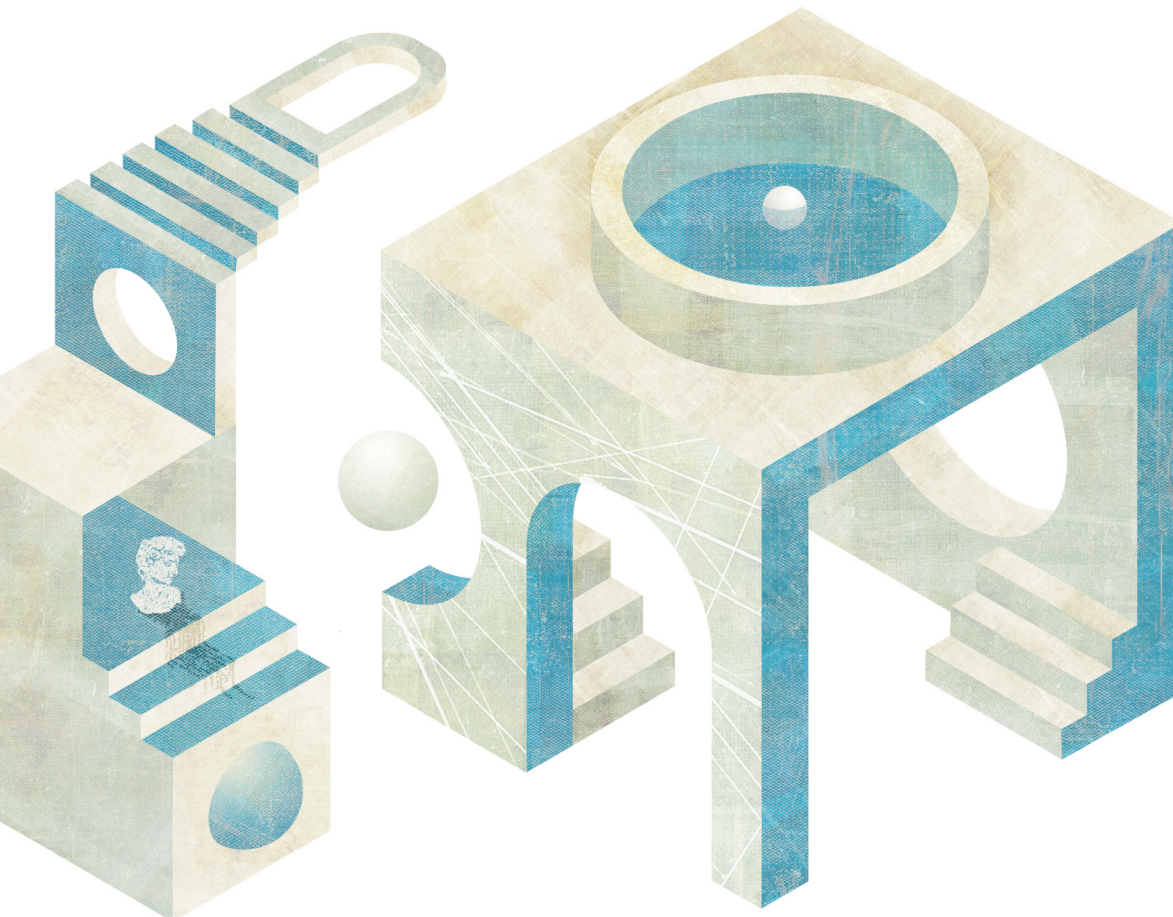
DESIGN CULTURE MATTERS

Embracing cultures and cross-cultures
through design perspective and matters

edited by Giampiero Bosoni, Marta Elisa Cecchi



D.I. FrancoAngeli
DESIGN INTERNATIONAL

The Design International series is born in 2017 as a cultural place for the sharing of ideas and experiences coming from the different fields of design research, becoming a place in which to discovering the wealth and variety of design, where different hypotheses and different answers have been presented, drawing up a fresh map of research in international design, with a specific focus on Italian design.
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4. The Material: An Active and Dynamic Medium in Design Education

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Abstract

In design education and practice, the material is considered one of the essential and transdisciplinary elements. New materials' various properties, attributes and applications attract designers' attention. The investigation and exploration of materials inspire and help designers achieve better design results and improve their hands-on ability and design intuitions. In the past years, although the material in the field of design education involved much knowledge from the engineering field, it developed its own approach for designers to dialogue with the material world. In some design classes, students learn and attempt to place the material in a privileged position in their design process, putting materials at the beginning, and exploring their infinite potential from their characteristics, applications, and future evolution path.

The discussion on the relationship between materials and objects, human beings, the environment, systems, and the planet has been booming. Nowadays, many designers choose to develop their careers in the material field to promote healthy and eco-friendly material selection and development. The material designer has become an emerging profession dedicated to designing material strategies and anticipating future impacts on material choices in the intersection of art, culture, technology, and design. Although material education in design has different layers and it is not aimed at making every young student become a material designer, it is essential to understand the dynamic material world and materials' evolution process for design students. Design educators are gradually aware that material can be an active and

dynamic medium to facilitate designers' cognitive sensitivity and hands-on ability to all the world's substances. In other words, the material can be an effective medium for design instruction.

This chapter will elaborate on the changing role of materials in design education during the decades and discuss the future pedagogical functions and approaches materials can have in the field of design.

Introduction

The phenomenon of designers using and exploring materials in various approaches over the years is thought-provoking. Regarding materials and design, it seems that for many people, 'choosing the materials that have the best properties for product design' is still the most supported and valid approach. Although this approach endures, the relationship between materials and design is far more complex and multi-dimensional than it might first seem. In 1986, Ezio Manzini proposed that an ever-increasing number of materials empowers designers to have more initiative to think and choose the materials used (Manzini, 1986). Subsequent research on designers' material selection processes in the late 20th and early 21st centuries led to larger quantities of engineering-derived materials knowledge being adopted in design decision-making and, consequently, becoming established as required for design education. With material selection having become a taken-for-granted topic in the design field, especially in product and industrial design, the opportunity arose to pay greater attention to peripheral and supportive material issues for improved material selection, such as sustainable or aesthetic value or expressive qualities. The engineering properties of materials thus became complemented by new design-relevant information, whilst materials and design as a topic grew new design perspectives and values. By embracing these new perspectives and values, many designers began to design in a 'reversed' way: instead of selecting materials for design, they use existing materials as inspirational sources for design, or they create new materials that form a radical new starting point for the design. As designers actively explore materials, these activities lead to new trends in work practices and bring more inspiration and insights to a new generation of designers. Phenomena like DIY-Materials (Rognoli *et al.*, 2015) show the willingness of designers

to challenge mass production and question the way we are designing with materials in a provocative way. As a new trend in the sphere of materials and design that offers great opportunities to positively contribute to product design through material experimentation as well as distributed and shared production processes, the DIY approach built on designerly intentions is starting to become influential.

In design schools, activities are taking place that are burgeoning the exploration of materials in contemporary design. The Bauhaus – still an important reference for many basic design curricula today – led the way, over one hundred years ago, in treating material itself as an important learning medium for design students to develop their creativity and enhance their hands-on intuition. Fast-forwarding to the current era, where material engineering knowledge has been dominant in foundation courses in design, a 'modern revolution' is starting to take place. At some progressive design schools, transdisciplinary material courses with an explorative and research-based approach have emerged, focusing on learning and exploring contemporary values and perspectives on materials, such as: experiential characterization, circularity and sustainability, smartness, democratisation of resources and making, and critical discussions on how materials will be created and used in the future (Zhou, 2022). The consensus is that the discussion on materials cannot be limited to a specific design field because the material is a transversal theme that serves as a means to build connections, materialise design concepts, or even more simply bring inspiration. Designers of different backgrounds can use the same language in their communications regarding materials, for example to exchange knowledge on material selection and processing, for discussions on material performance, and for sharing sensorial understanding of materials and how to explore material attributes, shapes, and creative functions.

Through such diverse practices and new areas of focus, the theories and methods of material-related content in design has transitioned from a position of technically-oriented selection processes to a more expansive and explorative activity emphasizing the relation between 'people' and 'materials'. Focusing on the attributes that describe personality or character, rather than the technical attributes of materials, plays to designers' interests and capabilities: an aesthetic perspective (e.g. sensed

visual and tactile properties), a cultural perspective (e.g. constructed meanings and associations), and a psychological perspective (e.g. evoked emotions) (Karana, 2009; van Kesteren, Stappers, and De Bruijn, 2007; Lefteri, 2005; Rognoli and Levi, 2004; Zuo *et al*., 2004). Bringing these varied perspectives together, the term 'materials experience' was coined in 2008 (Karana, Hekkert, and Kandachar, 2008) and expanded upon in 2014 (Karana, Pedgley, and Rognoli, 2014) and 2021 (Pedgley, Rognoli, and Karana, 2021), referring to the experience that people have with and through materials. Materials experience exists across four interconnected levels: sensorial, interpretative (meanings), affective (emotions), and performative. Using the materials experience framework is not only inspiring for designers' material explorations in different aspects but also beneficial to modernizing design education's relation to the phenomena of materials. As Rognoli and Levi (2004) said, in design education, it should be possible to supply knowledge that allows one to choose the most suitable material in a project regarding the technical performances and the expressive-sensorial characterization; this is what turns the idea into reality. The materials experience framework has formed the basis for various tools and approaches to support such decision-making. On the matter of how to learn materials, and in particular how to elevate materials experience, Pedgley *et al.* (2016) point out that active learning principles can deliver a good foundation for student appreciation of materials and design action, benefiting from classroom verifications.

These initiatives are helping to raise the importance of materials in design and education, from a background consideration to an active part of ideation. Accordingly, the role of materials as an inspiration resource is becoming more defined and growing in importance. ' The experiential implications of materials resonate with both designers and users and must be planned with care. To this end, material considerations by designers appear not only in the middle and end stages of a design process but now, increasingly, at the beginning. As Van Bezooyen (2013) said, including the material from the beginning is like turning the design process upside down; it can provide new definitions, concepts, discussions, and results. This new design process can be a start for a critical investigation, a hands-on journey, or a great communicative storytelling. Moving materials or material decision-

making to the front of a design process requires designers to adjust their material perspectives and become cognizant with person, material, product, environment, and system relations. In education, such material learning is supported by meaning-driven approaches, which emphasise the significance of the humanistic and environmental value attributes of materials in design, and uses materials-centric design methods to trigger students' active learning through questioning, experimentation, and investigation. On the broader level, it helps the improvement of design intuition and comprehensive competencies by building a non-anthropocentric way of design thinking and strengthens designers' awareness of social and environmental responsibility. It facilitates the expansion of design culture through more ecological and sustainable scenarios and might provide a stronger foundation for the careers of future material designers (Zhou, 2022).

Today's material and design field

Today our human lives are complex and connected. The combination of ever-expanding new technologies, massive open-access knowledge, and new (online) social forms, allied to increasingly urgent concerns for the wellbeing of the planet, place new demands on design and design education. Environmental and social values of design, including their circularities, impacts, cultural expressions, and their relations with human beings and the planet, are major influences on design decision-making and design practices. Materials are at the heart of the decisions. Every substance in the world is a material, being a vital aspect in configuring the natural and artificial worlds and therefore the environment and life. Materials ensure humans and all the other species thrive; they are interwoven within our realities and carry all the forms, functions, and changes (Cleries *et al*., 2021).

Circularity of materials

Designers are playing a vital role in the current transition towards a circular economy, by defining and finding disruptive design solutions that can put circularity theories into practice. Circular design can be

delivered not only by creating things which can be properly disassembled and recycled, but also through more holistic and radical design approaches where products are created using unused or discarded materials from technical or biological processes. These materials, in time, can be recovered from products and reused or recycled, thereby decoupling our economic activities from finite resources and minimizing overall waste and pollution. Unsurprisingly, material innovation is essential for designing circular products, with competencies in material circularity being developed at mining, extracting, manufacturing, recycling, and remanufacturing stages (Pollini and Rognoli, 2021). The mindset designers must possess is that products are never isolated: they exist in complex interconnected systems of materials and resources. A material that is treated as waste in one system or from one type of product may in practice be a precious raw material in another system or for another type of product, if properly designed.

There are many carbon-negative materials on our planet, found within the biosphere. Algae, fungi, and other biological populations offer multiple possibilities for improved carbon cycle management. This situation is one of the motivators for designers to work in the area of living materials and living artifacts, such as work presented under the theme *Alive. Active. Adaptive* of the EKSIG conference in 2017 (Karana *et al.*, 2020). Taking on a collaborative creative process with living biomass has already opened-up a new design section, biodesign, to rethink the human and non-human material relations in a post-anthropocene era (Rognoli, Pollini and Alessandrini, 2021). Another aspect of circularity impacting on designers is the preference for using local materials. Restricting material supply chains to local producers reduces the demand on centralized resources and lowers transportation pollution, whilst gaining positive local social impacts. Increased demand for local materials can facilitate a community's independence and boost local economies with higher self-sufficiency. Using local materials can drastically reduce the environmental impact of manufacture (Morel *et al.*, 2001).

The special place of materials in design

Alongside form, materials are a significant influence on the personality of a product. Differentiation via materials is an attractive propo-

sition: people appreciate materials with special or notable attributes. Designers can use materials to strengthen the connection of products to people, increasing emotional bonds and enriching dialogues provoked by material interaction. Artefacts and their materials from which they are made can also be meaningful and precious for people because of changes over time that are linked to lived experiences and memories. After our personal traces are left on a material surface, an emotional connection can be created, just like 'tame' and 'being tamed' relations between the Little Prince and the Fox[1]. Such material narratives bring a uniqueness – a valued imperfection – to the materials of our products (Rognoli and Karana, 2014), which raises discussions over the desirability or unquestionable nature of standardized industrial manufacture.. Materials have their age beauty, which has value with the passing of time (Parisi, Rognoli, and Ayala-Garcia, 2016).

Another unique value that materials of the current and future eras can bring is smartness and morphogenesis. Owing to transdisciplinary innovations between design and engineering, many interactive materials with unique attributes have been generated. They can be classified as ICS (interactive, connected and smart) materials (Rognoli, Ferrara, and Arquilla, 2017; Parisi *et al.*, 2018), being transformative (Brownell, 2017) and programmable (Tibbits, 2017; Johnston, 2017). Designers can give these materials different experiential attributes through electronic, chemical, mechanical, and biological means (Rognoli and Ferraro, 2021; Rognoli *et al.*, 2016; Ferrara *et al.*, 2018). ICS materials are designable as a single entity comprising physical and computational components, with the final composition forming a unit that is difficult to trace, opening-up more interactive, connected and smart dimension life experiences.

The democratization of materials, technologies, and 'tinkering' spaces

New digital fabrication technologies today bring people closer to the interface between end products and making processes. For designers,

1. The Little Prince is a novella by Antoine de Saint-Exupéry, first published in 1943. In the book, a dialogue generated between the fox and the prince reveals that taming can change something from being ordinary and just like all the others to being special and unique.

or indeed the general public, this phenomenon stimulates self-production and exploration of materials and materialization techniques. The democratization of materials and self-fabrication tools gives more agency to designers to fulfil a new role in material play, discovery and application. The growth and spread of Fab Labs make it possible to produce industrial and electronic projects with raw materials on a small scale (Diez, 2012). Moreover, this democratization of computational media and digital fabrication can support early-stage material-inspired ideation in design (Astrachan *et al*., 2009; Yasar and Landau, 2003), and spark discussions within a co-working atmosphere (Mostert-Van Der Sar, 2013). Such 'making' facilities in a lab setting – contrary to the 'analysis' facilities in science labs – enables designers and design engineers to make interdisciplinary coordination with machines and materials a mainstream activity (Blikstein, 2013; Mostert-Van Der Sar *et al*., 2013).

Alongside materials being elevated to a more active role in designers' decision-making, designers have also established physical resources to help them understand, select and explore materials from a more humanistic, first-hand, and experiential way. Material libraries, similar in concept to book loaning or reference libraries, collect and display physical material samples to raise awareness of novel and sustainable materials, adjusting the content and presentation according to student or professional designer needs. Usually, material libraries do not sell materials, but disseminate new material concepts and provide consulting services to help designers or other R&D staff find the best material for their projects. Material libraries are physical spaces where material suppliers, material developers, manufacturers, design companies, and designers can connect through their common interest in materials. One such example is the Materioteca located on the Bovisa campus of Politecnico di Milano. As a material library in higher education, Materioteca provides a valuable educational resource where students can touch, select, and get inspired from materials. In principle, material libraries and fab labs can have a synergistic relationship based on the common point of learning design through materials.

Many scholars have discussed the value of material libraries in design schools, emphasizing that the material collections can be used as tools for interdisciplinary study and research in design (Wilkes and

Miodownik 2018). Also, with material libraries, design students can access and handle material samples, which is valuable in helping to personalize and contextualize material information learned through other channels. As Akin and Pedgley (2016) elaborated, direct experience with material samples can expedite students' understanding and exploration of the material experience. Besides, the material library itself can be organized and managed according to design strategies of needs, for example having special emphasis on materials for circular design (Virtanen *et al.*, 2017).

Shifting to a meaning-driven approach for materials and design education

The exploration of new materials in design is catching-on in practice and education, whilst new approaches are being developed to educate designers through investigating, understanding, and using materials. In design education, a new phenomenon for teaching and learning materials is emerging. The new courses are neither like the traditional hands-on workshops where material knowledge and skills are developed through making, nor like the traditional engineering lectures or labs where material knowledge and appreciation are developed through testing, characterization and linking to material properties.The new courses emphasize the dialogue between designers and materials to explore and excavate the meaning of materials in design, which lead to the creativities or criticisms of the environmental, social, and cultural context of design activities. They usually advocate a change in mindset, where the material is considered early on, or even from the outset, of designing. Courses of this type use a meaning-driven approach to understand materials, their applications, and their most profound values (Zhou, 2022). They enhance the understanding and support the rethinking of the relevance of materials in different contexts, by reconstructing the relationship and dialogues between designers and materials.

In the new courses, material is the main medium through which design students can develop, contextualize and synthesize their design practices. Differentiating from a traditional making-focused learning-by-doing approach, the new material education activities

supplement hands-on experience in materials with various critical design practices such as speculation, experimentation, and digital interventions. They integrate materials as active actors in a bigger picture where technological, cultural, and environmental contexts are taking place.

Cultivating material designers

According to some critics, the combination of increased awareness of how circularity relates to materials, material's unique meanings, and accessibility and flexibility brought by the democratization of technologies, a new kind of materials expert, a 'materiologist' or 'material designer', is emerging (Brownlee, 2016). In a time where there is a need for a more responsible role of design in environmental, technological, and social issues, the 'material designer' may become a widespread and influential role. As a general remit, the material designer merges circular design, materials experimentation, and new creative processes to evaluate, ideate or develop materials. Moreover, the material designer is also maker-oriented, concerned with establishing processes to manufacture materials that must meet specialized design and performance specifications. In recent years, the Material Designers (MaDe) project co-funded by the Creative Europe Programme of The European Union (http://materialdesigners.org/) focused precisely on this point: providing professional material designers with the right context to boost their skills by addressing them towards the design of circular materials. The project showcased how a specific profile of materials designer is emerging, working in one of several categories: Grown Materials, Wasted Materials, Zero Waste Materials, Domesticated Materials, and Technocraft Materials (Cleries and Rognoli, 2021).

The emergence of material designers and the requirements from the industry, circular economy, and the environment fertilized the emergence of some new design education courses and programs that support the new material designer role. A common point amongst these is to include pedagogical activities that help designers realize their social responsibility for a more sustainable future. Witnessing the multiple roles materials have, such new 'material-centered' courses can guide

students to design, redesign, reform, reuse and redefine materials in ways that can help achieve circularity and step away from anthropocentric dominance. The learning outcomes can be various, such as researching, advising, communicating and educating what materials are and what they can be, as well as implementing positive social, economic, political, and environmental change across all sectors towards a responsibly designed future.

Concluding remarks

Design education has a long history of integrating or embracing other disciplines, as it evolves its themes and methods to adapt to the times: for example, showing a transformation from teaching basic design principles to guiding students' innovative exploration, from traditional industrial product design developed by applied art to the space and environmental design with larger scales, from the individual design objects to the systematic consideration of research and development. Starting from the traditional design field, the territories of design are constantly expanding with new approaches, no matter from which category it is viewed: art and craft, science and engineering, industrial production, and process and system design. As a transversal element within design education, materials can act as an active and dynamic medium through which skills in design thinking and design action may be developed. Materials can be used to help prepare the next generation of designers for today's ever-changing world.

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We live in an uncertain, changing, hard-to-focus era in which traditional design approaches and methods can no longer respond to today's challenges that surface in varying degrees and intensity. Moreover, we are developing a different perception of 'materiality' and the mediums employed. Hence in this 'liquid' and blurry landscape, the question emerges: What is the importance of understanding the value of design culture, more precisely, the "matters" through which this culture is manifested and expressed today? Moreover, how design culture aligns with the changed reality by responding "creatively" to today's emergencies?

The volume investigates a wide sphere of issues referring to an extended concept of "matter" – the word matter intended not only as materials as such but also of content and relationships – through design actions, approaches, processes, tools and methodologies employed in different areas and with different objectives, yet united by the desire to intercept the current shift, sometimes reinventing and sometimes evolving programmatically over time to embrace the changed framework.

The matter is thus interpreted in its range of potential declinations, bouncing from concept to object, material to immaterial, process to solution, and traditionally defined medium to a dynamic virtual tool.

This collection of essays is dedicated to all those who wish to explore the value and "matter" of design culture between past inheritance, present time and foreseeable future mutations through the deepening and inspiration of new and alternative tools, approaches and design methods.

FrancoAngeli
La passione per le conoscenze