support them to understand the building blocks of materials experience from sensorial, interpretive (meanings), affective (emotional), and performative levels, and to have a more concrete grounding for articulating ‘experi- mental’ material requirements and constraints alongside the technical (Pedgley 2014). Based on this, Material Driven Design method had been developed to facilitate design processes in which materials are the main driver (Karana et al. 2015). Designers are encouraged to apply the MDD method either to design based on a fully developed material sample or the semi-developed or exploratory samples, such as food waste composites, living materials made of bacterial cells, 3D printed textiles, flexible OLEDs, etc. Some emerging design courses, such as Designing Materials Experiences in Polimi, or Material Driven Design in Tu Delft, have enabled more design-driven exploration and innovation to emerge in design schools. Therefore, a transition had appeared and developed in material education of design these days: students are encouraged to actively explore new materials to test out the suitability of new or newly applied materials to a developing design concept. This is an effective approach to evaluate whether a material can meet the design requirements, or to explore the feasibility and effectiveness of unknown new materials, and sometimes this is the only way (Pedgley 2001). The competencies of selecting materials in accordance to their properties and processing has already become one of the prerequisites of designers today.

However, even if the material education discipline has used and adapted some resources developed from the engineering field, it also created its own approaches over time. As early as 1986, Ezio Manzini had a discussion on the abundance of new materials that has caused a shift in the relationship that people once had with materials (Manzini, 1986). Gradually, designers’ concern for materials and manufacturing selection is motivated not only by achieving utility but also to leave a more general positive impression on people (Christensen, 1992; Swei, 1999); in designers’ eyes, materials became “Multi-dimensional”, such as the engineering dimension (the technical properties), the usability of ergonomics and interfaces, the environmental issue considering sustainability, the expressive-sensorial dimension and the material “personality” (Ashby & Johnson, 2003). So far, although the material selection was still the major topic in material education, the principles of selection have become increasingly rich and complete. With the term of the “materials experience” generated (Karana et al. 2015), many material-based design tools were invented to lead designers under- stand and explore materials’ existential attributes, such as the Material Perception Tools (van Kesteren, 2008), Meaning Driven Materials Selection (Karana, 2009), Expressive-Sensorial Atlas (Rognoli, 2010) and the Material Aesthetic Database (Zuo, 2010). These sources are introduced to design students as well, to support them to understand the building blocks of materials experience from sensorial, interpretive (meanings), affective (emotional), and performative levels, and to have a more concrete grounding for articulating ‘experimental’ material requirements and constraints alongside the technical (Pedgley 2014). Based on this, Material Driven Design method had been developed to facilitate design processes in which materials are the main driver (Karana et al. 2015). Designers are encouraged to apply the MDD method either to design based on a fully developed material sample or the semi-developed or exploratory samples, such as food waste composites, living materials made of bacterial cells, 3D printed textiles, flexible OLEDs, etc. Some emerging design courses, such as Designing Materials Experiences in Polimi, or Material Driven Design in Tu Delft, have enabled more design-driven exploration and innovation to emerge in design schools. Therefore, a transition had appeared and developed in material education of design these days: students are encouraged to actively explore new materials to test out the suitability of new or newly applied materials to a developing design concept. This is an effective approach to evaluate whether a material can meet the design requirements, or to explore the
in the near or far future: waste of food, energy and other resources; over polluted water and solid; over emissions during manufacturing processes... Back to the theme of circular design, material consideration is essential, and designers need to break down the barriers branches such as material expertise, new material solutions to get a more sustainable results by manipulating the materials and its circular systems. The ninth principle of Dieter Rams says that good design is environmentally friendly and sustainable (Rams, 2017). From the point of view of material design, we can firstly interpret it as a flow of highly efficient material resources and low recycling emissions and production costs, but the circular choice by design students. Moreover, it’s, and material designers show the immateriality of the design: the social and economic impacts and the value of the user experience while using the product. Under this new context, designers need to have new dialogue competences with materials and make better material decisions.

In design education, the cultivation of the capabilities on dialoguing with materials has become more flexible and challenging. Designers’ material competencies must not only follow technological updates but also require them to keep their social responsibility in mind, in order to respond to the material sustainability issues today actively. It is necessary to put materials in a role that can be designed and explored, to allow design students to conduct multi-dimension explorations and dialoguing with materials’ experiential attributes and integrate it into the design process (Rognoli et al. 2015) to students and encourage them to explore and create new material experiences by hands-on approach, and have received very positive feedback because they allow a more engaging and active dialogue with materials.

04 CONCLUSION

As the designers’ perspectives on the material gradually changed from technical properties to materials experience, emerging educational activities began to conceptualize and contextualize the materials experiential attributes and integrate it into the design education. A phenomenon generated recently is catching people’s attention: the pedagogy in material education tends to engage students taking “materials” as an active entity to be designed, rather than just a passive one. This has led us to reorient the future of materials education in design: do we need new training methods to guide designers to dialogue with materials? Do contemporary designers need new material skills to adapt to this fast-changing world? Starting from the generic view on the material in the design world, and expanding to detailed branches such as material selection or materials experience, the literature on the material aspect of design can reveal how the designer’s perspective on materials gradually changes in these years. Besides the material selection in design, quite a few designers have begun to put materials at the beginning of their design path, exploring the infinite potential they can offer. Opinions of design scholars, material specialists, and material designers show how the evolution of the material world inspired designers to new circular solutions and ecodesign to look differently at relations between humans, objects, materials and systems. Reflecting on what has happened in the past to the present day, as well as anticipation following today’s new context, the chapter aims to encourage us rethinking the evolving role of materials education in design for a circular and more sustainable approach. There is still a long way to go for materials education in design, and it struggled to adapt to the current development and trends of science, technology and social forms. Putting materials in a position where they can be designed and explored will undoubtedly have a revolutionary impact shortly, and also heralds that materials will continue to be one of the crucial considerations in the development of design education. Thanks to design material educators, scholars and experts for their continuous explorations and teaching practices, in the future design field, there will be more and more material professionals who can connect design aesthetics with new educational approaches and create new courses. Some of them could have their unique methods and tools to “taste” feel materials, and be able to analyze, evaluate, advocate, and create new ones. They will play an essential role in building a sustainable future.
Materials Designers: A New Design Discipline

The history of the relationship between human beings, materials and technique is long and complicated but fascinating. It has always been addressed with a multi-disciplinary approach, thanks to various and relevant studies belonging to multiple fields of research. This relationship, since the mid-nineteenth century, has been inscribed in the field of industrial design, and it is transformed to an inseparable and consolidated connection between the designer, the materials and the techniques, capable of responding to the needs and requirements dictated by contexts and times.

Today, human beings are experiencing an era characterized by the need for a more responsible role for design in environmental, technological and social issues. It seems that new profiles of designers who are more aware and able to embody their work with the coming and future concerns, seem to be emerging. Scholars have always investigated the role of the designer, still questioning the foundations of a profession that initially seemed to be exclusively dedicated to giving an aesthetic form to artefacts. Nowadays, in modern societies, the designer has become significant creator of meaning in everyday life (Grant & Fox, 1992) with the growing responsibility of the product as a whole, starting from the material choices up to the considerations relating to the overall environmental impact (Thackara, 2006; Papanek, 1972). The urgent need to consider the specificities of respect for the environment in every artefact that is created is increasingly evident. It is no longer possible to wait or ignore the problems created by human beings to the environment in which they live.

Within the design culture, the idea is now ripe that it is always necessary to design inside the confines of design for sustainability practice. As Stengall stated in 2006, the role of the designer in developing a sustainable society is not merely to create "sustainable products," but rather to envision products, processes, and services that encourage widespread sustainable behaviour. This goal of designing for sustainability can be accomplished through the development of a new philosophy to help guide design decisions. Furthermore, it is necessary to take into consideration that every artefact is a form of persuasive communication in which it serves as an argument for how people should live because with every new artefact designers have directly influenced the actions of individuals and communities, changed attitudes and values, and shaped society in surprisingly fundamental ways (Buchanan, 1989).

Moving forward, you can also understand that to design for sustainability requires not only the redesign of human habits, lifestyles, and practices but also the way humans think about design (Wahi & Baxter, 2008). Vezzoli (2003) stated that designers have an essential role to play because they form a bridge between the consumers of culture and the world of production. Designers also need to become aware of their new responsibilities and their specific contribution in the transition towards a sustainable society.
Many scholars identify the materials used to shape the world as a fundamental element to manage a transition towards sustainability (Liedtke et al., 2015; Ceschin and Gaziulusuo, 2016; Crabbé et al., 2013; Gaziulusuo and Elenius, 2016). This is because the human being’s ability to extract, transform and consume material resources has defined it as a species. The fact of transforming materials into useful, meaningful, ergonomic and performative products has always been a concern whose end is seen only as a designer. The scale they have done this, both as humans and as designers, over the past 50 years is placing an unsustainable burden on the planet.

In the history of design it is possible to find examples of approaches and moments in which the importance of materials has emerged firmly. One of all is the example of Primary Design, thanks to which, towards the end of the 70s in Italy, a new approach to materials was defined. The merit of the Primary Design was to try to re-establish the primacy of human function and meaning among the product forms, moving reactive to the touch and manipulable, to reconnect the human being to the existing context. Sensation became a privileged theme of the project and the study of the characteristics of the material perception allows the possibility of elaborating new material languages that become just as important as the compositional and structural syntax.

With the Primary Design, the specificity of material design is born for the first time, which involves where the material is acquiring its set of chromatic, acoustical, visual and surface properties, to give it a specific profile of material design. Designers, such as Alghiero Petrillo (1989; Trini Castelli, 1985). It can, therefore, be said that in this case, the design of the materials was focused on their sensorial-expressive dimension. As scholars stated (Mazinzi, 1988; Dooley, 1998; Rognoli, 2005), the design of materials opened up new possibilities for planning and determining an intervention not on the form, but on the material definition, the core of all design processes. The materiality is indeed indispensable for this kind of design focused on materials, and it allows control for the constructive process of materials, often employed misusing their authentic expressive and structural skills. This material-sensorial difference is the basis of the design of materials, which makes the theme of materials the very ground of the project process. Materials have their own autonomy, which helps to create an expressive structure that requires an expressive and sensorial components. The acceptance of the independence of the design of materials has undoubtedly brought out the need for a professional specialization of this field, and it has been the foundations for today being able to talk about the design of materials aimed at the circular economy. In fact, the area of material design is mature enough to face the practical challenges that human beings have met, to defend their world from themselves, also thanks to design and the material designer.

This chapter is focused on communicating the reflections arisen during the Made Project regarding the designer’s role concerning the impending environmental problems and development of sustainable solutions, including circular materials. It is a contribution to the overall reflection about the way humans think about design in the context of urgent global challenges: materials for sustainable solutions to face uncertainties, turbulence and rapid change of the contemporary world. The contribution is aimed at outlining the characteristic features of the materials designer implicated in the specific role towards circular sustainability as a new design discipline and in discovering solutions for the circular economy approach.

A good material designer demonstrates these specific skills:
- Sectoral Transversality. Understanding the transversality of materials and connecting solutions from different industries.
- Scientific and creative perspectives. Adopting a multidisciplinary view of materials, both from creative and scientific approach.
- Sustainability and circular economies. Understanding circular economies in the context of design and materials.
- Hybrid of traditional and computational skills. Mastering hybrid skills that bridge traditional craft techniques with logical innovation in the field of materials processing (3D printing; Computer-aided fabrication...)

01 MATERIAL DESIGNERS IN CONTEXT

What are they agents for? What are their contributions? What are their specific skills? What have been understood today is that not only the designer can transform and create using the material of the invention (Mazinzi, 1986), but she/he has also a specific role to play (Mazinzi, 1998; Rognoli, 2005), the design of materials opened up new possibilities for planning and determining an intervention not on the form, but on the material definition, the core of all design processes. The materiality is indeed indispensable for this kind of design focused on materials, and it allows control for the constructive process of materials, often employed misusing their authentic expressive and structural skills. This material-sensorial difference is the basis of the design of materials, which makes the theme of materials the very ground of the project process. Materials have their own autonomy, which helps to create an expressive structure that requires an expressive and sensorial components. The acceptance of the independence of the design of materials has undoubtedly brought out the need for a professional specialization of this field, and it has been the foundations for today being able to talk about the design of materials aimed at the circular economy. In fact, the area of material design is mature enough to face the practical challenges that human beings have met, to defend their world from themselves, also thanks to design and the material designer.

This material designer showcases a hybrid profile of creativity with science-driven design. They are great ideators, connectors of unexpected combinations, being able to go out of their comfort zone. Their creativity develops fruitful design ideas and material-driven design approach make them a great asset in today’s economic, societal and environmental challenging context, including addressing the European Green Deal and relevant UN’s Sustainable Development Goals.

Their work should not be developed on their own, but being connected and collaborating with other designers, such as material science (to back up any creative-driven decision), industrial engineering (to scale up their materials design solutions into industry), social sciences (to systematically explore the impact of new materials design on social structures and to explore how to communicate to a wider public in order to raise environmental awareness), and environmental sciences (to evaluate the environmental impact of their creations).

The materials categories and processing typologies can be classified as follows:
- Materials category: GROWN Materials
  - Definition: Materials that are grown through the use of bacteria or fungi.
  - Reasoning behind: Biological processes to generate materials.
- Project/industry application: Small home objects, construction bricks, insulation panels.

02 MATERIAL DESIGN PROJECTS

What are the typologies of materials design projects? An early analysis of existing materials design projects has been performed, clustering them into five categories: Grown materials, Wasted materials, Zero-Waste materials, Domesticated materials, Technocraft materials. Table 1 displays the materials category along the definition, the reasoning behind, exemplifying design projects, and potential project/industry application. This analysis allows for the identification of the material design development starting point and the possible future applications, provided that the industrial scalability of these early material designs is addressed.
MATERIAL DESIGNERS: A NEW DESIGN DISCIPLINE

How is this new design discipline created?

In order to set the seed for this new creative profession, Action is needed: such as training the skills, establishing a quality standard, generating a community and giving it visibility. MaDe (Material Designers) is the project, co-funded by Creative Industry Fund, that seeks to support these actions between each winner and an appointed company or organisation, as a way to give access to material designers to the corporate context and to specific, practical challenges that industry may have.

The training of skills, quality standard and evaluation of the new material designer’s profiles is as important as the training in order to achieve a certain recognised status within the project partners, a context where physical and digital merger, and in order to successfully reach different audiences, it is necessary to find innovative ways to reach the audience, rely strongly on technological and generate attractive communication portfolios. The MaDeEdits is a short film, available for larger audiences, that promotes and positions with a focus on materials as taking up the responsibility for pursuing more circular design solutions. The MaDe Galleries and MaDe Films are audiovisual packages from the MaDe finalists that can help them showcase and share their projects and their professional profile. Conceived as the new MaDe Talks help share the personal and professional experience of these material designers on a first-person perspective, and the MaDe Book can collect the different academic and practical experiences that are the role of material designers in the context of circular economy.

As a conclusion, Material Designers are agents of change. They can design, redesign, reform, reuse and redefine materials giving them an entirely new purpose. Increasing the potential of materials they can go on to research, advise, educate and communicate what these materials are and can be in the immediate, near and far future, implementing positive social, economic, political and environmental change across all sectors towards a responsibly designed future.
In my opinion, there is nothing “specific” at all about a material designer, and that is both the beauty and the opportunity of the field: I see practitioners existing on a broad spectrum.

On one hand, there are problem solvers: a novel application needs a material with X or Y characteristics, and one doesn’t exist. They combine the necessary tools and knowledge to achieve a singular goal. On the other are explorers: they push material to its limits to see what is possible, with no specific goal in mind. They don’t ask the materials to do what they – the designer – wants them to do, they ask the materials to show what they – the materials – are capable of.

In between are those who, for example, develop replacement materials for a product that is currently made from one that is at odds with evolving knowledge about impacts to the environment, whether that is micro, meso, or macro; or who see a surplus of a material (often waste, often growing) that has inherent value and look to exploit it.

Material design stands at the crossroads of the Built Environment and Natural Resource Management – and it holds the keys to both. Until we will be able to transcend the laws of physics and either conjure matter from nothing or make matter disappear, our ability to shape material flows is of critical importance.

A major reason that makes these flows so important is that they weigh so heavily on the environment. From extraction to manufacture to useful life to end-of-life scenarios, all materials fundamentally impact the air, land, and sea. The ways in which they do this is maddeningly complex and interconnected, and cannot be understood from a single perspective.

Material designers have not only the opportunity, but also the responsibility, to consider the impacts that their ideas have from the perspective of multiple stakeholders. This vital perspective allows them to understand – and communicate the understanding of – the intrinsic connections that materials have to the health of the planet.
Industry and Sociocultural Impact

Circular Material for Creative Industries: The Emerging Bioplastics

Materials Shaping the Future

Expert Interview

Marinella Ferrara, PhD
Design Department
Politecnico di Milano

Laura Clèries, PhD
Elisava Barcelona School of Design and Engineering

Owain Pedgley, PhD
Industrial Design at Middle East Technical University
**INTRODUCTION**

Creative Industries (CIs) make up the most important sector of European economies and are among the fastest-growing (KEA 2006, Power and Nielsen 2010). According to the European Commission (2010), CIs have been defined as "the industry that uses culture as an input and have a cultural dimension, although their outputs are mainly functional." They produce tangible goods or intangible services and can support innovation in other industries through typical creative inputs of art, design, and architecture. Culture and creative labour are applying to new concepts of materials, products, services or strategic communication ensuring continuous innovation based on high values products (product innovation) and new technologies, procedures, and routines to raise efficiency or quality (process innovation). Speaking about CIs innovation, we recall that "Material research plays an important role in the creative industries because the key success of a new product is increasingly linked to the materials used, which can be seen as the key factor to reinvent new materials products and manufacturing processes or contribute themselves to material innovation. It is on this very topic that we focus our contribution to MaDe. We display the potentiality of new biobased plastics for CIs. At the same time, we highlight the role of the design-driven material innovation approach and the advisable implementation in CIs.

From 2012, European Commission, jointly with the EASME endorsed actions to promote new collaborative innovative strategies for the integration of design creativity into material research and development. Projects such as 'Damadei', dedicated to increasing the collaboration between creative and material community, and the 'Design for Enterprises', a series of courses to increase the innovative capability of European small and medium-sized enterprises (Ferrara & Lecce 2019) - with a dedicated module of 'Design for Materials' (Ferrara 2017 p.179-181) - contribute to spreading among scholar, SMEs and incubators an approach of designing the material innovation (also named as promotion of material innovation approach), relative methodologies and knowledge about what design creativity could do for materials development (EC 2013). EU actions have been contributing moving beyond the capable design guidelines, such as the selection and application of given materials, and pushed design culture toward an expanded and more complex materials innovation process to capture new value and drive production as well as consumption towards sustainability.

**CIRCULAR ECONOMY TRANSITION AND MATERIAL INNOVATION IN CIS**

In the topological and expected transition phase to Circular Economy (CE), first which resource loops flow, the ‘technical cycle’ and then the ‘biological cycle’. The first refers to closed loops within which inorganic materials or synthetic ones can stay in continued use without losing their properties or value. The biological cycle is associated to organic nutrients or materials that can return to the system or decompose without causing harm to the environment and provide a source of food for the wider system. Finally, a sustainable circular materials-Peddel has been contributed moving beyond the consolidated concept of CE to start to reorganize their product manufacturing on sustainability principles to reduce environmental footprint (Pendredlich et al 2014, Loiseau et al 2016, Glaeserow et al 2017). Within a context of organic materials-CIs can be seen as the key factor to reinvent new materials products and manufacturing processes or contribute themselves to material innovation. It is on this very topic that we focus our contribution to MaDe. We display the potentiality of new biobased plastics for CIs. At the same time, we highlight the role of the design-driven material innovation approach and the advisable implementation in CIs.

In this scenario, the objective of this essay is to give insight into the role of design in the enterprises' transition towards CE. Pursuing this intent, after having briefly highlighted the connection between CIs and design, we want to clarify the relationship of CE-sustainability and to present an innovative sensibility and design research awareness according to EU plastics Strategy. Design is called from the process beginning to establish a material innovation process between resources and production (Korhonen et al 2018).

**CIRCULAR ECONOMY AND SUSTAINABLE INNOVATION**

According to the Ellen MacArthur Foundation (2016a), CE is a concept "based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems". By designing products with materials that come from, and safely flow into, their respective nutrient cycles, they can be part of creating an optimized materials economy that eliminates the concept of waste (2016b). A useful sustainable business conceptualization by Scott (2010) is based on "a zero waste industrial metabolism that profits from two types of material inputs: (i) biological materials which are those that can be reintroduced back into the biosphere in a restorative manner without harm or waste, by breakdown naturally and, (ii) technical materials, which can be continuously re-used without harm or waste". Even, McDonald and Braunsg (2002) recognized two cycles in the CE framework which resource loops flow, the ‘technical cycle’ and the ‘biological cycle’. The former refers to closed loops within which inorganic materials or synthetic ones can stay in continued use without losing their properties or value. The biological cycle is associated to organic nutrients or materials that can return to the system or decompose without causing harm to the environment and provide a source of food for the wider system. Finally, a sustainable circular materials-Peddel has been contributed moving beyond the consolidated concept of CE to start to reorganize their product manufacturing on sustainability principles to reduce environmental footprint (Pendredlich et al 2014, Loiseau et al 2016, Glaeserow et al 2017). Within a context of organic materials-CIs can be seen as the key factor to reinvent new materials products and manufacturing processes or contribute themselves to material innovation. It is on this very topic that we focus our contribution to MaDe. We display the potentiality of new biobased plastics for CIs. At the same time, we highlight the role of the design-driven material innovation approach and the advisable implementation in CIs.

In line with sustainability theories, a strong environmental sensitivity has stimulated researcher and innovators towards a deep exploration around CE (Scott 2010). Production cycles, material and energy flows through industrial systems have been questioned for understanding how these systems interact with the environment. Researchers are on the way to turn industrial waste and industrial byproducts into new materials, developing techniques and also machines for the recycling of thermoplastics, such as the Precious Plastic machines by the Dutch designer Dave Hakkens - that originated a movement to promote plastic-recycling organizations - or the candyfloss inspired machine by Polyfloss Factory allowing for the recycling of thermoplastics into fibres. Similarly, in Germany 3DEVO, developed a machine capable of transforming the plastic waste into 3D printable granules, which can be then turned into filaments. Instead, Refil that produced 100% recycled filaments of many thermoplastics from plastic waste, now is changing its focus on the operations of Better Future Factory to help brands & business moving to sustainable plastics. Technical cycles like these could be considered as a partial solution to the environmental problems but can open new economic of ecological potentials for manufacturing companies as well as for crafts-people and local communities in many cases. In a time when plastics are ubiquitous with a profound negative impact on animal welfare and the environment, plastic waste is a crucial issue.
There are plenty of CE transition cases through materials' innovation among design-oriented industries. Speaking of technical material cycles, for instance, Magis, one of the most popular Italian design furniture companies. They manufacture mostly from recycled material, producing products from waste-sourced materials from the production process. This material was applied by the designer Konstantin Grcic in the monobloc Bell chair, which uses the minimum quantities of material and causes less energy consumption during manufacturing. The process is simple, and it is an example of micro-organisms action that metabolises the material. According to European Bioplastics (2018), a bio-based material "is defined as biobased if it is either bio-based biodegradable, or features both properties."

One of the first bioplastics, both biobased and biodegradable, is the Polylactic Acid (PLA). PLA is a polymer that is fully recyclable and composed of a carbohydrate source like corn starch. It was discovered in the 1930s, but only recently became the most popular and promising green plastic alternatives for commercialization on a large scale. It happens thanks also its properties, comparable to other plastics in the industry, such as PET, and to the ability to be processed by biocatalyst under controlled conditions. PLA is biodegradable and compostable. Biodegradable refers to a substance able to entirely degrade naturally by micro-organisms action that metabolises the material. According to European Bioplastics (2018), a bio-based material "is defined as biobased if it is either bio-based biodegradable, or features both properties."

BIOBASED PLASTICS: A RENEWED GENERATION OF GREEN PLASTIC

Nowadays, for a more long-standing challenge, new sustainable and renewable substances enter the productive scene and new ones are promising to soon enter thanks of material researches. We refer to biobased plastics, i.e., industrial polymeric materials which are wholly or partly derived or composed of substances or waste-based material solutions compatible with a bio-economy, like materials derived from agriculture or food waste. If combined with bio-resin, these bring effective sustainable alternatives to conventional plastics for a new generation of green products.

As regards to the expected biological cycle, it is important to consider that biobased plastics are not necessarily environmentally friendly. This could be not biocompatible, nor biodegradable (Vert et al. 2012). It must make attention to the needed biodegradation conditions and to the eventual presence of bio-resistant additives or moieties, respectively (Vert et al. 2012).

Another group of bio-based plastics are the biopolymers that are produced from bacteria such as the polyhydroxyalkanoates (PHAs). Each type of PHA is produced by a specific strain of bacteria. These are exposed to a specific supply of essential nutrients (such as oxygen and nitrogen), which promotes the growth of PHA in granules of plastic inside their cells as food and energy reserves. Industrial production prefers certain bacteria capable of producing PHA from a range of carbon sources including waste effluents, plant oils, fatty acids, alkane, and simple carbohydrates. In this case, PHA has the dual benefit of reducing cost and the cost of waste disposal. PHA is non-toxic, fully biodegradable under the right conditions, and can be used in a wide range of applications, from food packaging to medical implants.

Biotherm the polybutylen adipate and terephthalate - and the polycaprolactone (PCL). Used primarily in hybrid conjunction with starch or other bioplastic materials, they improve the application-specific performance of the final product due to their biodegradability and mechanical properties. They have emerged as promising biopolymers finding numerous applications as thermoplastics, elastomers, adhesives, packaging materials, dining utensils, disposable razors, diapers, cosmetic containers - shampoo bottles and cups.

CONVENTIONAL / MAINSTREAM PLASTICS

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<tr>
<th>NOT BIODEGRADABLE PLASTICS BASED ON NOT RENEWABLE PETROCHEMICAL RAW MATERIAL</th>
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<td>Biopolylactic</td>
<td>Cellulose-based polymers</td>
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<td>LDPE</td>
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<th>BIOBASED PLASTICS</th>
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<td>Biobased polyethylene fumarate</td>
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<th>FOSSIL-BASED (NON RENEWABLE RESOURCES)</th>
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<td>Polybutylen succinate</td>
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<td>Polyolefins-adipate</td>
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<td>Polyethylene adipate,</td>
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1.4 MARINELLA FERRARA

The fashion sector often includes niche materials and results of start-ups, as evidenced by the growing number of fashion brands that produce new semi-finished products that, while being environmentally sustainable, also maintain adequate physical properties and aesthetic qualities to meet the performance requirements of fashion products, accessories and upholstery. Among these, there are green alternatives to leather that, while contributing to reduce the use of raw materials and their production processes, maintain the valuable properties of the natural material such as durability and flexibility, and also offer colour customisation options and a cost comparable to high-quality animal leather. These leathers can be divided into Vegan and Bacteria leathers. The Vegan ones are of vegetable origin. They contain neither fossil nor animal materials, so are mainly PETA-approved vegan. All are cellulose-based and also offer colour customisation options and a cost comparable to high-quality animal leather. They are easily cut, sewed and embroidered.

Thanks to the storytelling about their areas of production and the material origin, like waste transformed into products, new biomaterials are enabling consumers to make a business saying sustainable innovation to express their value.

1.5 DESIGN DEPARTMENT

To make a material omitting technical development to industries and the design of applications possibility into the innovation approach and manage their enterprise from a bio-based business. These innovation approaches can be divided into two categories: material design and material application design.

In this last paragraph, we offer empirical models each combining acoustic functionality with the design of detailed structures. These have been introduced. The hemp materials development in eyewear is not much common yet, but promising.

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captive tone variations, makes the aesthetic of each module a single piece rather unique.

The second product is MoGu Floor a disruptive solution for commercial and residential resilient flooring, combining design and function. The product is no harmful VOCs, sustainable, faster to install and easy to repair with a natural look and a great "foot feel" and last but not least, cheaper than luxury vinyl.

SUCCESS STORY 1 — SULAPAC

The Sulapac project, developed by Finn’s passionate biochemists Guvi Haimi and Laura Kylõnen, aims to accelerate the plastic waste-free future with sustainable materials that are beautiful and functional. The already developed materials is a biased plastic-free poly for biodegradable packaging with an initial application for the cosmetic industry.

When the two biomaterial researchers, were combined with the design studio Metropol, Lahtinen and Antti Pärsinen, Sulapac material innovation was born. The patent material consists of renewable natural wood chips from sustainably managed forests and bio-plastic-like properties natural binders that replace the traditional fossil-based plastic material with a new more sustainable one (Sulapac Ltd. 2017). It biodegrades fully without leaving permanent microplastics behind. The material is resistant to oil and water and it doesn’t penetrate oxygen. Sulapac® can be processed with existing plastic product machinery, making the switch from conventional plastic to an eco-friendly alternative easier than you might think.

The Sulapac start-up was founded in 2016 in Helsinki, Finland, and immediately started a strong collaboration with Make Helsinki. This is a team of designers and creatives, working in many design fields. Their collaboration has been the right hand of Sulapac when it comes to communicating, marketing, and also package design needs. Visual communication guidelines and artifacts, from brochures to photoshoots, from the website to investment applications, have been pretty much designed and put together by Make Helsinki, Sulapac and their network of trusted investors, B2B customers as well as to the public in a friendly, effective, reliable, and ecological way as designers know to perfectly deal with. Marketing and communication had to be awakening, informative, and emotional at the same time. Thanks to its effective way to communicate, Sulapac has won multiple competitions and gained very good feedback on their brand story. Their circularity and sustainability has resulted in more companies entering the bioplastic market, promoting further research and competition.

In a time of transition to CE, the demand for sustainable strategy is growing and expand. Biobased plastics are of prior importance for sustainable innovation and a plastic waste-free future. Today the bioplastics industry is a small but rapidly growing sector of the plastic industry. At present, it makes up around 1% of the total plastics market, a tiny drop in the plastic ocean. However, analysts foresee cast strong growth within the sector. Advances in technology have improved product quality and versatility while lowering production costs. This, in conjunction with rising fossil-fuel costs, has resulted in more companies entering the bioplastic market, promoting further research and competition.

In the path toward the CE paradigm shift, a great designer can emerge as an innovator and disruptor in the industries. The cited here presented projects, materials, and success stories introduce disruptive innovation in the plastics industry. Visual communication guidelines and artifacts, from brochures to photoshoots, from the website to investment applications, have been pretty much designed and put together by Make Helsinki, Sulapac and their network of trusted investors, B2B customers as well as to the public in a friendly, effective, reliable, and ecological way as designers know to perfectly deal with. Marketing and communication had to be awakening, informative, and emotional at the same time. Thanks to its effective way to communicate, Sulapac has won multiple competitions and gained very good feedback on their brand story. Their circularity and sustainability has resulted in more companies entering the bioplastic market, promoting further research and competition.

CONCLUSION

In a time of transition to CE, the demand for sustainable strategy is growing and expand. Biobased plastics are of prior importance for sustainable innovation and a plastic waste-free future. Today the bioplastics industry is a small but rapidly growing sector of the plastic industry. At present, it makes up around 1% of the total plastics market, a tiny drop in the plastic ocean. However, analysts foresee cast strong growth within the sector. Advances in technology have improved product quality and versatility while lowering production costs. This, in conjunction with rising fossil-fuel costs, has resulted in more companies entering the bioplastic market, promoting further research and competition.

In the path toward the CE paradigm shift, a great designer can emerge as an innovator and disruptor in the industries. The cited here presented projects, materials, and success stories introduce disruptive innovation in the plastics industry. Visual communication guidelines and artifacts, from brochures to photoshoots, from the website to investment applications, have been pretty much designed and put together by Make Helsinki, Sulapac and their network of trusted investors, B2B customers as well as to the public in a friendly, effective, reliable, and ecological way as designers know to perfectly deal with. Marketing and communication had to be awakening, informative, and emotional at the same time. Thanks to its effective way to communicate, Sulapac has won multiple competitions and gained very good feedback on their brand story. Their circularity and sustainability has resulted in more companies entering the bioplastic market, promoting further research and competition.

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Materials are inevitably linked to the evolution of mankind. Everything around us are materials. Materials are now at the core of innovation, generating impact not only in industry, but on society and even cultural values. Materials are no longer defined at the end of the design process but are part of the early design development. Moreover, consumers pay more attention to the materials they surround themselves with, they are far more literate and interested in materials innovation than before. Materials-driven innovation allows for new industries being developed, more sustainable solutions found, and more creative design processes put into place.

This interest in materials and what we are surrounded by is in direct relationship to new sociocultural behavioural patterns. Society and the planet are in upheaval and complete transformation and consumers are more aware of certain overarching topics related to human evolution: sustainability, health, and ethics amongst others, that results in product-service-system developments that either force new behaviours and/or answer them.

In one way or the other, new design projects arise where materials take a new role. This essay presents the current scenarios of materials trends that are responding or generating new sociocultural behaviours, that is, those materials typologies that are shaping the futures.

The first scenario is that of Scarcity and Ethics, where guilt-free and self-sufficient behaviours take the role. Plastic free packaging, using derivations of bioplastics such as those from potato starch, are populating the supermarket aisles (Ekoplaza) and various experimental designers creatively develop new biopolymers in collaboration with scientists (Gleather Glubber, by Petra Lilja). The zero-waste movement is pushing companies and material designers’ entrepreneurs to formulate new materials derived from discarded surplus, either in combination with bioplastics (Sawdust chair, Form us with love for Ikea) or more interestingly, in a mono material format, for instance, out of lettuce waste (Feltwood).

The vegan movement has also promoted the development of bio-derived ‘vegan-leathers’ (Pitalefn). Manufacturing processes that minimise waste and use a single material fail also into this category (COS Zero-waste collection, Monobloc brush by Andrey and Shay). Companies and designers also strive to generate environmental awareness in society through campaigns where materials are the asset: products that are ephemeral and can compost (F-fabric by Freitag) or museum ‘jewel’ pieces that are made from ocean plastic waste (Gyrecraft by Studio Swine). Ethical awareness is also a key message, with products that explain the traceability and ethical and sustainable collection SS19.

The second scenario, entitled Purity, is associated to the demand for healthier lifestyles, promoting the development of more natural environments for humans and to alternative symbiotic ways of manufacturing. This is achieved by using naturally healthy materials such as cotton, hemp or clay or newer developments of engineered naturals, such as wood fibres and cellulosic MDF-type of boards (Honext), or even naturally anti-bacterial materials such as copper or zinc which are embedded into textiles. Well-being is not only for humans, and there is a movement to cater for the well-being of the planet, with systems that use materials to de-carbonise the environment (Bio-char by India School of Design, Algae raincoat by Charlotte McCurdy) and to capture pollution (Airlink).

Nature is also a source of inspiration for alternative manufacturing processes: in-vitro growing processes using bacteria and fungi, (This is grown by Jen Keane, Growing a Mars boot by Oficina Corpuscoli) or the early development of new colour sources out of bacteria (The Colour Biolab by Maria Boto, Faber Futures by Audrey Chieze) are disruptive ways of transforming the industrial ecosystem.

Finally, the fourth scenario, entitled Wellthy, is related to emotional and spiritual needs. There is a need for more holistic perspectives of human existence, where the sensorial properties of materials are used as emotional tools (Tools for therapy by Nicolette Sodewees) or colour is used as a means to inform (Measuring less to feel more by Mickael Boulay). Sensorial surfaces become the interface for a certain indulgence (Locus chair by Anastasia Mass, My kind of wall by Andrés Reisinger). Haptic surfaces add a premium tactility to products (Active shoes by Christophe Guberan and Carlo Clopeth, MIT Selfassembly Lab). Digitally-informed materials can translate personal data into a physical representation (Phonoma by Sandra Lara).

In conclusion, materials and material designs can therefore impact and transform behaviours, contributing to the well-being of humans and the planet.
An essential part of circularity is to plan for what happens when a product becomes ‘out there’ in the world. Traditionally, once a product has found a buyer and a home, apart from certain obligations under warranties, guarantees and service contracts, the manufacturer lets the product go. End-of-life actions become the responsibility of the consumer. This has to drastically change in a properly functioning circular economy. If we look from the perspective of materials innovation, materials (re)usage and materials reclamation, I can foresee new obligations, new industries and new knowledge requirements. Industry will have to understand thoroughly and deeply people’s acceptance of new and alternative materials, as well as people’s willingness to engage as product custodians rather than product owners or consumers. Such ‘human factors’ research related to circular materials innovation will be equally as important as the technical and sustainability achievements.

Without doubt. I think some sections of society have a dreadful attitude towards consumption. Products designed to have years of service are sometimes prematurely and abruptly junked. For example, tents at music festivals, or deck chairs and tennis racquets left as waste across beaches in southern England – the aftermath of people’s mad rush to soak up the sun during the coronavirus pandemic. This is totally irresponsible consumption. Affluence and convenience, along with ultra-low-priced products and single-use packaging, have jaded our relationship with materials and skewed our perception of cost and value. Our normality must be to buy and consume only what we need, and to be much more conscious about the provenance of the materials used in packaging and artefacts. But more than that: hiring, renting, borrowing, sharing or swapping might need to be part of a ‘new normal’ for a much higher proportion of our material goods. That will take a great deal of education and persuasion.

Owain Pedgley is Professor of Industrial Design at METU, Turkey. His expertise centres on design for interaction and experience. He is co-editor of the book series ‘Materials Experience’ (Elsevier, 2020; 2014) and a strong advocate and early practitioner of academic ‘research through design’. Owain was a founding member of the Industrial Design program at the University of Liverpool, UK (2014-2017) and previously worked as a designer of sports equipment and musical instruments.
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Glossary

List of words and definitions selected by Laura Clèries, Seetal Solanki & Valentina Rognoli
Biodegradable
Matter with the ability to be broken down into non-harmful substances through natural processes. The time frame taken for materials with this capacity varies dependent on the perishability of the material itself.

Bioplastic
Plastics which fall into this definition exist on a spectrum ranging from fossil-fuel and biologically based plastics that are biodegradable to biologically based plastics that are not biodegradable.

Circular Economy
The circular economy, following the model outlined by the Ellen MacArthur Foundation, is based on three principles. These are: to design out waste and pollution; to keep products and materials in use; and to regenerate natural systems. By following these principles the aim is to design waste out of the system.

Compostable
Sometimes wrongly considered to be the same as biodegradability, compostable materials require specific conditions in order to decompose back to their natural elements, and typically do so in a shorter time frame.

DIY Materials
Any material created through individual or collective processes of invention, play, failure and fixing, often by techniques of the designers own invention.

Ecological Matter
Matter which has a symbiotic relationship between the organisms it is composed of and the environment that sustains it either during the process of making or continually throughout its life.

Industrial Ecology (IE)
Industrial Ecology (IE) is a field of study focused on the stages of the production processes of goods and services from a point of view of nature, trying to mimic a natural system by conserving and reusing resources.

Lifecycles
A series of stages that characterise the course of existence of a material product, individual or culture. When thinking about the lifecycle of a material we can witness its progression from raw state to product and back again if it has the ability to biodegrade, be recycled or repurposed. See also – Material Flows.

Maker Culture
An inclusive community of makers built upon the idea of using making as the basis of knowledge production and sharing. This creator society is largely based upon an agreed model and belief in open-source making. Due to making being understood as a process, maker culture in its definition is understood to develop as such too.

Material Designer
Material Designers are agents of change. They can design, redesign, reform, reuse and redefine materials giving them an entirely new purpose. Increasing the potential of materials they can go on to research, advise, educate and communicate what materials are and can be in the immediate, near and far future. These actions have the ability to implement positive social, economical, political and environmental change across all sectors, towards a more responsibly designed future.

Material Narratives
The stories emergent from the cultural, ecological and technological system of relations surrounding the material, its making, and the purpose it now holds.
→ Preservation
An act and process of preventing damage or decay, dependent on size, material composition and perishability, usually due to value or survival

→ Recoverable
Recoverable materials are restored to usefulness, regaining their former condition or being designed into another functional state

→ Recycle
Previously used or surplus materials are processed and treated in order to regain materials suitable for further use

→ Regenerative Design
Process-oriented whole systems approach to design. The term “regenerative” describes processes that restore, renew or revitalize their own sources of energy and materials. Regenerative design uses whole systems thinking to create resilient and equitable systems that integrate the needs of society with the integrity of nature

→ Repurpose
To repurpose is to give new purpose or use. In material making this can take different forms. It can apply to the use of the tools during making, the matter being given a new purpose from that we are currently used to, or the matter being processed in a way that alters the state we know it in

→ Social Resilience
Social resilience refers to a social unit or a group to collectively cope with or respond to external stresses and disturbances resulting from social, political, and environmental changes

→ Speculative Design
A critical frame of design thinking which considers possible futures through a series of fictional objects and systems. This form of material interrogation is used to stimulate debate, imagination and critical thinking with publics

→ Surplus
Something that produces in excess of what is required. Within materials thinking and making there is a resurgence in considering use for overlooked material resources, resulting in new applications for otherwise unused leftovers and waste

→ Sustainable
In terms of materials, sustainability is a method of using a resource in moderation in order to enable continual reuse and refrain from damaging surrounding ecological and social landscapes. With regards to systems, to be sustainable is a measure of whether an action or process can indefinitely keep going

→ Systems Thinking
A holistic approach to analysis of systems that understands emergent behaviour from component interactions. This analysis views everything as intimately interconnected and considers how systems work over time, the interrelation of the parts which make up the overall system, the processes that connect these constituent parts and the larger systems that they make up
Original Resources

2.2

The 8 best original ingredients used during the 6 MaDe Workshops
Sunflower is widely cultivated all over the world and used mainly for oil production. However, sunflower stem is a serious problem for farmers - usually it is burned or used for heating purposes - which is causing serious problems to the environment. Each hectare of sunflower can produce 3-7 tons dry biomass. By-products of oil production like sunflower husks and press cake also do not have a real application in the industry. They consist of approximately 40% of lignocellulose bers, which means it could be used without any additives to make biodegradable and cheap materials. Because of the local availability and huge amount of the raw materials at once I have decided to work with sunflower’s waste.

I’ve been working with the cassava starch as a base for bioplastics for almost a year and I wanted to mix it with other things. When I got in Barcelona, I noticed this very beautiful tree that was peeling and has interesting round seeds. Searching a bit more I discovered it was the plane tree (or platanus hispanica), very common in the big cities in Europe, because it absorb a lot of pollution and toxins and improves air quality, it was perfect for experimenting and transforming into bioplastics. I started collecting parts from the tree, without harming it: the barks, leafs, seeds and fruits that was already on the floor, and used this elements to make bioplastics. It was very interesting to notice and evidence the diversity of materials we can get from the same tree species, the final result is a collection of materials with lots of different textures, and qualities: one smoother and flexible, other harder and scratchy, other translucent and structured.

Posidonia is a submarine plant endemic from the Mediterranean. When the rhizome of the plant looses its fibers, the movement of the sea creates balls that arrive to the Mediterranean coasts, they are considered waste. It is also one of the most threatened species of the planet, a 25% of its extension has been loose. In addition to having awesome properties, the material can send a message and talk about a problem. The final result is a combination of balls with applications in different fields. The idea is to create a very located material to benefit the economy of the regions around this sea.
I have analyzed the fish waste of fishmongers in particular of “Pescheria da Ninin”, which is located in the center of Senigallia (AN). Most of the waste is composed by fish bones, heads, skin and scales. Fishmonger is specialized in debone and cleaning fish for consumers, in order to make easier the cooking part. As a result, each day he has a big amount of waste, more than 20kg per day. My experimentation has been focalized on fish scales: the scales are formed in the dermis. They have the function of providing a sort of external support, but more than anything else they protect the underlying tissues. At first sight the fish scales seems fragile, but is not like this. They are really resistant, and thanks to their trasparency and sheen are a beauty to observe. Their beauty lies in their apparent fragility and their property of seeing through them.

For the development of this material I wanted to make a reaction on the potential of the area where I come from, Puglia (southern Italy). It is the Italian region with the highest oil production quantity. I have analyzed the possible raw materials that are currently an industrial food waste and try to insert it as an ingredient of a biomaterial.

This material comes from lupini beans, being made with their skin (that isn’t eaten by the majority of the people I know. For this reason, I found it interesting to find a way to reuse them and make them have a new purpose.

This material comes from leftovers in the footwear industry that has a great impact on my locality, the leftovers are harnessed to the maximum but there are small pieces that have no other destination but the garbage. So I decided to try to find a way by creating a new material.
MaDe, a project co-funded by the Creative Europe Programme of The European Union, aims at boosting talents towards circular economies across Europe partnering with design and cultural institutions, Elisava, Ma-tt-er and Politecnico di Milano. Among the 120 Workshops participants, in the first round, 18 finalists were selected, six for each of the following categories: Best industry application; Best start up potential; Best future vision. Among the finalists the Jury designated the winner of each category.

- **Industry Application**: Magdalena Sophie Orland, Malu Luecking, Fanny Corina, González Rodríguez, Carolina Giorgiani, Tamara Orjola, Valdís Steinarsdóttir.

- **Start Up Potential**: Lab La Bla Studio, Andrés Ramírez, Laura Van De Wijdeven, Davide Franci, Bianca Streich, Signý Jónsdóttir.

- **Future Vision**: Sara Kickmayer, Paula Nerlich, Elena Albergati, Maria Mayer, Davide Piscitelli, Rosie Broadhead.
I am a textile designer with a special focus on experimental material research and the development of innovative technologies. I'm particularly interested in interdisciplinary contexts, craftsmanship and the interface between traditional manufacturing techniques and contemporary interpretations. To implement my conceptual projects by myself is as important to me as finding inspiration in different traditions. The role of textile design within social topics is an essential part of my concepts, as is working with unconventional materials.

This year, I finished my studies in Conceptual Textile Design (M.A.). My graduation project BETWEEN_SPACES deals with the digitalization of society and the resulting changes within the design of textiles. I have reflected on this topic by using lace as the case study – a perforated material – and reinterpreted it by developing innovative technologies and textiles during the process. Material experiments are an essential part of my practice and I seek to place them at the beginning of my independent work in which I would like continue the development of my own innovative yet manual technologies and their application.
I am always looking out for new manufacturing processes and possibilities to produce perforated textiles and materials.

Magdalena Sophie Orland

Through her project Magdalena has demonstrated a creative and disruptive approach to develop new material expressions for natural latex, a material that industry is aware of and therefore offers great perspectives for industrial scalability.

MaDe Team
I would like to work in this workshop with cigarette butts, with a DIY approach, trying to give to this material new life. I’m interested in DIY materials, exploration and experimentation, moreover I would like to enter more and more this field in my career and this is an incredible occasion to work with materials and experts! The first time I’ve worked with DIY materials has been two years ago with Valentina Rognoli, in that occasion I understood that working with materials, especially regarding industrial or domestic waste, is the most interesting subject to me.

I am Carolina Giorgiani, 27 years old. Born and based in Milan, lived in Fano, by the Adriatic sea. Master degree at Politecnico of Milan (Product Design for Innovation). Bachelor degree at L.A.B.A. Fine Arts Academy, Rimini (RN) (Product Design). Fond of material futures. When I design, the most interesting thing to me it’s to think how to create new gestures or new perspectives, imagine new scenarios in the future. My graduation project has been a research on giving new life, new function and aesthetics to cigarette butts with a DIY approach.
Fanny Corina González

Finalist

I have been into smart materials since I took my master’s degree in Elisava in 2014. I believe materials are an important part of the message you send when you design an object, they have a meaning. I often go to Materfad ‘Center of materials of Barcelona’ to check the updates, I find them impressive. And in my daily work I try to apply these materials.

I left my job as an industrial designer to become a craftswoman. The aim was to make things with my hands instead of just modeling them behind the computer. Through this process I’ve learnt how materials really work (not just the theory or the Iron-Carbon Phase Diagram). That is why I’d like to go further, having a deeper understanding of materials and its possible combinations.

I am an industrial designer with tons of curiosity. The combo design tech sustainability suits me. I’m currently studying Artistic Jewelry making in Barcelona.
With the beginning of the Anthropocene era, the role of the designer has changed. In my opinion, due to 'wrong' consumption and resulting environmental changes, we find ourselves at a point in time where not only politics and economy but also designers have to take responsibility. On one hand, designers have to take responsibility for the materials they use to give the design a physical form. On the other hand, through aesthetics, material and form, designers can function as a 'communication tool' that bring relevant scientific, political and social issues to society.

In July 2019 I successfully graduated from the art school Berlin- Weissensee with a Bachelor's degree in Textile and Surface Design. In the last years of my studies I turned away from purely aesthetic design and confronted myself with environmental and socioecological questions. Since then I am specialising in experimental material research at the intersection of design, biology and activism. I see my role as a designer in developing responsible and sustainable material solutions so that the planet, the people and their products can coexist in the future.
First of all, I would love to gain more knowledge and guidance from the experts. Besides working with materials during my education I lack real professional experience in the material field. Second of all, I would love to meet and connect with like-minded professionals. This will broaden my horizon, inspire and provide me with very useful connections in the future. Materials play an important role in my design, as a designer living in the rise of consumerism, growing population, and climate change. I find it very important to understand the global picture, the whole cycle of materials applied.
2.3 WINNER VALDÍS STEINARSDÓTTIR

Valdís Steinarsdóttir
Finalist

Icelandic designer that focuses on material experiments and finding unique solutions to social and environmental issues. Loves to have an open discussion with an audience, getting to the bottom of why we think certain things are beautiful, interesting, ugly or offensive.

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Lab la Bla Studio

Winner

Start Up Potential

LAB LA BLA, founded by Axel Landström & Victor Isaksson Pirtti, is a studio and “konceptfabrik” bridging the gaps between design, art and science. LAB LA BLA has previously worked with industries and institutions developing bio-composites from Sweden's biggest sectors of natural resources, as well as more conceptual work.

We want to join this creative workshop as we believe it represents a common goal, being, shortly described, a sustainable future. LAB LA BLA is driven by illustrating the problematic material view in our society today and demonstrate what responsibility and impact the role of a designer can have. Our practice illustrates how innovative thinking with a holistic approach can challenge the existing systems of production towards a more regenerative, circular way of understanding products. Joining MaDe and this green movement would be a great possibility for us to meet other makers, designers and researchers struggling with the same problems, and together help push our works further.
Through their project and the use of a resource globally available and at local level, they have demonstrated a sense-making approach and entrepreneurial and communicative capacities.

MaDe Team

Our focus is on widening the scope of use for unwanted matter, and the development of new bio-composites manufactured from by-products and raw materials sourced from Sweden's top three industries, mining, agriculture and forestry.

Lab La Bla Studio
I have been into smart materials since I took my master’s degree in Elisava in 2014. I believe materials are an important part of the message you send when you design an object, they have a meaning. I often go to Materfad ‘Center of materials of Barcelona’ to check the updates, I find them impressive. And in my daily work I try to apply this materials. I left my job as an industrial designer to become a craftswoman. The aim was to make things with my hands instead of just modeling them behind the computer. Through this process I’ve learnt how materials really work (not just the theory or the Iron-Carbon Phase Diagram). That is why I’d like to go further, having a deeper understanding of materials and its possible combinations.
In my recent design projects I have developed a focus on material research, social design, and human behaviour change by imagining new concepts to rethink the current perception and state of affairs in order to raise awareness to environmental and social problems. This workshop is an amazing match to my background and interests. The search for new and more sustainable materials that question today’s consumption is particularly important to me. The further I engage in the topic of material research the more I am eager to keep on learning. I am convinced that during this workshop I will be able to learn a lot, exchange and gather important experiences in the field of material studies. In my opinion there can never be enough exchange of knowledge.
Davide Franci
Finalist

My name is Davide Franci. I am 20 years old and I am currently in my second year of studying Product Design at Politecnico di Milano. I like to create, explore, change and hopefully leave the world better than I found it.

I'm interest in taking part in MaDe because of the theme dare to me. I am excited about the possibilities, still unknown, of many materials that I'm sure can lead to unexpected ways. I think, in fact, that materials and their end of life have an important role for the future in our society. I believe that through materials we can start a change of course that is crucial for us nowadays and I would like to give my contribution to deal these theme."

"I have worked last semester on a project about material waste and circular economy that give me more awareness regarding these theme. After this experience I look with more attention the materials all around me and I see better their effect into the environment."
Laura Van de Wijdeven
Finalist

The studio researches the future of materials to maintain our connection with nature. Inspired by the social impact of the materials we use in daily life and which we surround ourselves with. Translating this inspiration into surface and material design and developing products that contribute to Biophilic surroundings.

Laura strongly believes in the benefits of natural materials on modern human environments. By the use of organic waste streams, she like to show the possibilities of new natural materials.

Atelier LVDW is the material research and design studio of Laura van de Wijdeven, based in Rotterdam the Netherlands. She graduated at the Lifestyle Design department at Willem de Kooning Academy in Rotterdam in 2016. Her love for nature and the creation of materials evolved into her own design studio in 2017. Laura grew up in a green environment on a farm in the south of the Netherlands.
I am in my third year at the Icelandic University of the Arts, department of Product Design. The key concepts concerning the department’s emphasis is material, tools and transformation in the process. Emphasis is also laid on media and different ways of communicating and sharing projects. With applying for this workshop I wish to gain more knowledge in those fields, deepen my understanding and get a broader mind for new things. I trust that MaDe will fulfil those desires and help me in this process.
Paula Nerlich

Winner

Future Vision

I am a designer and explorer. A deep fascination for Circular Design and Futures Thinking drives me. I am active in the fields of Material Design, Trend Research and Sustainable Innovation.

I graduated in Textiles from Edinburgh College of Art and gained experience as curatorial assistant, planning art exhibitions and films at a production company in Berlin for several years. My current research into sustainable materials has brought new materials, such as 'Aqua Faba Foam' and 'COCOA_001', which can be found in several material libraries across Europe and 'Aqua Faba Foam' was on display at the London Design Museum in 2019 and 2020, as part of the display 'Get Onboard: Reduce. Reuse. Rethink', curated by Priestmangoode.

With my work I aim to support the elimination of so called food waste through the creation of circular biomaterials from industrial food production surplus. I initiate discourse around the value of waste as resource and the place of new products and materials in a circular economy. I have had a deep fascination for healthy materials for a long time. I define healthy as a term encompassing matters such as well-being, sustainability, human-centred, circular and alive. The MaDe workshop series opened up the world of Biodesign to me, in which I continue my ongoing exploration with a strong concept driven research approach around healthy materials and well-being.
Through her project she has demonstrated not only mastery of materials experimentation, but also an open mind to develop new material languages and visions. MaDe Team

I aim to continue my research of the material in order to create a material that would be industrially reproducible.

Paula Nerlich
Each application should challenge, question and reframe our pre-existing knowledge surrounding the material world. This sentence, extracted from your brief, reframes one of the main reasons I have been fascinated by materials and the concept of materiality during the last years. This is also why, I graduated from MA Material Futures (Central Saint Martins) where I had the opportunity of deep researching topics such as sustainability, synthetic biology, the complexity behind the production of products and Artificial Intelligence. Combining them with my previous studies in emerging technologies and new media I am developing a personal artistic frame for exploring the concept of materiality, and the related idea of responsibility towards our environment.
To better explain my intention in taking part to this workshop I would like to tell something about my educational background. I enrolled at the Politecnico di Milano, undertaking the three-year course in Interior Design thinking it was the right road for me. I have cultivated experiences and received satisfaction, but once I graduated I decided to change perspective, aware of the fact that this path had given me and taught me so much but also that the world of Design was really too rich and vast to explore only a part of it. In fact, over the years, I found myself faced with the unexpected and fascinating territory of Biomimetic Design.
The path to my profession of textile and material design has its origins in traditional textile craftsmanship. Understanding and experiencing material and textiles with my hands and making them come alive are the roots of my creative work. To experience the origin of all materials and to find new ways for it brought me to my study of textile design and my work in the field of limits of textile possibilities. Developing my material research means for me sharing this deeply motivation and with all other believers of the great power of material for a change in dealing with our environment.
Rosie Broadhead is an apparel designer specialising in biomaterials in the fashion industry. She is a recent MA graduate from Central Saint Martins’ Material Futures, and has a background in R&D in sportswear and fashion design. She is interested in the skin and its interaction with clothing, and how science and technology will influence the future of fashion. Her most recent project ‘Skin II: probiotic clothing, explores the natural biological function of the skin in combination with everyday garments. Rosie believes that by looking at what is natural on our bodies, we can create sustainable yet functional clothing which contributes to personal health and wellbeing.

My background is in material design within the fashion and sportswear industry. I have designed for a small brand Chervichkiotvichki, where the focus was on natural hand-dyed fabric and locally and artisanal techniques. In contrast, I have worked in the R&D department at road cycling brand Rapha Racing, where I developed materials that would increase speed, comfort or durability of the rider. This exposure to future technology in the industry and through my studies has helped to influence a new direction in my work. This experience has given me a strong understanding of materials and their application. As a result, I have become more aware of the problems that are involved in producing materials in a sustainable way.
“Materials Matter” – as I just finished my Bachelor’s degree in Fashion & Technology at the University of Applied Arts and Design in Linz/Austria this month - looking back at the studies and projects I have done, this is somehow the common message of my work. Materials matter in any way - in Fashion, in Textile, in Design I feel like without the material, there would be no shape, no structure, no texture and at the end even no aesthetic. Material is for me the main essence of creation. Material can be the inspiration as well as the outcome and especially coming from fashion and textiles, material can bring a whole new dimension into the processes necessary.
Scalable Material Recipes

Process description of the 18 materials selected during the MaDe Workshops
Between_Spaces

Magdalena Sophie Orland

Industry

Vegetable

Ingredients

- 100ml Natural Latex
- 1–5 Drops Food Colouring
- 1 Tbsp Sawdust (for stability)
- Copper Wire for dynamics

Material Qualities

- Perforated Surfaces, Nubs
- Reds & Violets
- Shiny or Matte depending on polishing
- Translucent / Partially Transparent
- Natural Latex Smell

Industrial Processes

- Heat Mixing
- Casting

EXTRUDING

1. Pour latex into a container
2. Add food colours and stir by turning, beware of air bubbles
3. Leave the container for a while to eliminate last air bubbles
4. Add other ingredients such as saw dust (it’s important not to add too much solid material, otherwise latex will be binded directly, first liquid, then solid)
5. Fill latex into syringe
- Extrude on a carrier material or yarn grid (baking paper below) optionally add wire
6. Allow to dry
7. Remove the sample and powder all sides with talcum powder, otherwise it sticks

POURING

See Extruding method (left)

1. Coat the silicone mould with silicone fat as a separating medium
2. Pour natural latex into the silicone mould
See Extruding method (left)
Butt_er

Carolina Giorgiani
Industry

Ingredients
- 4 stopper of Acetone
- 30 Cigarette Butts
- Food Colouring

Material Qualities
- Coloured
- Matte
- Irregular
- Not completely hard, but not soft
- Loses odour with time
- Spreadable, flexible and shapeable

Industrial Processes
- Heat Cleaning
- Heat Mixing
- Compression Moulding

METHOD / PROCESS
1. Clean cigarette butts with boiling water for one hour and then pour butts into water with two stoppers of bleach. Leave the butts in the water for 24h with bleach, then squeeze and let them dry.
2. Put 30 butts and a dye in silicone/aluminum mold or bowl, (food colorings are fine as well)
3. Pour 4 stoppers of acetone on cigarette butts
4. Mix the ingredients until cigarette butts are completely dissolved
5. Spread the mixture with a silicone spatula over a mold and let it dry for about 30 minutes
Rigid Foam

Fanny Gonzales Industry

Animal, Vegetable and Recoverable

Ingredients
- 6.3g Pine Resin (colophony)
- 24g Gelatine
- 10ml Soap
- Water

Material Qualities
- Colour dependent on soap
- Looks Spongy
- Possible to add pigment
- Matte
- Hard

Industrial Processes
- Heat Mixing
- Casting

METHOD / PROCESS
1. Grind pine resin into a powder
2. Mix water, pine resin, gelatine and liquid soap
3. Bring it to a boil and stir until it is just combined
4. Remove from heat and beat with a rod blender
5. Place in mold and wait 24h at room temperature
Cabbage Chemistry

Fanny Conzales
Industry

**Ingredients**
- Dried Red Cabbage Leaves
- Glycerine
- Red Cabbage Juice
- Alginate

**Material Qualities**
- Changes between pink, purple and Blue
- Soft
- Shiny
- Smells like red cabbage
- Translucent / Partially Transparent

**Industrial Processes**
- Cleaning
- Grinding
- Additivation
- Extrusion

**PRE-PREPARATION**
1. Soak outer, unusable red cabbage leaves in distilled water for 1–2 days (to remove the dye)
2. Keep water for cooking stage
3. Dry outer leaves either in air or in the oven
4. Then grind the dried leaves

**MATERIAL COOKING**
- Mix alginate with the left over cabbage water from step one
- Add glycerin and the ground cabbage pigment to the water
- To form foil-packaging, the liquid mass can be poured into a flat mould to produce a foil like film.
- To form fruit-net
- In order to create a nonwoven from the warm mass, the alginate-based injected into the mould with a syringe.
Pine Needle Dye

Fanny Conzales
Industry

**Ingredients**
- Dehydrated Pine Needle Extract
- Soda and Alkaline Solution
- Casein, Gum Arabic, Chalk or Oil

**Material Qualities**
- From Yellow to Brown
- Matte or Shiny
- Thick or dry powder depending on the binder or application
- Grainy dry texture to high polish lacquer
- Pine Needle Tea Smell

**Industrial Processes**
- Liquid Extraction
- Grinding
- Additivation

**METHOD / PROCESS**
1. Collect the liquid coming from the extraction
2. Add natural ingredients such as salt and soda to turn the liquid into a powder
3. Leave to dry
4. Mix with different mediums
Bioplastic Skin

Fanny Conzales
Industry

**Method / Process**

1. Mix animal hide and gelatine with water
2. Melt gelatine
3. Mix with glycerine and sorbitol
4. Pour into mold
5. Leave to dry and solidify

**Ingredients**
- Rawhide / Gelatine
- Water
- Glycerin
- Sorbitol

**Material Qualities**
- Violet, Yellow, Clear, White
- Sweet Smell
- Many qualities, can both be hard, soft, thick and thin
- Smooth

**Industrial Processes**
- Mixing
- Additivation
- Moulding
Bread Nouveau

Ingredients
- Wheat
- Animal Bones

Material Qualities
- Variable Colour
- Variable Texture
- Can be both Shiny and Matte

Industrial Processes
- Peel separation
- Grinding
- Additivation

METHOD / PROCESS
1. Reap wheat
2. Separate husk and seed
3. Grind seed and rinse flour
4. Grind bone
5. Mix dry ingredients and add water
6. Knead
7. Roll
8. Leave to dry
 PossiBalls/ PossiMoulds

Andrés Ramírez
Start Up Potential

**Ingredients**
- 5g Colophonia
- 13g Jelly
- 120ml Boiling Water

**Material Qualities**
- Brown
- Soft
- Matte
- Sea Smell
- Fibrous Texture
- Very Light
- Antibacterial
- Flexible
- Almost Fire Resistant

**Industrial Processes**
- Heat Mixing
- Sewing
- Coating

**POSIBALLS (HIGH COMPRESSION BALLS) RECIPE TO PROTECT MATERIAL**

1. Melt 5g of colophonia in a pot
2. Once melted, add 120ml of boiling water
3. Add 13g of jelly and stir strongly until all the ingredients are mixed and dissolved
4. Remove the pot from heat
5. Put the previously sewn balls inside the mixture for 10 seconds or use a brush to spread it

**POSIMOULDs (LOW COMPRESSION BALLS) MIXTURE RECIPE TO USE WITH THE MOULDS**

1. Melt 13g of colophonia in a pot
2. Once melted, add 100ml of boiling water
3. Add 10g of jelly and stir strongly until all the ingredients are mixed and dissolved
4. Remove the pot from heat
5. Add previously separated fibers until it creates a dough like substance
6. Put it into a mould
Gomma

Andrés Ramírez
Start Up Potential

**Ingredients**
- Recovered Chewing Gum
- Cornstarch
- Natural Pigments like Kurkuma (depending on desired saturation)

**Material Qualities**
- Off White
- Menthol Smell
- Matte
- Soft
- Sticky to Smooth Elastic

**Industrial Processes**
- Cleaning
- Heat Mixing
- Twisting
- Pigmentation
- Additivation

**METHOD / PROCESS**
1. Recover and clean chewing gum
2. Apply heat
3. Stretch
4. Colour using natural pigments
5. Anti sticky
6. Model
Billy

Davide Franci
Start Up Potential

Ingredients
- Cement
- Water
- Receipts (or Metro Tickets)

Material Qualities
- Black and White
- Matter
- Hard
- No Smell
- Smooth and Regular Texture
- Pleasant to Touch

Industrial Processes
- Grinding
- Heat Mixing
- Additivation
- Compression Moulding

METHOD / PROCESS
1. Grind the receipts or metro tickets
2. Prepare the concrete mixture
3. Mix the concrete with grinded receipts
4. Put the dough in a mold and leave to dry
5. Crumple some receipts (with other processes it is possible to obtain different decorations)
6. Iron the receipts quickly
7. Paste the receipts to the concrete

Recoverable
Eggshell Ceramic

**Ingredients**
- Eggshell
- Arabic Gum
- Water

**Material Qualities**
- Off White
- Hard
- Matte
- No Smell
- Smooth Texture

**Industrial Processes**
- Heat Cleaning
- Mixing
- Additivation

**Method / Process**
1. Cook the discarded egg shells in water
2. Grind the egg shells with a mortar or blender
3. Weigh the ingredients
4. Mix the ingredients by hand
5. Pour the material into a mold
6. Wait until it's airdried and demold

Laura van de Wijdeven
Start Up Potential

Animal
Lyme Grass Roots

Laura van de Wijdeven
Start Up Potential

Ingredients
- Lyme Grass

Material Qualities
- Light Brown
- Soft
- Matte
- Ocean, wet, wheat smell
- It can sting or slip from you fingers
- Reminiscent of Horse Hair

Industrial Processes
- Cleaning
- Twisting

METHOD / PROCESS

1. Gather lyme grass, keep it damp, do not let it dry out. It has to be during springtime or autumn.
2. Categorize it, make five millimeter thick bundles and around one meter long.
3. Pick up one bundle, break it in half and start turning it. Then you break it in half again after you have a good tension. There you have a piece of rope. Clean up the end.
4. Find a strong thread in the pile of roots, the longer the better and start sowing the ropes together that will form a seed container.
Aqua Faba

PAULA NERLICH
AQUA FABA FOAM

Aqua Faba Foam is made with aqua faba, a surplus from food preparation and is mixed with further ingredients which are vegan, compostable and non harmful to the environment. Aqua faba is a by-product from the preparation of chickpeas with emulsifying, foaming, binding and thickening properties. It inspired me to create a vegan bioplastic, which I am continuously developing and discovering applications for it. The temporary, transitory nature of biodegradable, compostable biomaterials has the potential to create more value to the end product, whilst also emphasizing the circular nature of the material.

Material Qualities

- Pearl Shine to High Gloss
- Both hard or soft depending on density
- No Smell
- Light Pink to Terracotta
**Digital Lichen**

Potential Pollutants: Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Ground Level Ozone (O3), Particles (PM10 and PM2.5) and Sulphur Dioxide

Live Stream Data of Air Pollution

**Material Qualities**
- Transparent / White
- Soft
- No Smell
- Shiny or Matte depending on Air Quality
- Digital
- Smart
- Smooth or Rough depending on Air Quality

**METHOD / PROCESS**

1. Generation of the algorithm
2. Connect to an official air pollution database
3. Elaboration of the data
4. Simulation of the material
Inside Out

Eléna Albergati
Future Vision

Vegetable and Recoverable

Ingredients
- 4g Glycerine
- 40ml Water
- 1.6g Agar Agar
- 5g Fruit Seeds (e.g. Avocado, Papaya, Lychee, Mango, Mandarin)

Material Qualities
- Colour Dependent on Seeds Used
- Smell of Seeds
- Slightly Rough
- Flexible
- Soft
- Tensile Strength
- Water Resistant

Industrial Processes
- Grinding
- Mixing
- Additivation
- Compresion Moulding

1. Clean and pulverize the seeds
2. Boil water with agar agar and glycerine
3. Take pan off the heat and add seed powder
4. Pour the liquid into a mold to let it cool for a few minutes – it will become solid.
**Algae Pattern**

**Ingredients**
- 40ml Coloured Water
- 1.6g Agar Agar
- 0.5-4ml Glycerine
- Cotton, Silk, Linen or Viscose
- 2g Natural Pigment
- 4l Water

**Material Qualities**
- Natural Colours
- Elastic
- Matte
- Soft and Hard Pattern
- No Smell
- From 2D to 3D

**Industrial Processes**
- Heat Mixing
- Additivation
- Compression Moulding
- Pigmentation

**PROCESS / METHOD**

1. Prepare raw textiles (Mordant), measure water and weigh out Aluminium sulphate
2. Mix them together
3. Lay fabrics in water
4. Bring all to boil and simmer for 30 minutes
5. Prepare dye baths and weigh pigments
6. Add them to the dye baths
7. Dye textiles and bring to the boil, simmer them for at least 30 minutes
8. Wash them out with warm water
9. Dry them
10. Prepare Algae compound and weigh out agar and glycerin
11. Measure coloured water and mix
12. Lay coloured textile on table or working area
13. Put on textile stencil to create a pattern
14. Cook Algae compounds for 1 minute
15. Pour Algae compound on stencil onto fabrics
16. Let it dry for 10 minutes
17. Take stencil off and dry printed sheet of fabric
Magnesium Bikini

Rosie Broadhead
Future Vision

Ingredients
- Glycerol
- Water
- Agar Agar
- Corn Starch
- Magnesium Sulphate Powder

Material Qualities
- White
- Liquid
- Shiny
- No Smell

Industrial Processes
- Heat Mixing
- Additivation
- Pigmentation
- Compression Moulding

PROCESS / METHOD

1. Source sustainable Magnesium Sulphate
2. Draw illustrator file for the mould (energy use)
3. Get mould laser cut (this mould can now be used indefinitely)
4. Assemble 2 layer moulds
5. Pour 500ml natural latex into a beaker
6. Mix 2g of magnesium Sulphate
7. Pour into mould and let air dry
8. Once dry remove from the mould and assemble into a garment
Nanostructured Materials

Sara Kickmayer
Future Vision

The best outcomes were achieved with a recipe using corn starch and agar agar.

1. Mix them and put them together in a pot.
2. Heat up with water.
3. Put the liquid in the mold.
4. Dry on a heating plate for half an hour.
5. Slowly remove mold from biomaterial.
6. Put the material in light and see the reflections!

Ingredients: Agar Agar, Corn Starch

Material Qualities: White, Hard, Shiny, No Smell, Flat

Mostly Rainbow Colours depending on structures used to imprint

Industrial Processes: Heat Mixing, Compression Moulding
MaDe Database

A–Z Contacts of all 120 participants in the MaDe Workshops
<table>
<thead>
<tr>
<th>Country</th>
<th>Name</th>
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<tbody>
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