ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XX INTERNATIONAL FORUM

Le Vie dei Mercanti

20th World Heritage and Ecological Transition

XX INTERNATIONAL FORUM

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Carmine Gambardella
WORLD HERITAGE and ECOLOGICAL TRANSITION
Le Vie dei Mercanti
XX International Forum

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ARCHITECTURE HERITAGE and DESIGN | 10

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Le Vie dei Mercanti_XX International Forum

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20

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WORLD HERITAGE and ECOLOGICAL TRANSITION

Le Vie dei Mercanti

XX International Forum

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Peer review

Scholars has been invited to submit researches on theoretical and methodological aspects related to Smart Design, Planning and Technologies, and show real applications and experiences carried out on this themes. Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected. Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

Conference report

300 abstracts and 550 authors from 40 countries:

Albania, Arizona, Australia, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Greece, India, Italy, Japan, Jordan, Lebanon, Malta, Massachusetts, Michigan, Montenegro, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

From the XIX FORUM WORLD HERITAGE and DESIGN for HEALTH to the XX FORUM WORLD HERITAGE and ECOLOGICAL TRANSITION

In 2022 the Capri International Forum 'Le Vie dei Mercanti' will reach its 20th edition.

A Story of love for the Earth and its Inhabitants, Landscapes, Architecture, Cultural and Archaeological Heritage told by over 7000 Scholars and Academics from all over the World in an interdisciplinary way, by integrating skills, experiences, good practices in order to train talented people who care about the destiny of our Planet.

If the Future is an Eternal Present, the renewal of the Forum in these twenty years has produced a wealth of knowledge to guide those who govern and administer the Public Good, and citizens in their daily activities. A future that must be prepared in this era, that cannot ignore the ongoing climate change and that should not catch future generations unprepared.

A Present that transmits to the future the values that Humanity has passed on to us and that must be protected and transmitted as regenerative sources of Humanity itself.

Not coincidentally, the First International Forum assigned the topic 'From Luca Pacioli to the Ecogeometry of the Territory' to the participants.

An invitation to submit scientific contributions and good practices based on double-entry, legitimized by the measurement of tangible and intangible assets, in order to integrate knowledge and state it like entries in an income statement.

Therefore, if Luca Pacioli, tutor of the Rompiasi Venetian merchants family, suggested the method to legitimize the results of the activities undertaken, that is, through the measurement he indicated the survey activity as managing a heritage, which as such must not only be geometrically definable but must be also discretized into batches, noted in its multidimensionality, in order to produce a result whose added value can always be quantified and is given by the difference between the value of the asset, as we have received it, and the value reached for the activity of knowledge and management of the potentialities which are identified and stated as in an income statement; Eco-geometry, intended as a technological echo of reality, feasible through the use of digital and artificial intelligence to create forecasting scenarios, a model in which it is possible to measure all the components and relationships between the parts and to restore the matter, no longer as an instrumental covering to be described only in the geometric matrices generating the forms.

Once again Leonardo point us the way, conceptually anticipating the transition from analogue to digital and to the management of big data: "io vò pigliare quella licenza ch'è comune ai matematici, cioè siccome loro, dividono il tempo a gradi e di quantità continua la fanno disscontinua, ancora io farò il simile, dando col miglio o renella nella comparazione all'acqua" (Codice Atlantico, f. 126, t.a.).

Through the topic of the next XX Forum World Heritage and Ecological Transition, I want to provide some interesting food for thought, to identify a lived place, a life

environment, as an integral of forms of organization of the elements that surround us, examined through the prism of a civilization; we will deal with an innovative project of measurement and representation of the natural and built environment that is no longer an expression of the relationships between society and the natural environment but a construction of the relationships between the future as an eternal present and the legacy of the past as an economic value. A vital commitment that binds people to the environment; an educational revolution that match skills to the new way of managing what is learned and measured; the ecological transition with the use of technological innovation shall have the aim of entering the body of the territory, of the buildings and of the objects, it analyzes all its components through a multi-criteria analysis in order to establish a rating which in itinere defines the added of the results.

Just as the rulers and merchants in the mid-15th century, on the margins of international trade, in an economy contracted for mercantile life, combined research and training in new paths, taking refuge in agricultural operations, in favour of the reclamation of uncultivated lands in relation to the search for energy and its distribution and established the reasons of the earth compared to those of the sea in a perspective of systemic response.

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President and CEO of the Benecon University Consortium
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and Territorial Governance

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NAPLES 16 - CAPRI 17|18 JUNE 2022
WORLD HERITAGE and ECOLOGICAL TRANSITION
ARCHITECTURE|CULTURE|HEALTH|LANDSCAPE|DESIGN|ENVIRONMENT|AGRICULTURE|
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Sustainability in Eyewear Design

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Design additions for building a truly sustainable model in the eyewear industry.
The beginning of an organic reflection on sustainable development is conventionally traced back to the report Our Common Future, better known as the Brundtland Report, published in 1987, in which the concept of sustainability is defined as: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.
Over thirty years have passed since this definition, but there is still some confusion about these concepts which, precisely because of their complexity, are sometimes manipulated or trivialized to the point of often generating inadequate design practices, which lead to the creation of partially "sustainable" products, in relation to some limited and circumstantial aspects of their life cycle.
This work focuses on assessing the environmental impact of an apparently simple product like the frame for ophthalmic lenses and solar filters and it tries to highlight, through significant case studies, which actions are today implemented in this sector in relation to the acquisition of raw materials, design, production processes and the use and disposal of products. The article also intends to highlight the importance of design in terms of the circularity of the system, as it can influence the entire life cycle of the product.

Keywords: Eyewear Design, Sustainability, Global system circularity, Fashion Design

1. From Brundtland report to today: the evolution of the concept of sustainability.

The beginning of an organic reflection about the subject of sustainable development is conventionally traced back to the Our Common Future report, better known as the Brundtland Report, published in 1987: in that document the concept of sustainability is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs ".
This first meaning of sustainability does not put the environmental protection as such in the foreground, but refers to the well-being of people, emphasizing the responsibility of the present generations who must, or at least should, use natural resources rationally and consciously to satisfy its own needs without compromising those of future generations, with the goal of a sort of "intergenerational equity". Subsequently, the concept of sustainability, precisely due to its being dynamic and applicable to different disciplinary areas, has gradually expanded, acquiring a 'multidimensional' meaning, which is interpreted as the interrelation between economic development, environmental protection and social development. Promoting sustainable development, therefore, means seeking a balance between the economic, social and environmental dimensions: a constantly evolving balance to interpret market changes while ensuring a conscious and efficient management of the planet's resources. More than thirty years have passed since the official Brundtland Report’s definition of sustainability has been posed, but some misunderstandings and confusion still remain, especially in the meaning of the manipulation or trivialization of complex contents, that in the end risk to favor inadequate design practices or to create "sustainable" products only limited to some aspect of their life cycle. As Maria Canepa points out, drawing up an updated balance sheet on the theme: "The adjective" sustainable "- along with other adjectives such as "eco", "bio", "green", etc. - it has become

a way to cloak market products that needed a new look to be still profitable with presumed quality. On the one hand this has led to an effort of innovation in many sectors, on the other it has often taken away the basic idea that the resources on our planet are limited and therefore they must be used carefully and sparingly" (Canepa 2018).
The observation that the word sustainability has actually been "watered down" over the years brings together many recent reviews and it is precisely to underline the improper use of this term and the superficial attitude that derives from it, that Robert Engelman speaks of "sustainability" (Engelman in Bologna 2012). What he writes "We live today in an age of sustainababble, a cacophonous profusion of uses of the word sustainable to mean anything from environmentally better to cool", once again highlights how the term rages in the media, fueling the belief that it is possible to continue in this direction with the objective risk of really compromising the well-being of future generations. Despite the undeniable positive actions taken, which also represent important signs of an effective change of direction, with the passage of time the international situation still appears far from reaching a level of real sustainability, to hypothesize more reassuring scenarios from the point of view of resource conservation.
Protecting the environment from actions (and omissions) that can damage it, often irreparably, must therefore not be a virtue signaling on the side of companies, but a concrete objective that involves, first and foremost designers as connective figures and catalysts of different knowledge, that can contribute significantly to the creation of truly "sustainable" products.

2. The concept of sustainability applied to the eyewear design.

The assessment of the environmental impact of a given product or service is an objective and complex process even if it refers to a relatively simple object such as a frame, whether it be for ophthalmic lenses or sunscreens. Even if the topic is not new, it turns out to be one of the strongest and most heartfelt theme of the contemporary world. Terms such as "sustainable", "ecological", "bio-compatible", etc... have become increasingly common in our daily life, while leaving spaces for a certain ambiguity.
It is known that the main stages of the life cycle of a product include the acquisition of raw materials, the production of goods, their use and disposal: all these stages, together with the transport necessary to move products and materials, must be taken into consideration, in an integrated approach that affects the technological, cultural, economic and social components. Sustainability is therefore also configured as an ethics or a new mentality, to face the present and future challenges of humanity. To implement such a radical change in the way of acting, all the actors involved in the production process must acquire a strategic awareness. For that, in the short-medium time, it is still possible to intervene with optimization procedures of existing structures and the development of new technologies capable to limit the environmental impact, by reducing the production of waste and polluting emissions.
Underlining once again that the concept of sustainability is complex and articulated, which very often it is reduced to a mere question of communication and recalling the dual nature of producer and consumer that sometimes does not coincide with an environmental interest, it is necessary to start a reflection on this issue with reference to the frame sector.
Let's start with the physical size of the object.
A frame is composed by front part, made up of the circles into which the lenses or sunscreens are inserted, the bridge that joins the two circles, the plates, or rather the supports of the frame on the nose; from the rods that have the function of supporting the frame laterally by anchoring it firmly to the ears; from the hinges that connect the temples to the front; from the muzzle (or nose), that part of the temple tip to which the lenses are connected in different ways and from the tube, that, in the metal frame, makes the closing of the rim stable after the lenses have been correctly inserted .
Although the improvements in the environmental performance of a product alone are not sufficient to ensure substantial reductions in the use of resources, it is also true that a system innovation in which the product-component is not adequately designed (i.e. respecting the criteria of the Life Cycle Design) will not be able to achieve this goal.
The ideal would be to have a frame made with a single sustainable material, with high aesthetic and functional qualities, such as to become, like other iconic models, an object with an high affective capacity but which, on the contrary, preserves with care and attention.
What we could define as "designed for the next generation" is what we think will survive in the future, to which a value is attributed and which, for this reason, as the famous Patek Philippe "Generations" campaign states: "You never own it completely. It is simply guarded. And it is handed down" and therefore it reduces the global impact on the environment. Beyond market strategies, the duration of a product contributes significantly to its being sustainable. In order to establish an "emotional bond" between user and product, it is necessary to "undertake a new design direction", capable of attributing values and making unique products, "such as to be able to emerge in an increasingly crowded and indistinct commercial landscape" (Gnasso, Iabichino 2014).

The designer must therefore become aware of the fact that the emotional dimension of physical objects, the so-called fourth dimension, can (and must) be designed; even in a complex historical moment like the present one, this means to capture emotions: the objects of modernity must leverage the consumer's emotionality and stimulate experiences, positive sensations and values he shares. For first we should fight against planned obsolescence, so that in my opinion we can produce effective and sustainable things.
That said, we cannot underestimate all those other actions capable to orient research towards experimentation and use of new materials. Nor can we underestimate the adoption of "good practices" in the production chain, (for instance aimed at developing eco-efficient systems), and many critical elements, fueled by different global trends, which can lead us to think that it is possible to intervene limited to a phase of the process without considering it as a whole.

3. Company best practices in the eyewear sector.

The transition towards sustainable and resilient systems also affects the frame sector which, for some years, has started actions aimed at reducing its environmental impact in the various stages of the production chain: from the choice of materials to final consumption. In this context, the fundamental role of research becomes fundamental, as it can guide evidence-based decision-making processes towards the identification of innovative strategies in which the objective of environmental protection is able to reconcile with the needs of productivity, competitiveness and profitability in a load sharing perspective.
Some case studies deemed significant have been selected below to exemplify sustainable business and production models, based on the use of cutting-edge technologies and design choices that aim at the durability and recyclability of products.

3.1 Raw Materials

The first step towards circularity moves from rethinking the raw materials that can be used in the production process. Undoubtedly cellulose acetate (a thermoplastic resin of natural origin traditionally used in the production of frames due to its undoubted qualitative and aesthetic value) continues to be one of the most widespread material in the optical sector because it allows to obtain chromatic and three-dimensional effects, not reachable with other techniques. It is known that cellulose acetate, obtained by reacting cellulose (natural polymer) with acetic anhydride and subsequently added with plasticizers designed to improve its workability above all, has a long history in this sector: starting from the end of the 19th century , in fact, both celluloid and acetate were used to produce different objects, from dolls to umbrella handles, from fountain pens to jewelry and eyeglass frames that looked similar to those that, up to that moment, had been made of tortoiseshell, ivory, horn, boxwood... materials of considerable value, worked by the expert hands of skilled craftsmen.
It was the tine when the entrepreneur Pompeo Mazzucchelli begun to take an interest in celluloid (a material later abandoned in the production of frames due to excessive flammability) and, in 1906, he had set up a new plant in Castiglione Olona for the processing of this promising material.
Today, the company "Mazzucchelli 1849" is a world leader in the production and distribution of acetate products for the eyewear industry and, like other Italian companies, is adopting a further sustainable approach in its business strategies: anticipating the evolution market it has developed a "revisited acetate", a bioplastic called M49, which combines the classic physical-mechanical characteristics of cellulose acetate with a high eco-sustainability due to the use of a vegetable plasticizer based on citric acid.
According to the definition of the European Bioplastic Association, M49 is bio-based and biodegradable.
The term bio-based means that it is a material of natural and renewable origin: M49 has a content that is up to 68% traceable to natural origin based on the results of the ASTM D6866 test (a standardized analytical method for determining of the renewable content of solid, liquid or gaseous samples through radiocarbon dating).
Regarding the biodegradability of M49, reference is made to the International Organization for Standardization which defines biodegradable any material that can be broken down (through the enzymatic activity of microorganisms, sunlight and other environmental physical agents) into simple chemical compounds such as water, carbon dioxide and methane. The rate of biodegradation is influenced by the chemical nature of the material and the environment: in this sense biodegradable plastic must guarantee the level of 90% degradation in an incubation time of no more than 6 months. M49 already exceeds 90% after 115 days, resulting therefore biodegradable according to the UNI-EN-ISO 14885-2: 2018 standard.
Mazzucchelli has also decided to introduce the production of sheets made with Acetate Renew™, an innovative flake generated through a process that transforms plastic waste into primary molecules in order to obtain a new raw material. The waste resulting from the processing of acetate is collected by Eastman (global supplier of advanced plastics), which converts it into a new material: a cellulose

acetate flake composed of 60% biological materials and 40% of certified recycled materials. This process makes it possible to obtain a 100% sustainable acetate flake while using the waste that is normally sent to landfills and contributing to the reduction of greenhouse gas emissions (Acetate Renew ™ reduces gas emissions from 20% to 50% greenhouse compared to normal acetate). And it is for this reason that Eastman has now concentrated its efforts on the large-scale collection and recycling of waste from eyewear manufacturers to convert them into the new material, guaranteeing a real closed cycle for the eyewear industry.
Luxottica, the Italian eyewear giant, has signed a partnership with Mazzucchelli with the aim of reducing the environmental impact of their respective activities in the long term throughout the value chain; similarly, the Thélios company, founded in 2016 from a joint venture between LVMH and Marcolin, has chosen to collaborate with Mazzucchelli and Eastman to develop new sustainable materials by testing different eco-responsible formulas based on certified organic and recycled materials.
In addition to these leading companies in the sector, which have greater opportunities for investment in research and in the implementation of policies and initiatives aimed at reducing the main environmental impacts, there are many industrial companies that have decided to adopt an eco-oriented, ethical and social, using bioplastics as raw material or experimenting with new materials.
Among these, "Etnia Barcelona", an independent eyewear brand founded by David Pellicer in 2001, wanted to highlight its commitment to promoting the circular economy in the document "Impact Review 2021", a work in progress analysis in which the contributions of the company are collected in terms of economic, social and environmental sustainability. In a recent interview, Pellicer said: “Our frames are made of natural acetate and our lenses are made of mineral glass. We are removing all plastic from our packaging and replacing it with sustainable materials. We are also auditing all of our processes to detect everything that we can and should improve. But the best contribution we can make is to produce a long-lasting product and to continue building a brand that is committed to the environment”.
Thomas Kimber, founder and CEO of the "Karün" company in Patagonia, also focused on values linked to sustainability: “We have created our own Karün Conscious Development Model™ which is recycling tons of discarded material, working together with hundreds of rural entrepreneurs to protect hundreds of thousands of hectares of pristine nature in one of the wildest areas in the world: Patagonia. […] This report is an important milestone for us, as it is the first outcome of a team effort in measuring as much of our impact as we can. It is a first step in a long road where we aim to prove through example that it is possible to change the way we relate to our natural environment, and we intend to measure every step of the journey and share it with the world, so that our discoveries as well as our challenges can serve as inspiration for others out there”.
The name Karün, which in Mapudungun, the native language of the indigenous indigenous Mapuche in Chile, means "to be nature", reflects the vision of the founder who, in his company, is building the entire value chain according to a circular and regenerative model, designed to help restore natural ecosystems and support local communities. The first phase of this model consists in finding discarded materials, such as fishing nets, ropes, metals, wood which, through an organization of local micro-entrepreneurs; once selected, they are sold to Karün. In particular, the fishing nets are sent to the Italian Aquafil which transforms them into regenerated polymer (commercially known as Econyl) with quality and processing characteristics equal to those of the substance deriving from petroleum but with an energy consumption lower than 50- 60% compared to the traditional product. In the medium term, Karün expects to be able to locally produce the raw material for its operations in order to avoid the carbon footprint that transport implies and which is currently offset by TNC carbon credits.
In evaluating the impact of its products, Karün does not limit itself to considering the sustainability of the raw materials with which frames and related packaging are made, but the entire production process aiming at the creation of high quality models, at reducing the negative effects of transport, to control the working conditions of their employees. Furthermore, the after-sales service encourages the customer to send back the old glasses which, designed according to the “made to be made again” logic, are regenerated if they are no longer recoverable or, alternatively, reconditioned and aimed at community initiatives. Even the Belgian entrepreneur François van den Abeele considers eco-disruption an inevitable, as well as desirable, process that will lead companies to be sustainable, not only for an ideological attitude or a fact of image and communication, but for their own survival. Founder and CEO of the Catalan company "Sea2See", van den Abeele, in his eyewear company, outlines new horizons in reference with the protection of the environment and the implementation of a circular economy, based on recycled materials. Sea2see is a vertically integrated company that collects marine litter in over 37 ports located in Spain and France, but also off the coasts of Senegal, Ghana and Madagascar. Through the support of hundreds of fishermen, who in this way have been able to access an additional source of income, an average of 15 thousand kg of plastic are collected per month: these are separated and selected to move on to the next phase of transformation into certified raw material (a variety of pellets called Upseatm Plast) which has obtained the Cradle to Cradle™ Gold mark (a globally recognized certification system to ensure safer and more sustainable

products made for the circular economy). For the realization of the finished product, Sea2See has chosen Italy, not only for the competence and high quality that characterizes the sector but also for the image benefits deriving from a recognized and consolidated tradition.
Following a similar logic that aims to obtain secondary raw material from a waste material, the "Re.Mo" (Mozziconi Recovery) project, with the participation of AzzeroCO2 and the CNR, aims to continue the research developed by the previous “Rinasce” project aimed at extracting cellulose acetate from exhausted cigarette filters to obtain plates to be used for the production of frames, in an advanced manufacturing context. Through a specially designed plant, contaminants are eliminated and the most valuable commodity fractions of filters are recovered, in particular cellulose acetate, in order to allow their re-entry strategy into the market for the production of consumer goods (including the frames). The research is still in progress, and now it requires further steps aimed at refining the process and making it repeatable at an industrial level.
Precisely for the aforementioned reason, before ReMo, other projects also at an international level, have investigated the application possibilities of the materials deriving from the recycling of filters: among these, Cigarette Waste Brigade was the first program, carried out in Vancouver, which provided for the dissemination of collection points for cigarette butts from which the Terracycle company of Toronto subsequently produced plastic pellets and objects; a team from the Royal Melbourne Institute of Technology has verified that clay bricks made up of 1% filters have the same characteristics as traditional bricks but use less energy for production; finally, the Chilean designer Alexandra Guerrero “spun” the purified butts mixed with a percentage between 10-20% of sheep's wool to make garments.
Launched in June 2016, the Austrian brand "Neubau Eyewear", part of Holding Silhouette International, also produces sunglasses and optical frames with a responsible approach to the environment, thank to the use of bio-based polymers from the processing of non-GMO castor beans (NaturalPX and Natural3D). Castor beans play an important role in the chemical industry, where oil and its derivatives are used as a raw material in the production of plastics (such as Rilsan), coatings, paints, pharmaceuticals and cosmetics. 80% of the world supply of seeds (equal to about 1.2 million tons) is produced every year in India, where this cultivation constitutes a constant income for many small landowners and family farms.
In May 2016, BASF (one of the largest chemical companies in the world), Arkema (multinational company operating in the chemical and advanced materials sector), Jayant Agro-Organics Ltd. (pioneer of castor oil-based chemicals in India) and the international civil society organization Solidaridad launched the “Pragati” project precisely to improve working conditions, create awareness for sustainable agriculture and increase yields thanks to more efficient agricultural practices. In addition, the project has established the unified sustainability code SuCCESS (Sustainable Castor Caring for Environmental and Social Standards) which defines a standard for certified sustainable castor oil, the first code on the global market.
NaturalPX and Natural3D frames are stable and lighter than acetate ones, and NaturalPX's characteristic transparency allows for a wide variety of color combinations and customizable finishes: color can be added before the material goes through the process by injection molding, or at the end of the process by airbrush, dipping dyeing or digital printing. Natural3D has slightly different properties but still offers great flexibility in terms of color and styles. Both are hypoallergenic, free from plasticizers, resistant to solvents and free of harmful chemicals such as BPA, BPS. In particular, NaturalPX is made up of 65% oil extracted from organically grown castor seeds, while the remaining 35% is a normal polymer necessary to give the frame resistance and elasticity. Natural3D, on the other hand, is 100% bio-based and is used in 3D printing using the SLS process (selective laser sintering), an additive manufacturing technology (AM) that uses a high-powered laser to sinter small particles of polymer powder and transform them into a solid structure based on a 3D model.
Sikalindi is another natural material with which the Salento company "Ferillieyewear" created its first limited edition eyewear collection. The Sikalindi fiber is extracted from the still green cladodes of the prickly pear, through a patented process that takes place in full compliance with the life cycle of the plant and without the use of pollutants. Considering that the prickly pear, due to its ability to reproduce quickly spontaneously, is classified as a weed, and therefore periodically thinning interventions are essential in order to contain its growth, the idea of using it as a covering in the front of the frames is undoubtedly interesting, not only for its aesthetic value and for the "uniqueness" of the piece (which derives from the heterogeneity of the texture that forms always different "graphics") but also because the woody fiber of the prickly pear it is extracted into sheets of modest size which therefore are well suited to the small size of a front. The coating is applied to a birch plywood and subsequently treated with special products and impregnating resins that have the purpose of preserving the material from attack by any parasites, increasing its mechanical strength and making it waterproof. During this phase, which is done by hand with a brush, the dense and slender texture of the wood fiber, with its characteristic honeycomb structure, becomes one with the support surfaces, and it itself takes on a

Fig. 1: Sikalindi is a material extracted from the still green cladodes of the prickly pear

considerable hardness and consistency. All the processing phases of FerilliEyewear frames, starting from the fiber extraction phase up to the realization of the masks, are carried out in artisan laboratories located in the Salento area and currently all the processed raw material is also obtained from pruning and thinning waste. of plants located in those areas.
From this brief excursus it is evident that not only large companies aim at sustainability as a focus for planning assets and investment strategies, but also small-medium-size ones are paying more and more attention to the research activity connected with the experimentation of new material entities, with the aim to reduce the use of virgin raw materials and transform it into a fundamental element of competitiveness in the global market.
Despite their formal simplicity, eyewear has a strong communicative value, as Ugo Volli underlines: "From a tool to see, glasses have become an object to be seen" (Volli, 2002) decreeing the importance of the aesthetic-expressive dimension of this accessory, which cannot be overlooked or underestimated. In other words, if a material, however eco-friendly, is not able to be resistant, flexible but at the same time light, aesthetically "stable" in the shape and brightness of its colors, in line with contemporary trends but also capable of not undergoing sudden changes in fashion… in the end if it does not ensure the performance that an eyewear must have, some other traditional materials may seem more useful for production and use.
It is therefore evident that design assumes the role of a connector between several aspects, intervening on production processes, calibrating the use of resources, selecting materials on the basis of functionality and aesthetic characteristics, or, in a word, coordinating the plurality of factors - economic, cultural, social - that affect the creation of a product.

3.2 Design and Production processes

One of the primary focus of many companies is the search for ways to minimize the environmental footprint of their processes and products and for integrating sustainability into the core business as an unavoidable premise in determining business strategies.
As John Thackara (Thackara 2008) writes, the environmental impact of many products that surround us is determined up to 80% in the design phase: the role of the designer therefore becomes essential as he has the possibility (and responsibility) to guide planning towards sustainable practices that lead

to the development of products or services capable even to "educate" the consumer towards new attitudes.
This ability to build new behavioral scenarios through targeted design is also a valuable tool for those companies that intend to pursue sustainable goals but need a "bridge figure" (designer) who knows how to interpret new social trends and translate them into products intended for increasingly evolved and aware consumers.
The designer's ability to synthesize knowledge and contributions not always (or not only) close to the area of planning, as well as his ability to interact with others, allows him to transfer knowledge and experiences to the various operators in the supply chain, favoring new dynamics of cooperation between the protagonists of the scientific world, the productive world and users. It is precisely through the development of these “virtuous connections” that supply chain relationships are strengthened and new production models are often created.
As Bieke Hoet, designer and co-founder of the Hoet company observes, innovative technologies can provide solutions for a more efficient use of resources and, at the same time, contribute to increasing the competitiveness of companies by innovating production and consumption models and targeting to the circular economy.
“We also only print what we need. I mean that in two ways. The additive process itself immediately reduces waste material, it’s much more sustainable, but we also print what we need in terms of stock – we’ll never have too much or too little. Also, because we can print according to demand, it helps us be responsive to consumer trends, for instance producing more of a certain color if it is selling well, or adapting shapes to reflect subtle shifts in taste. The decisions about a new line that you used to have to make up-front and then live with, are no longer fixed. They can be fluid. Really with 3D printing we have the design freedom to create new looks that capture imaginations, and then the business freedom to supply product according to how imagination translates to customer appetite. It keeps things fresh but also efficient”.
Surely the success of 3D printing constitutes an opportunity to consolidate more sustainable processes in many sectors, including the field of frame production, because it leaves a wide freedom range in designing and reshaping the product fitting and cause it significantly limits waste materials production.
Daniel Miko, designer and founding partner of the German You Mawo, also considers the use of 3D printing in the production of frames as one of the possible ways to reduce the environmental impact in this sector: a systematic life cycle analysis (LCA) carried out from the 3D printer manufacturer EOS and Fraunhofer EMI has in fact highlighted significant advantages, in terms of sustainability, of eyeglass frames produced in additive manufacturing mode compared to those produced with traditional techniques. In all 18 impact categories analyzed the carbon footprint of a custom 3D printed product, You Mawo eyewear, is about 58% lower than conventionally manufactured eyewear; CO2 emissions are three times lower; waste is reduced by 80% and it is possible to avoid long post processing. Research in this field continues to develop powders with an even lower footprint (for example, bio-based) and/or to optimize the recyclability processes of the powders themselves (powder refresh rate) and further contain energy consumption.
By innovating traditional production paradigms, 3D technology therefore plays an important role in the transition towards forms of circular economy. It allows a more efficient use of materials with the consequent reduction of waste and scraps; it has advantages as it guarantees a fast and efficient but also flexible and variable production; it allows the creation of tailor-made objects, an aspect that is not negligible in the frame sector, where customization is a fundamental parameter; it reduces production costs and lead time.
As recent analyzes have shown, additive manufacturing - albeit with some limitations of an emerging technology - can bring about sustainability benefits at every stage of the product life cycle, from prototyping to distribution, favoring the development of new business models based on the decentralization of the supply chain and the extension of the life span of the products through repair or on-demand production of components and spare parts. By transforming products into files, 3D manufacturing applies the acceleration and paradigms of digital to them: the ability to send the digital file containing the three-dimensional prototype of the single product to any part of the world allows its global distribution while maintaining production close to the consumer.
But how can design offer an effective contribution to sustainability?
Undoubtedly it can do that to the extent that helps to find technical solutions to limit the use of different materials in the frame (given the obvious difficulty to design using a single material) or to prefigure an easy to disassemble product, as to be able to dispose of it more easily. Giuseppe Leone's research has focused on these issues. In his thesis project, he revisited the maxi lines of the Seventies eyewear, lightening them visually and materially through the use of recycled titanium. Of course, this is a study that aims above all at the creation of eyewear that can be easily disassembled because, as is known, titanium, used for the first time in frames in the early 1980s, despite being suitable for use in this sector for its characteristics of lightness, resistance, hypoallergenicity, has

rather high processing costs. In this project, to minimize the components, we started with a single titanium plate engraved by chemical photo-blanking and then folded.
Of course, the environmental impact that a similar product can have must be estimated through the evaluation of various parameters and not be limited to the material one. It would be necessary to "make a perfect loop between the beginning and the end of the product's life" to use the words of Corrado Rosson, designer and founder of Lightbird Eyewear, “and in the eyewear sector we are still very far from this”. However, it is undeniable that, thanks to digital globalization, a greater sensitivity towards these issues is spreading even if the level of attention declared towards the issue of environmental sustainability does not always find adequate correspondence in production practice.
Even extending the life of a product by focusing on a high qualitative and communicational level of it, so much to make it assume the role of an icon in the collective imagination, represents a strategic action for the affirmation of the circular economy and the implementation of a sustainability-oriented design. Ernesto Gravante, designer of the Campania company Original Vintage Sunglasses, says "Truly sustainable eyewear is that one designed just to last, beautiful and of the highest quality available in time", a "relevant" object, that is an object to which a value is attributed and capable of establishing an emotional bond with those who have chosen it. Thus Zack Moscot, current Chief design officer of New York-based Moscot, underlines the importance of "working" on the relationship between product and user:
“A valuable consumer-product relationship is one that is driven by both function and emotional attachment” and he continues by reiterating the importance of extending the life of a product, which is fundamental for the affirmation of the circular economy, loading it with meanings that go beyond its manufacturing qualities: “Since eyewear has become a fashion accessory, certain brands and companies provide cheap, short-lived products. Names like H&M (clothing) and Warby Parker (eyewear) are companies that epitomize a system where cheap products reflect the current style, but are easily discarded of. In contrast to cheap fashion and wasteful purchasing, there are handmade items meant to last for years. During my semester abroad in Copenhagen, I was strongly inspired by the demand in the market for hand-made wooden furniture. I visited a factory called PP Møbler Furniture, where one chair could reach a price equal to that of an automobile. Incredibly, the person who buys this chair uses it for their entire life. The oils of the human hand and skin create a finish on the chairs arms that further enhances the beauty and timeless elements of the chair. The chair and its naturally changing aesthetics grow with the user and emotional relationships take form. Not only am I interested in the symbiotic growth that evolves between the chair and its owner, but also the sustainability of the chair via form, craft and material”. If until a decade ago, the designer's work was mainly linked to aesthetic/formal and functional issues, today multi-sensory marketing puts the 'sentimental' part of the consumer at the center of attention and tries to create empathy at the emotional, endowing the products with a strong and engaging identity on a cognitive and passionate level. Precisely for this reason it is possible to think not about the end of life of a product but about how to 'keep it with us', transforming the pleasure of using it into the pleasure of keeping it. The designer should be able to transpose, even in an apparently simple object like a frame, those intangible contents capable of making it timeless: a new idea of sustainability that passes through the emotional and evocative power that objects contain.

3.3 Sustainable design vs obsolescence: the other life of a frame

If in the past design became an accomplice of the unsustainability of the economic system, today it is increasingly configured as a fundamental tool to implement a paradigm revolution in terms of sustainability, focusing not only on the product, but also on the consumption choices themselves, contrasting an approach inspired by the principles of maintenance, recovery and recycling to the “disposable” culture. After all, also Objective 12 of the 2030 Agenda "Guaranteeing sustainable production and consumption models" promotes a radical change in the current production and consumption trends, as inseparable dimensions of the market to which a unitary strategy must be applied. In particular, the target 12.8 aims to "make sure that all people, in every part of the world, have the relevant information and the right awareness of sustainable development and a lifestyle in harmony with nature". This point out how important is to structure adequate communication strategies to orienting consumers and people in general towards increasing a sustainable mind-set.
In practice, it is a question of acting on the sense of responsibility of the potential buyer who, supported by clear, effective and above all reliable information, conveyed through appropriate channels, can direct himself towards those more sustainable goods and services, thus stimulating, with his own demand, an ever-increasing offer of products that meet these characteristics. Current environmental awareness campaigns mainly concern waste management through correct separate collection and, in particular, highlight the problems associated with the disposal of plastics and microplastics that pollute the seas and oceans. Emblematic for its communicative effectiveness is the Sand, Soil, Sea campaign, created in 2019 by The Leo Burnett Thailand agency and promoted by

Trash Hero, an environmental association actively involved in waste disposal: “just a second is enough to abandon plastic in the midst of nature, but it takes hundreds of years for it to decompose”.
In our opinion, however, what is often underestimated, is the concept of repair or service which, together with the object, can be designed from a sustainable perspective. In other words, "designing with the perspective of adjusting" is a concept often considered obsolete and not convenient, but which should be re-evaluated especially in a context, such as the current one, in which environmental issues are at the center of every debate. A contemporary “Make Do and Mend” that dignify and enhances the action of "repairing", as in the well-known Japanese practice of Kintsugi which tells and enhances the "wounds" of the object even highlighting them with gold or the Sugru (a silicone-based polymeric material, similar to plasticine in consistency and modeling methods, which allows you to repair but, in the limit, also to customize and innovate precisely through repair).
In this sense the “Réanim project: La médecine des objets”, by the French studio 5.5, is very interesting: “Réanim was first and foremost about questioning the proliferation of mass-consumption objects, produced for commercial purposes without any concern for durability: but it was also a true alternative designed to put an end to the constant turnover of our objects. Reanimating, recuperating, rehabilitating, recycling, rethinking, bandaging, healing. The designer is a doctor for objects, and put his skills in the service of injured furniture. […] These treatments, which face veritable epidemics, are based on systematic intervention principles that improve the perception of the object. Once treated, the object is reintroduced into regular commercial channel before returning to its original habitat”.
In the same way, the contribution given by the Platform21 project, created by a group of Dutch designers and aimed at enhancing the culture of repair with the definition of the Repair Manifesto, is a milestone, which summarizes in eleven points the fundamental prerequisites for the adoption of production methods and sustainable consumption.
On 2022 January the 11st an initiative was published by the European Commission aimed at promoting the repair and reuse for sustainable consumption of goods with the general aim of extending their useful life and empowering the consumer in the green transition. In fact, the Right to Repair is often denied because companies are not required to distribute spare parts, do not train repair workers and, in many cases, do not guarantee after-sales assistance today recognized as fundamental for numerous luxury brands.
Moreover, a change in this sense is already visible in the purchasing choices of generations Y and Z, who show greater attention to environmental issues and are inclined to verify that what is communicated by companies - not least the commitments undertaken in sustainability - is based on truthful, measurable and verifiable performance indicators. Bringing the concept of repair back to the eyewear sector, a leading expression of Made in Italy, it is clear that a distinction is required between commercial models and "special" products which, like any other object of value, must be entrusted to expert hands of specialized craftsmen: some models by Cartier, Chopard or Dolce and Gabbana (the DG2027B is an excellent example) are configured as pieces of jewelery, in precious metals, often studded with diamonds, whose indisputable value is evident , but so are those models with an iconic design that have become part of the collective imagination: from the colored ones by Sottsass that inspired the collection of the Spanish designer Nina Mûr goes Memphis, to the oversized frames by Hans Hollein, passing through the two-tone ones by Roger Tallon up to some models conceived by the brilliant and revolutionary mind of Andrè Courrèges that are inspired by the future.
Speaking of reparation makes even more sense if it is aimed at a gesture of solidarity. If the second life of sunglasses is often in physical or virtual vintage stores, it is different for “eyewear”. There are in fact many projects, often promoted by eco-solidarity or voluntary associations, aimed at giving a new life to used eyewear; among these, of particular importance, the program, which, born in 2003, has led to the creation and dissemination of Centers for the collection and recycling of used eyewear. These are cleaned, arranged, divided according to gradation and packaged by volunteers who distribute them free of charge to the people who need them, thus promoting a model of social cooperation in the territories. Similar initiatives are carried out by many opticians who, inspired by the entirely Neapolitan gesture of "suspended coffee", allow their customers to bring old glasses and buy new ones at a discounted price.
Essilor and Luxottica themselves, with the "Suspended Eyewear" campaign, have chosen to make eyeglasses (this time new) available, leaving them "pending" for those who find it difficult to bear the costs, at over 800 optical centers throughout Italy. This initiative has also affected Portugal, especially the Algarve region, whose economy dependent on tourism has particularly suffered due to the pandemic situation. The Portuguese project "Together 4 Vision" involved institutional figures, opticians and optometrists and was initially aimed only at children aged 6-17, children of unemployed parents, and was then extended, in a second phase, also to particularly adults. vulnerable regions of Madeira and the Azores.
Despite these initiatives, however, the concept of "repairable", especially in the eyewear sector, still appears quite limited even though it could lead to the experimentation of "new aesthetics" capable of adding further narratives to an accessory with an already highly communicative character.

4 Conclusion

The reflections carried out so far allow an appropriate positioning of the situations in which the project in general - and that one of a pair of glasses in particular - has been able to be innovative, also with reference to the current transition towards a planning that tends to sustainability. In fact we must consider that, if that eyewear is a small object, its diffusion (around 1.2 billion people wear glasses in the world) means that it too can offer an important contribution in this sense.

Of course, to evaluate the "sustainability" of a frame, the analysis of its entire life cycle should be considered: it should be checked whether the greatest impact on the environment occurs in the production, transport, use or disposal phase and, subsequently, implement an intervention strategy aimed at overcoming the criticalities emerged. In this study we want to highlight some initiatives undertaken by companies in the sector from an environmental and social point of view, in the awareness that only a global approach can make a significant contribution to sustainability. In many cases these are interventions aimed at the first phase of product life cycle (i.e. the choice of material), in other cases the focus is on sustainable production models or on the possibilities of recycling or disposal. However, it is clear that the implications go beyond the mere question of selecting less impacting materials and processes and choosing eyewear based on the ease of disassembly or the reduction of its material complexity. Therefore it is necessary to conduct a more complex analysis of the entire production chain, in order to be truly sustainable in design processes. It is essential to fight waste and try to give long life to products by focusing on quality, on a design that resists the time and that is able to establish a strong affective "relationship" with clients and users.

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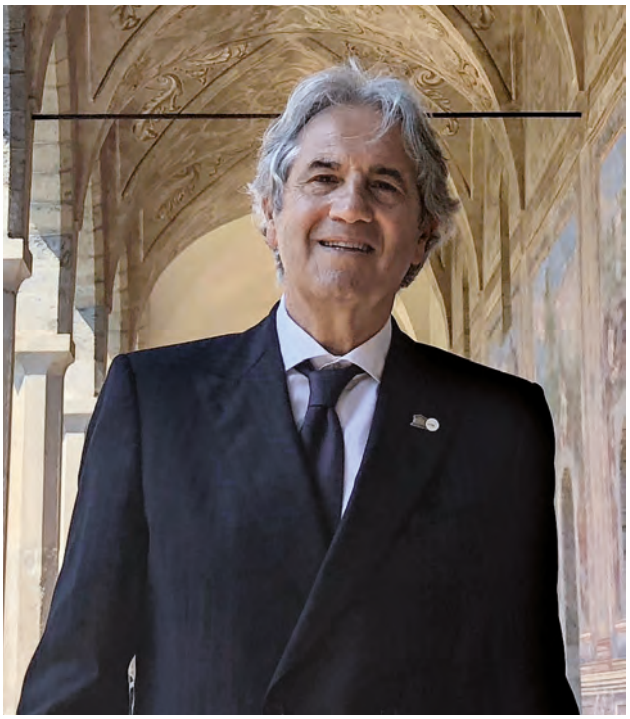
INDICE



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