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Glass: Millennia-Old Excellence Between Innovation and Sustainability

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Glass is one of the oldest and most fascinating materials ever crafted by humans. Its origins date back to 5,000 BCE, when craftsmen in Egypt and Mesopotamia started producing this unique material, which is admired for its beauty and versatility. The Phoenicians then spread glassmaking techniques throughout the Mediterranean, transforming it into a prestigious and widely used material. Later, the Romans refined these techniques and introduced new methods – such as glassblowing – that allowed for the creation of lighter and more complex forms.

During the Middle Ages, the Republic of Venice became a reference point for glass art, with the island of Murano establishing itself in 1291 as a global centre of excellence in glass production. In Murano, glassmakers developed innovative techniques that enabled them to produce blown glass of extraordinary purity and mirrors and colourless crystals of the highest quality. These skills were jealously guarded by artisan families and passed down from generation to generation. Each item produced on the island was the result of a long and complex process that required skill, experience and creativity. Glass working was therefore not merely a craft but an art form, the fruit of an ongoing dialogue between creativity, technique and respect for tradition.

This prominence, which lasted for centuries, began to decline during the 1960s. The rise of the glass industry had a tremendous impact on Murano, which gradually lost its central role. This crisis intensified further in the early 2000s. Globalisation and new challenges related to sustainability have posed serious challenges to the island's economy: Deeply tied to its traditions, Murano struggles

to face the transformations dictated by our century and to maintain its relevance and competitiveness in the contemporary context. The need to combine historical heritage with the demands of the present and future inevitably calls for a rethinking of traditional production practices, along with an openness toward innovation and new technologies.

Serendipity

My encounter with Murano glass happened almost by chance. After spending a period abroad, where I had the opportunity to collaborate with Carlo Ratti, Director of the *MIT Senseable City Lab*, and to develop a multidisciplinary, research-oriented approach, I returned to Venice in the summer of 2016.

The initial idea was to dedicate that summer to rest and to reflect on new life projects. However, for someone restless like me – always seeking new challenges – inactivity is a difficult concept to accept. My wife, a native of Murano who comes from a family with a long tradition in the glass sector, put me in touch with a local furnace that needed technical consultancy. With a degree in architecture and a strong interest in research and innovation, I found myself immersed in a world almost suspended in time, where artisanal mastery was expressed through a dedication and passion that immediately fascinated me. Meeting the master glassmakers felt like a step back in time: Their ability to shape molten glass into objects of extraordinary beauty was the result of years of experience and a deep love for their craft.

Yet, I could not help but notice a certain resistance to technological innovation. Although the Murano furnaces are custodians of a centuries-old tradition, they seemed crystallised in a production model that, on the one hand, guaranteed product authenticity but, on the other, limited opportunities for developing and adapting to new challenges in the global market.

This observation contrasted sharply with my natural inclination toward research and innovation, which seeks to harness seemingly improbable synergies between various fields of knowledge. I began to see Murano glass not only as a material tied to tradition but also as an opportunity to experiment with new techniques and new languages – a chance to build a bridge between craftsmanship and new technologies.

The Glass Matters Project

It was from these reflections that the *Glass Matters* project was born in 2017, with the goal of establishing a dialogue between Murano's artisanal tradition and new technologies. With the support of *Ca' Foscari University of Venice* and the *Promovetro Consortium of Murano*, we managed to involve six Murano glassworks in a workshop where the artisans had the opportunity to become familiar and experiment with some digital fabrication tools (CNC milling, laser cutting and 3D printing). The beginning was not without challenges: The mistrust toward technologies that seemed to threaten their art was palpable. However, thanks to their open-mindedness and willingness to embrace change, the glassmakers began to explore the possibilities afforded by these new tools and discover how they could expand their creative options without altering their identity as artisans.

The results were surprising. During the first edition of *The Venice Glass Week*, we presented a series of works that combined Murano's artisanal mastery with digital technologies. This project opened up new avenues for collaboration between artisans and designers, highlighting how technology does not necessarily represent a threat but can, in fact, become a powerful ally in exploring new forms of expression. The success of *Glass Matters* marked the beginning of a more open dialogue between Murano's traditional practices and the world of technological innovation, demonstrating how even a sector so deeply rooted in its tradition can find new ways to express itself and thrive.

Building on the success of *Glass Matters*, I began collaborating as a consultant with various glassworks on the island, pursuing research and development projects oriented towards design. Thanks to a multidisciplinary approach, I was able to introduce new perspectives and methods of work that had not been explored before. Among the most significant collaborations, the one with Stefano Bullo, a young master glassmaker and the owner of *Vetrate Artistiche Murano*, proved to be particularly fruitful. Together, we embarked on a research path aimed at overcoming the limits of traditional leaded glasswork, an essential feature of stained glass but one with increasing technical and ecological issues.

Fig. 1: Costantini Glassbeads, Kanz Architetti, Matteo Silverio, LUME lamp, 2017.

Courtesy of Matteo Silverio

After numerous experiments, we developed a flexible interconnection system that led to the creation of a collection of manipulable glass vases called *Touch-Me!* (Fig. 2). Thanks to their particular geometry, these vases can be shaped by the user, transforming the relationship between the object and its viewer and reversing the perception of glass as a fragile, untouchable material. The project was first presented to the public in 2019 during the *New Glass Now* exhibition organised by the *Corning Museum of Glass* and received widespread acclaim for

its originality and innovation. Later, it won the award for the best work created by artists under 35 at *The Venice Glass Week 2020*, further consolidating the value of this experimentation.

Fig. 2: Stefano Bullo, Matteo Silverio, Touch-me vase, 2019.

Courtesy of Stefano Bullo and Matteo Silverio

A New Approach to the Management of Glass Waste

Waste management is a critical challenge for all production chains. Every living being generates waste, and humans are no exception. However, our society produces a significant amount of waste, much of which is neither recycled nor reused and ultimately pollutes the environment. It is only recently that this issue has become the subject of public debate and specific policies.

Murano is no exception: About 50% of the glass processed on the island be-comes waste,[1] amounting to approximately a thousand tons per year destined for landfills. The main problem is that this glass, enriched with pigments and substances that alter its composition, cannot be recycled along with regular packaging glass. Consequently, the glassworks are forced to bear high disposal costs and then purchase new raw material, perpetuating a vicious cycle of waste and inefficiency. Globally, the situation is equally critical: It is estimated that around 130 million tons of glass waste are produced each year.[2] Most of this waste is not recycled but ends up in landfills or undergoes downcycling.

The scenario becomes even more paradoxical when we consider that sand, the basic element for glass production, is the second most exploited natural resource in the world after water, and its intensive extraction is causing severe environmental and geopolitical problems. Furthermore, transforming sand into glass requires a considerable amount of energy, making the waste of this material even more senseless.

The *rehub* Project and Sustainable Innovation

In 2019, after working on a project commissioned by the *Expo Dubai 2020 Com-mittee*, I wondered if it was possible to find a sustainable and low-impact so-lution that enables us to reuse glass waste. The idea was to develop a method for revaluing locally produced waste, avoiding transportation and reducing en-ergy consumption. Starting from Murano but with the goal of extending this approach to all places that lack an efficient glass recycling system, the objective was to combine artisanal tradition with new technologies – to unite research, design and art.

It was a rather ambitious project, but we gave it a try. After several years of experimentation and development together with Marta Donà, we arrived at a

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1   Barucco Maria Antonia/Cattaruzza Elti/Careno Paola/Centenaro Stefano/De Benedetti Filippo: Murano Pixel. Economia circolare per gli scarti di vetro. Treviso 2022.

2   Aranvinthan Thiru/Ferdous Wahid/Lokuge Weena/Manalo Allan/Mendis Priyan/ Schubel Peter/Siddique Rafat/Wong Hong/Zhuge Yan: Recycling of landfill wastes in construction – A review on global waste generation, performance, application and future opportunities. Darling Heights 2021.

new process that allows glass waste to be transformed into a paste that is easily workable at room temperature. This paste, similar to clay in consistency, can be used in various industrial processes, such as rolling, stamping and injection moulding. Additionally, thanks to a patented extruder, the paste can also be 3D printed (Fig. 3), paving the way for a wide range of applications – from architectural surfaces to design objects. Our innovative process, which requires 70% less energy than traditional glass processing, enables the creation of sustainable products that are free from plastics or resins and use secondary raw materials.

Fig. 3: Matteo Silverio, rehub, Proprietary 3d printer extruding revero (glass paste), 2024.
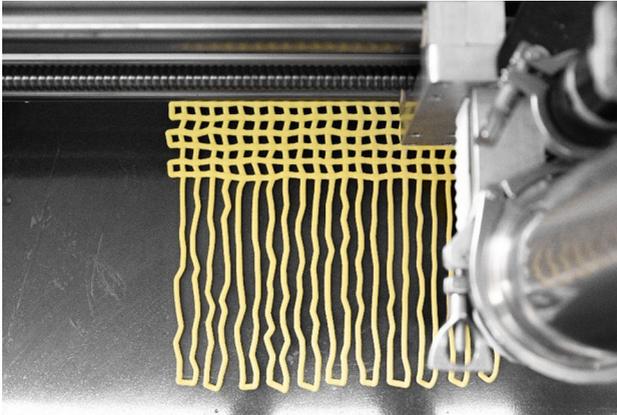
Courtesy of *rehub*

In 2022, we founded *rehub*, an innovative startup that leverages the developed process to create new products from glass waste (Figs. 3–5). The objects made by *rehub* testify to the possibility of a more responsible resource management and demonstrate how a centuries-old tradition like Murano's can become a driving force for innovation that is capable of improving environmental quality.

Fig. 4: Matteo Silverio, rehub, Terazzo-inspired tile (100% made of glass-waste), 2024.

Fig. 5: Matteo Silverio, rehub, Terazzo-inspired tile (100% made of glass waste), 2024.

Courtesy of *rehub*

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Our process can be applied to not only Murano glass but also other types of non-recyclable glass, allowing us to aim for a positive impact on a global scale. Through the products that we create, either independently or in collaboration with companies in the fashion and design sectors, we prove that even waste considered irrecoverable can, in fact, be revalued.

rehub is not just a business project; it is a true innovation and research hub, where artisans, designers and researchers can explore new creative and productive possibilities together. In a context like Venice, where the balance between tradition and innovation is crucial, promoting and demonstrating that sustainable development is achievable is not only a goal but a necessity.

Venice and the island of Murano, steeped in history, now face unique challenges that demand innovative and sustainable solutions. Investing in new technologies and environmentally responsible production methods not only

helps to preserve the city's artisanal heritage but also creates a new legacy rooted in a balance between progress and respect for the environment. Innovation thus becomes a pillar for Venice's future, where sustainable development can revitalise the local economy, rejuvenate the glass sector and ensure that the city remains an example of cultural excellence and resilience.

Looking to the future, we aim to continue expanding our activities and developing new projects that can help transform Murano into a centre of excellence for the circular economy and sustainability. We are convinced that Murano glass, with its millennial history and extraordinary beauty, can become a symbol of rebirth and innovation, demonstrating that even the oldest traditions can find new ways to thrive in a constantly evolving world.

The challenges of the 2030 Agenda require an innovative and responsible approach: At *rehub*, we are ready to do our part in building a more sustainable and inclusive future.